The 17th International Graduate Students Conference on Population and Public Health Sciences

Public Health &population CONFERENCE

IGSCPP 7 JULY 2026

at Pharmingkhwankarnsuksathai Building
Poonsapaya Navawongs na Ayudhya Conference Room,
3rd floor, Faculty of Education, Chulalongkorn University

Conference Proceeding Book

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Professor Dr. Chitlada Areesantichai
Chairperson, Executive Committee, 17th IGSCPP
Dean, The College of Public Health Sciences,
Chulalongkorn University, Thailand

Dear Colleagues:

On behalf of all the academic staff and students at the College of Public Health Sciences (CPHS) Chulalongkorn University, I would like to extend our warmest welcome to all the participants at this; the 17th International Graduate Student Conference on Population and Public Health Sciences (IGSCPP).

The College of Public Health Sciences (CPHS), Chulalongkorn University, Institute for Population and Social Research (IPSR) and the ASEAN Institute for Health Development (AIHD), Mahidol University have collaborated by taking turns in organizing this international conference for 17 years. Together, we have made such an incredible and exciting international conference.

This year, CPHS, as the host, is pleased to learn that the Conference has brought together both members and non-members, local friends, and colleagues from abroad who share a common goal; a view of global health and public advocacy. Naturally, this conference provides an excellent forum for the discussion of problems, challenges and solutions in public health.

I would like to express my sincere gratitude to our distinguished invited speakers for their presence and contributions to the conference. I also thank all the program committee members for their efforts in ensuring a rigorous review process in selecting high quality papers for presentation.

Finally, I sincerely hope that all our participants will benefit from the technical contents of this conference, and wish you a very productive conference and an enjoyable stay in Bangkok, Thailand.

Assoc. Prof. Dr. Chalermpol Chamchan
Co- Chairperson, Executive Committee, 17th IGSCPP
Director, Institute for Population and Social Research,
Mahidol University, Thailand

The International Graduate Students Conference on Population and Public Health Sciences (IGSCPP) has been held annually since 2010. Now in its 17th year, the conference continues to be a sustainable success because of the ongoing academic collaboration between three Institutes: The College of Public Health Sciences (CPHS), Chulalongkorn University, and the ASEAN Institute for Health Development (AIHD), and the Institute for Population and Social Research (IPSR), Mahidol University. The continued success of the conference proves that even faced with a considerable challenge, such as with COVID-19, nothing will prevent us from working together to make this conference happen.

On behalf of the Institute for Population and Social Research (IPSR), Mahidol University, it is my honor to extend a warm welcome to everyone participating in this special event. I believe what we will learn from each other in this conference will enrich our knowledge of diverse aspects of population and public health. This opportunity will provide an invaluable experience for all of us. Sharing our research with other colleagues for feedback and comments in such an international setting, like this conference, is a critical process of learning in becoming a qualified and competent academic.

Now, without hesitation, I would like to sincerely congratulate, and extend my gratitude to, the two cochairs of our organizing institutes, the College of Public Health Sciences (CPHS), Chulalongkorn University, and the ASEAN Institute for Health Development (AIHD), Mahidol University, for putting forth a great deal of effort to make this conference possible. My heartfelt appreciation also goes out to all students and presenters who will be presenting their research at this conference. Your contribution is key to this collaboration and networking event.

Once more, welcome everyone to the International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). I hope you find this experience to be truly invaluable.

Thank you.

Assoc. Prof. Dr. Thunwadee Suksaroj
Co-Chairperson, Executive Committee, 17th IGSCPP
Director, ASEAN Institute for Health Development,
Mahidol University, Thailand

Dear Colleagues,

On behalf of the organizing committee, I am honored to welcome you to the 17th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). This international conference is jointly organized by the College of Public Health Sciences, Chulalongkorn University, Institute for Social and Population Studies and ASEAN Institute for Health Development of Mahidol University. The collaboration between these three organizations has been strengthened for several years. I wish for further achievements, and hope for continued cooperation.

This annual conference is served as a platform for graduate students to exchange their ideas, broaden their knowledge, meet new friends and do networking, and also strengthen academic collaboration among three partner organizations.

The success of the conference depends on our colleagues who have worked with us in planning and organizing this international conference. Recognition should go to the College of Public Health Sciences, Chulalongkorn University for organizing this successful conference. I also thank the Institute for Social and Population Studies for jointly organizing this outstanding conference. I sincerely congratulate you on the success of the conference, which was well-organized.

I would like to thank all participants for their contributions to the conference. I hope that you will have a productive and pleasurable time at this very special conference. I hope that you find the conference stimulating, fulfilling and enjoyable.

The 17th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP) July 7, 2026

A collaborative conference organized by

College of Public Health Sciences, Chulalongkorn University
ASEAN Institute for Health Development, Mahidol University
Institute for Population and Social Research, Mahidol University
Venue: **Poonsapaya Navavongs na Ayudhya Conference Room, 2nd-3rd Floors, Faculty of Education, Chulalongkorn University, Bangkok, Thailand**

Time	Program
8.00-8.30 **8.30-9.00**	VDO Presentation &Welcome **Conference Welcome Report** **Welcome keynote:** ***Professor Chitlada Areesantichai, Ph.D.*** Dean, College of Public Health Sciences, Chulalongkorn University ***Associate Professor Thunwadee Suksaroj, Ph.D.*** Director of ASEAN Institute for Health Development, Mahidol University ***Associate Professor Chalermpol Chamchan, Ph.D.*** Director, Institute for Population and Social Research, Mahidol University **Conference Opening Keynote** ***Prof. Rungsun Rerknimitr, Ph.D., M.D.*** Vice President of Chulalongkorn University *MC: Asst. Prof. Wandee Sirichokchatchawan, Ph.D.* Group Photo
9.00-9.30	**Keynote Speech** **Topic: Rethinking Population and Public Health: Aging, AI, and Global Resilience** ***Suwit Wibulpolprasert, M.D.*** Vice Chair, International Health Policy Program Foundation Chair, Research Policy Committee, Mahidol University Council Member, Mahidol University Council, Thailand *MC: Asst. Prof. Wandee Sirichokchatchawan, Ph.D.*
9.30-12.00	**Oral Presentation**
Room 1	**Poonsapaya Navawongs na Ayudhya Conference Room (1)**
	Track 1: Population, Demography, Aging and Migration, Active Aging and Innovation Maternal and Child Health **Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience** **Chairperson & Co-Chairperson** ***Assoc. Prof. Kraiwuth Kallawicha, Ph.D./ Lect. Truc Ngoc Hoang Dang, Ph.D.*** **Committee:** ***Tarinee Buadit, Ph.D.***
	1) Factors Associated with Full Immunization Status Among Children Aged 12 to 23 months in Selected Townships, Yangon Region, Myanmar by Yamon
	2) Access to Dental Services and Oral Health Status among Children Aged 0-12 Years Following the Transfer of Subdistrict Health Promoting Hospitals to Provincial Administrative Organizations by Anon Fuengkhajorn

	3) Factors Associated with Heat-Induced Productivity Loss among Myanmar Migrant Farm Workers in Mae Sot, Thailand by Khaing Thin Hlaing
	4) Sociocultural Adaptation of Filipino Migrants in Bangkok, Thailand by Cinderella Robles Rancap
	5) Determinants of Heat Adaptation among Myanmar Migrant Agricultural Workers by Nyein Thwe Ko
	6) Adverse Experiences and Unmet Maternity Care Needs among Myanmar Migrant Women Who Experienced Miscarriage in Thailand by Hnin Wai Wai Lin
	7) Factors Associated with Dietary Diversity among Myanmar Migrant Women during Pregnancy in Mae Sot, Thailand by Kyaw Zin Htut
	8) Associated Factors of Sedentary Behaviour among Myanmar Migrant Garment Workers in Mae Sot, Thailand by Khant Kyaw Kyaw Htet
	9) Ambient PM2.5 and Age-Appropriate Early Childhood Development in Thailand: A Nationwide Province-Level Panel Study, 2022–2025 by Yu Myat Nandar
	10) Post-Disaster Resilience and Its Associated Factors Among Volunteers of the Sagaing–Mandalay Earthquake, Myanmar by Thwet Su Su Htwe
Room 2	**Poonsapaya Navawongs na Ayudhya Conference Room (2)**
	Track 2: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology **Track 4: Communicable Diseases (CD) and Non-Communicable Diseases (NCD), Sexual and Reproductive Health and Rights, Gender and Sexuality, Violence Against Women and Children, STIs and HIV/AIDS** **Chairperson & Co-Chairperson:** *Assoc. Prof. Montakarn Chuemchit, Ph.D. / Asst. Prof. Dusita Phuengsamran, Ph.D.* **Committee:** *Suhaimee Buya, Ph.D.*
	1) Food Hygiene Practices and Associated Factors among Caregivers of Children Aged 6-59 Months in Peri-Urban Yangon, Myanmar by Myat Piti
	2) Determinants of Breast Cancer and Breast Self-Examination Knowledge and Perceptions among Women Aged 20–49 Years in Yangon, Myanmar by Nway Nway Mon
	3) Experience of Gender-Based Violence (GBV) and GBV Prevention during Disasters among Women and Gender-Diverse People in Japan: A Mixed Methods Study by SAE IINO
	4) Prevalence of Human Papillomavirus Vaccine Uptake and Associated Factors among Myanmar Women in Central Thailand: A Cross-Sectional Study by Nang Htwe Nu Aye
	5) Correlation and Associated Factors of Knowledge and Perception Regarding Cervical Cancer and Screening Among Women Aged 30-49 years in Yangon Region, Myanmar by Khin Kyi Thar Win
	6) Structural equation modeling for health practices of rural adults regarding non-communicable disease care during COVID-19: an endemic crisis in a pandemic by Suhala Ashraf Zeba
	7) Facilitators and Barriers to Access Sexual and Reproductive Health Information Services Among Young People in The Internally Displaced Population, Myanmar by Nang Hawm Hseng Khurh

	8) Association between Skincare Knowledge, Attitudes, Practices, and skin health among International University Students in Thailand by Vasundhara Nagini Ramisetty
	9) Inhibitory effect of 2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene in Migration and Epithelial-Mesenchymal Transition in Non-Small-Cell Lung Cancer Cells by Yuhao Xu
	10) Workplace Violence Against Prehospital Emergency Nurses: A Multicenter Cross-Sectional Study in Vietnam by Phan Minh Toan
Room 3	**Phra Ming Khwan Room 2 and 3**
	Track 3: Primary Health Care, Global Health, Health Care Management, Health Promotion, Health Behaviours, Substance abuse, Addiction studies, Mental Health, District Health System, Health System Research, Universal Health Care Coverage, Social Health Protection and Health Security Management, Health Economic, Behavioural Economic, Health Policy and Administration **Track 6: One Health, Zoonoses and Antimicrobial Resistance** **Chairperson & Co-Chairperson:** *Assoc. Prof. Jukkrit Wungrath, Ph.D. / Asst. Prof. Nucharapon Liangruenrom, Ph.D.* **Committee:** *Assoc. Prof. Pramon Viwattanakulvanid, PhD.*
	1) Direct Medical Cost of Chronic Kidney Disease Under the Universal Coverage Scheme in Thailand: A Nationwide Cross-Sectional Study by Rongrit Nanthapaibul
	2) Fear of Missing Out, Loneliness, and Social Media Checking Among Myanmar Migrants in Bangkok Metropolitan Area, Thailand: A Preliminary Findings by Aung Min Tun
	3) Factors Influencing Perception on Antimicrobial Stewardship Among Medical Doctors in Yangon, Myanmar by Chan Nyein Thet Tun
	4) The influence of motivation, self-confidence, and time management on academic burnout among secondary school students by Pitchatorn Yinchai
	5) The Influence of High-Sodium Intake Behavior Among Secondary School Students by Yanisa Pattaburee
	6) From Discomfort to Diagnosis: Examining Bhutanese Women's Perceptions and Challenges in Seeking Urinary Tract Infection Treatment by Sherab Zhiden Yezer
	7) The Missing Link Between Coverage and Care: Information Asymmetry among Myanmar Migrant Workers under Thailand's Migrant Health Insurance Scheme by Aye Chan Saint
	8) Factors Influencing Adherence to DASH Diet in Adult Patients with Hypertension in Watthana Nakhon District, Sa Kaeo: A Pilot study by Chayakan Laviplatanyaboon
	9) The Association Between Healthcare Resources and Road Traffic Mortality and Years of Potential Life Lost in Thailand, 2019 to 2024 by Nunnapat Pungloy
12.30-13.30	**Poster Presentation** **Poster committees:** *Prof. Emeritus Ratana Somrongthong, Ph.D. / Nanta Auamkul, M.D, M.P.H.* *Asst. Prof. Pokkate Wongsasuluk, Ph.D./ Kriangkrai Lerdthusnee, Ph.D.* *Assoc. Prof. Chaweewon Boonshuyar/ Sompong Chaiopanont, M.D.* *Nipunporn Voramongkol, M.D., MPH. / Assoc Prof. Khemika Yamarat, Ph.D.* *Narumol Bhummaphan, Ph.D. / Ridhwan Fauzi, Ph.D.* *Onuma Zongram, Ph.D. / Nuchanad Hounnaklang, Ph.D.*

1) Challenges and Suggestions for Disease Prevention and Control Performance of District Health Boards in Health Region 2, Thailand
by Woraphon Reangchan

2) Climate Change–Related Quality of Life Among Residents of Five Cities in Myanmar: Physical and Psychological Perspectives
by Myo Thuta

3) Role of Media Framing and Tone in Shaping Anxiety Responses to Sexual Violence Content among Women in New Delhi, India
by Deepali Sharma

4) Association between Chewing Tobacco Use and Oral Health Outcomes among Women in Bilaspur City, India: A Cross-Sectional Study
by Karuna Ekta Chhatter

5) Sports Habits and Sports Injuries associated to Chronic Pain Among University of Physical Education and Sports Students in Beijing, China: A Preliminary Study
by Li Jiameng

6) Cyberbullying Involvement and Digital Self-Harm Among Adolescents: The Role of Help-Seeking Behavior and Demographic Factors
by Nurlaila Fitriani

7) Multilevel Barriers to Childhood Immunization among Migrant and Refugee Caregivers: A Scoping Review Using the Socio-Ecological Framework
by Kyaw Hein

8) Determinants of Hypertension Health Literacy Among Myanmar Migrant Workers in Early Adulthood in Tak Province, Thailand
by Htin Kyaw Soe

9) Exploring the determinants of Health Seeking Behaviors among Tuberculosis Patients in Hlaing Thar Yar, Yangon, Myanmar
by Ye Htut Naing

10) Factors Related to the Revisit Intention to Thai Massage Services among International Tourists in Bangkok, Thailand
by Sukanya Watanapradit

11) Adaptive Strategies for Catch-up Immunization Delivery in Humanitarian Settings: An Embedded Implementation Study
by Htet Zaw Shein

12) Current Status of Medical Staff's Cognition on Integration of Medicine and Prevention in Infectious Disease Hospitals of Inner Mongolia
by Chen Cong

13) Barriers to Lifestyle Modification and Self-Care Behaviors Among Patients with Diabetes and Hypertension: A Cross-Sectional Study in Nonthaburi, Thailand
by Panun Suwannit

14) Dietary Behaviors and Cultural Food Practices among Older Adults with Uncontrolled Hypertension in Rural Southern Thailand: A Qualitative Study
by Wannapa Bunsong

15) Negotiating Masculinity Beyond the Body: Responsibility, Recognition, and Social Navigation among Self-Identified Transgender Men from Myanmar
by Khaing Thinzar Kyaw

16) Association Between Fertility Limiting Intentions and Couple Contraceptive Utilization among Married Men in Urban Yangon, Myanmar
by Thaw Zin Thein

17) Socioeconomic and Demographic Drivers of Fertility Intentions among Married Women in Kathmandu, Nepal
by Samun Acharya

18) The Influence of Loneliness and Joy of Missing Out (Jomo) on Doomscrolling Among Adolescents
by Nicha Satayamana

19) Research on the Mechanisms and Optimization Pathways of AI-Assisted Diagnosis and Treatment Empowering Primary Healthcare Services in Inner Mongolia, a protocol
by Mu Junhan

	20) Exploring How Local Public Financial Management Practices shape the delivery of Primary Health Care: An Explanatory Study within the Philippines' Universal Health Care Implementation by Gillian Lauren Lipumano Garcia
	21) The effects of Social Influence, Self-regulation, Sedentary Behavior, and Escapism on Fear of missing out (FOMO) among Secondary School and University Students by Nataorn Thamasanong
	22) Prevalence of Work-related Musculoskeletal Disorders and Associated Factors among Male Machinery Workers in Mandalay, Myanmar: A preliminary study by Thin Zar Htet
	23) Manifestation of the Biopower Concept in the Vasectomy for Requirements to Garner Social Assistance by Andra Pratama Juliyanto
	24) A community survey on uptake of booster dose of COVID-19 vaccine among rural adults in Bangladesh: Structural equation modeling using the theory of planned behavior by Muhammed Ashraful Alam
	25) Spatial Educational Gradients, Educational Migration and Adolescent Mental Health: Preliminary Findings and a Mixed-Methods Research Protocol from China's Sichuan–Chongqing Border Region by Zanyun Huang
	26) A Cross-Regional Chronic Disease Risk Prediction Method Based on Federated Transfer Learning by Zhuangzhuang Zhu
	27) Examining the Influence of Sleep and Eating Behaviors on Academic Performance in High School Students by Waritchaya Suksaroj
	28) Does Resource Allocation Follow Need? Assessing the Distribution of Nutrition Service Units Relative to Stunting and Poverty Levels in Indonesia by Suci Retno Ningtiyas
	29) Association Between Social Media–Related Appearance Consciousness and Appearance Anxiety among University Students in Phuket Province, Thailand by Yarong Wang
	30) Effectiveness of a Multimedia Health Education Intervention in Improving Inhaler Technique Among Caregivers of Children with Asthma in Vietnam: A Randomized Controlled Trial by Vu Ngoc Thao Vy
	31) Factors Affecting Earthquake Preparedness Behavior in Earthquake-Prone Area based on Disaster Literacy Model: A Systematic Review by Wisutthiphat Singklang
	32) Association Between Short-Video Use and Depression Among Female Undergraduate Students in Shanghai: A Cross-Sectional Study by Yiying Chen
13.30-16.00	**Oral Presentation**
Room 1	**Poonsapaya Navawongs na Ayudhya Conference Room (1)**
	Track 1: Population, Demography, Aging and Migration, Active Aging and Innovation Maternal and Child Health **Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience** **Chairperson & Co-Chairperson:** *Assoc. Prof. Sudarat Musikawong, Ph.D./ Kinga DR. Biro, Ph.D.* **Committee:** *Assoc. Prof. Wattasit Siriwong, PhD.*

	11) Determinants of Psychological Resilience and Its Associations with Professional Quality of Life among Health Workers of Ethnic Health Organizations on the Thai-Myanmar Border by Si Thu Naing
	12) High-Salt Food Consumption Behavior Among Myanmar Migrants in Samut Prakan Province, Thailand by Aye Myat Mon
	13) Determinants of Sustainable Food Consumption among Myanmar Migrants in Mae Sot, Thailand by La Min Thaw
	14) Correlation between Perceived Self-Efficacy and Disaster Preparedness among Employees of the Selected Higher Education Institution in Pasay City: A Basis for an Action Plan by Adrian Orrick T. Capiral
	15) Factors Associated with Childhood Vaccination Completeness among Myanmar Migrants in Mae Sot, Tak Province by Htoo Mu Phaw
	16) Psychological Well-Being among Older Filipinos in Solitary and Parent–Child Network Living Arrangements by Joy Marie A. Gillera
	17) Association Between Thai Language Proficiency and Psychosocial Well Being among Myanmar Migrants in Samut Sakhon Province, Thailand by Kyaw Kyaw Phyo Myat
	18) The Influence of Water Literacy, Hydration Awarness, Drinking Frequency, Drinking Behaviors, And Exercise on Confidence in Wster Quality Among Secondary School Students by Panthila Tanyakum
	19) The Effect of Muscle Strengthening and Balance Training Programs on Falls among Older Adults in Asia: A Systematic Review by Saowaluk Sudjarawut
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	11) Barriers to Glycemic Control among Patients with Uncontrolled Type 2 Diabetes in a Rural Community in Southern Thailand: A Qualitative Study by Taksina Choochuay
	12) Parental Knowledge on Adolescent Sexual and Reproductive Health and its Associated Factors among Parents of Adolescents aged 10-19 Years in Yangon, Myanmar by Haymar Aung
	13) Household Food Insecurity and Coping Strategies in Myaungmya Township of Ayeyarwady Delta Region of Myanmar by Soe Thura
	14) Factors Associated with Menstrual Hygiene Practices among Reproductive-Age Women in Yangon, Myanmar: A cross-sectional study by Moe Aung @ Moe Aung Myin
	15) Evaluating Knowledge, Attitudes, and Digital Health Literacy for Artificial Intelligence Readiness among Healthcare Professionals in Yangon Region, Myanmar by Mi Mi Thet Chal

	16) Digital Health Literacy and Susceptibility to Health-Related Online Misinformation among Older Adults in Sriracha District, Chonburi: A Cross-Sectional Study by Supanun Wongsermsin
	17) An Analysis of Online Sexual Violence as a Risk Factor for Sexual Health in out of school Adolescent Girls in Zimbabwe by Lynn Ndlovu
	18) Knowledge, Attitudes, And Practices Regarding Breast Self-Examination Among Early Female Young Adults Aged 18–25 In Taiwan: A preliminary study by Shin Yu Shen
	19) Oral Health Conditions and Associated Factors Among Incarcerated Individuals with and Without Type 2 Diabetes Mellitus: A Cross-Sectional Study by Su Myat Noe
	20) Factors Associated with Sexual and Reproductive Health Literacy Among Adolescents in Karenni State, Myanmar by Tun Hla Phyu

Room 3	**Phra Ming Khwan Room 2 and 3**
	Track 3: Primary Health Care, Global Health, Health Care Management, Health Promotion, Health Behaviours, Substance abuse, Addiction studies, Mental Health, District Health System, Health System Research, Universal Health Care Coverage, Social Health Protection and Health Security Management, Health Economic, Behavioural Economic, Health Policy and Administration **Track 6: One Health, Zoonoses and Antimicrobial Resistance** **Chairperson & Co-Chairperson:** *Asst. Prof. Tepanata Pumpaibool, Ph.D, / Seema Vijay Medhe, Ph.D.* **Committee:** *Kwanchanok Jaisuekun, Ph.D.*
	11) Assessing Electronic Medical Records System Usage Among Medical Interns in Uganda Public Referral Hospitals. by Masika Mercy Masitula
	12) Knowledge, attitudes and practices on substandard and falsified medical products among nursing professionals in Bhutan by Gyelwa Kuenzom
	13) The influence of weekly exercise and allergic rhinitis symptoms frequency on sleep deprivation among secondary school students by Pen-eck Phattharawimoltham
	14) Knowledge, Attitude and Practice of Adverse Drug Reaction Reporting among Healthcare Professionals at the National Referral Hospital in Bhutan: A Cross-Sectional Study by Kinley Penjor Tshomo
	15) Relationship between attitudes toward oral cancer and betel quid dependency in Mandalay, Myanmar by Ye Yint Htet
	16) Attitude towards road crossings, peers influence, and perceived severity behavior on pedestrian behavior among secondary school students by Janista Jue-chan
	17) Development of board game prototype for reducing rabies risk behavior of secondary school students based on pet attitude, rabies knowledge, and perceived vulnerability framework by Siraphassorn Charikphruet
	18) Prevalence and Associated Factors of Burnout Among Fifth-Year Medical Students in Chengdu, China: An institutional-based cross-sectional study by Lu Chen

	19) Financial Toxicity and Treatment Adherence: The Association between Out-of-pocket Expenditures and Treatment Continuation among Adult Cancer Patients in Bangladesh: A Secondary Research by A K M Shahriar **20) Psyche Integration Mental Health Ecosystem Model (PIMHEM): A Systems-Level Framework for Mental Health Development in Thailand** by Panthipa Suksirisorn
	Wrap Up & Evaluation *MC: Representative CPHS students*
16.00-16.30	**Outstanding Award and Closing** ***Prof. Chitlada Areesantichai, Ph.D.*** Dean, College of Public Health Sciences, Chulalongkorn University *MC: Asst. Prof. Anchalee Prasansuklab, Ph.D. and Asst. Prof. Wandee Sirichokchatchawan, Ph.D.*

Track I

Communicable Diseases, Immunization, AMR and Medicines Safety

DEVELOPMENT OF A BOARD GAME PROTOTYPE FOR REDUCING RABIES RISK BEHAVIOR OF SECONDARY SCHOOL STUDENTS BASED ON PET ATTITUDE, RABIES KNOWLEDGE, AND PERCEIVED VULNERABILITY FRAMEWORK

Nunnapus Huamaungrach[1], Waranyupa Ukkutanon[1], Siraphassorn Charikphruet[1*], Chayawat Siripantasak[1]

[1]*Srinakharinwirot University Prasarnmit Demonstration School (Secondary), Thailand*

**Corresponding Author: Siraphassorn Charikphruet,*

Srinakharinwirot University Prasarnmit Demonstration School (Secondary), Bangkok, Thailand,

Email: siraphassorn.saw2306@gmail.com

ABSTRACT

Introduction: Rabies is one of the most serious infectious diseases. It can affect all age groups, including children. However, there remains a significant knowledge gap in the development of innovations affiliated with rabies risk behaviors. Such development requires understanding of pet attitudes, rabies knowledge, and perceived vulnerability, which deserve further study.

Objectives: This study aims to 1) examine rabies risk behavior, pet attitude, rabies knowledge, and perceived vulnerability; 2) examine the relationships between rabies risk behavior and pet attitude, rabies knowledge, and perceived vulnerability; 3) examine the impact of pet attitude, rabies knowledge, and perceived vulnerability on rabies risk behavior; and 4) develop a board game that reduces rabies risk behavior among secondary school students.

Methodology: Samples were 85 secondary school students. Research instruments were the rabies risk behavior, pet attitude, rabies knowledge, and perceived vulnerability scales. The questionnaire demonstrated adequate reliability and construct validity. Data were analyzed using descriptive statistics, Pearson's correlation, and multiple regression analysis.

Results: Research results were as follows. 1) The mean score of rabies risk behavior, pet attitude, rabies knowledge, and perceived vulnerability was 2.56, 3.74, 2.87, and 3.55, respectively. 2) Pet attitude had a significant positive correlation with rabies risk behavior at .05 level. 3) 15% of the variance in rabies risk behavior was explained by pet attitude, rabies knowledge, and perceived vulnerability. Pet attitude had a significant positive influence on rabies risk behavior at the .05 level. Rabies knowledge and perceived vulnerability had an insignificant negative influence on rabies risk behavior at the .05 level. 4) A board game was developed by focusing on pet attitude as the significant predictor of rabies risk behavior and adapting from monopoly boardgame, along with introducing theoretical content, including emotional expressions and situations in which mammals should not be approached, into the play process.

Conclusion: Among secondary school students, pet attitude without boundaries and lack of safety awareness is a major factor driving rabies risk behavior. An important outcome is the development of a board game that provides a framework for future use and research.

Keywords:

Rabies Risk Behavior; Pet Attitude; Rabies Knowledge; Perceived Vulnerability

INTRODUCTION

Rabies continues to place a burden on the Thai public health system (1). Therefore, rabies risk behavior has become an issue worth considering. It refers to systems' actions related to the likelihood of rabies contamination developing into infection. This includes interacting with mammals, as well as behaviors that increase the probability of contracting rabies (2). For example, approaching animals with unknown disease status (3). Thus, it can be seen that rabies risk behaviors are important and should be handled efficiently.

One of the tools with the ability to build motivation, reinforce, and provide knowledge is board games. They also support social involvement while being played. As stated above, they are a viable alternative to gamification for health behaviour change (4). Moreover, studies suggest that well-designed educational board games can help students master difficult concepts in less time than traditional lectures (5). Given these points, board games are expected to be able to reduce risk behaviors. Nevertheless, resources on board games that include rabies risk behavior and its factors are still limited.

Managing rabies risk behavior and designing a board game to interfere with the issue as stated effectively requires knowledge of factors that may influence it. Pet attitude is one factor associated with rabies risk behavior refers to the perspective, as well as the evaluation of the worthiness of pets to an individual. It reflects the level of adoration, attachment, and acceptance of the pet's role in life (6). By reflecting through closeness and viewing the pet as a family member. From studying the concept of Lakestani (7), attitude toward pets leads to demeanor toward animals, which may result in the likelihood of getting bitten and could be considered as rabies risk behavior.

In addition, rabies knowledge may cause rabies risk behavior; it refers to a valuable state in which individuals acknowledge and understand facts correctly (8) about rabies, which contains general clinical characteristics and fundamental laws related to rabies (9). From a study by Ross (10), the lack of rabies knowledge could lead to ignorance of consequences which comes with dog bites. Accordingly, low rabies knowledge may lead to rabies risk behavior.

Considering other factors that may lead to rabies risk behavior, perceived vulnerability is one of the factors. Perceived vulnerability refers to an individual's perception of their risks of experiencing dangerous situations in life (11). Based on a study by Laorujisawat (12), a relationship between rabies protective behavior and Protection Motivation Theory was found. One of the components in the factor previously mentioned is perceived vulnerability. Consequently, perceived vulnerability may affect Rabies risk behavior.

The findings suggest that pet attitude, rabies knowledge, and perceived vulnerability may influence rabies risk behavior. However, previous findings that associate them remained limited. For example, research by Seligsohn (13) mentioned that children's probability of getting bitten by dogs was higher than adults'. Nevertheless, the sample delimitation was 10-18 years old; delimitation of narrower scopes, such as 12-18, was not found, as were correlations between other factors that may affect rabies risk behavior. Furthermore, the effects of health literacy and Protection Motivation Theory on rabies protective behaviors were found (14). However, mentions of other factors that could affect rabies risk behavior have not yet been identified. Moreover, research stated that individuals with better pet attitudes are more likely to be able to evaluate dog behaviors better (7). On the other hand, connections between other factors that could affect rabies risk behavior have yet to be found. Even though there is a substantial amount of health-related educational board games, e.g., board game to promote healthy habits for patients with coronary artery disease (15), educational board game for increasing knowledge, positive attitudes-beliefs, and self-efficacy for dengue prevention (16), and card game aims to increase children's Rabies knowledge (17), studies that associate rabies board games and previously discussed factors are still scarce. Moreover, board games that

interfere with rabies risk behavior resulting from those factors are still limited.

Previous studies have identified significant knowledge gaps on the effects of these factors on rabies risk behavior, which should be examined. Furthermore, developing an effective board game affiliated with rabies risk behaviors requires understanding of the factors as mentioned. Therefore, researchers intended to conduct research and develop a board game that emphasizes the reduction of pet attitude, rabies knowledge, and perceived vulnerability, which affect rabies risk behavior among secondary school students. Researchers hope that this study will raise awareness of factors contributing to rabies risk behavior and lead to approaches for solving this problem. This aligns with one of the seven backbones of Thailand's MOPH Policy 2026 belonging to the Ministry of Public Health, Smart Life & Primary Care Connectivity, prevention and seamless care (18), by adjusting the youth's behaviors in the long term. Furthermore, this aligns with two of the Sustainable Development Goals (SDGs), goal number three, to ensure healthy lives and promote well-being for all ages, and goal 4.7, ensuring that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles (19).

METHODOLOGY

This research consisted of 2 phases. Phase 1 involved studying the influence of various factors on rabies risk behavior. Phase 2 was about board game development. Methodology for each phase was described as follows:

Phase 1: Study of influence on rabies risk behavior

Participants

The target population comprises Thai secondary school students. A total of 85 participants were recruited via online platforms and were required to be 12-18 years old, providing consent for data collection prior to participation. The sample sizes are more than the minimum sample size (N = 85) from multiple regression analysis, corresponding to Soper (20), with an effect size Cohen's f^2 from Morowatisharifabad (21) of 0.226, an alpha value of .05, power of .95, and a number of predictors of 3.

Research instrument

This study uses a scale via Google Forms to examine and collect primary data with 4 sections: rabies risk behavior, pet attitude, rabies knowledge, and perceived vulnerability as follows. The quality assessment results of the Rabies risk behavior scale using Cronbach's alpha coefficient ranged from .360 to .940, and the construct validity assessment revealed that the scale demonstrated good fit indices ($X^2/df < 0.9$, $p > .05$, $RMSEA < .05$, $SRMR < .05$).

1. Rabies risk behavior. This section included 5 items, and each item was rated on a 5-point Likert scale. The scale was adapted from Seligsohn (13).

2. Pet attitude. This section included 6 items, and each item was rated on a 5-point Likert scale. The scale was adapted from Templer (22).

3. Perceived vulnerability. This section included 3 items, and each item was rated on a 5-point Likert scale. The scale was adapted from Laorujisawat (12).

4. Rabies knowledge. This section included 3 items, and each item was a True-False test. The test was adapted from Laorujisawat (12). The internal consistency assessment result of rabies using KR-20 revealed that the scale demonstrated good fit indices.

Data analysis

Data analysis was performed using R version 4.5.2 and RStudio:

1. The description of rabies risk behavior, pet attitude, rabies knowledge, and perceived vulnerability was analyzed using descriptive statistics. The criteria used for assessing pet attitude and rabies knowledge were adapted from Templer (22) and Laorujisawat (9).

2. The relationship between Rabies risk behavior, pet attitude, Rabies knowledge, and perceived vulnerability was analyzed using Pearson's correlation coefficient.

3. The influences of pet attitude, Rabies knowledge, and perceived vulnerability on Rabies risk behavior were examined using multiple regression analysis. Variable selection by using enter regression and review agreement as follows, 1) examine normal distribution of residual in data analysis by using Shapiro-Wiks, which has higher efficiency than Kolmogorov-Smirnov (23), 2) examine linear relationship by using Harvey-Collier test and Rainbow test, 3) examine homoscedasticity by using Breusch-Pagan test and Goldfeld-Quandt test, 4) examine the absence of autocorrelation by using Durbin-Watson test and 5) examine multicollinearity problem by using *VIF* statistic.

Phase 2: Board game development

The second phase was the board game development stage. The board game was designed using the variables that demonstrated statistically significant influence on rabies risk behavior in Phase 1. This study uses the Monopoly board game and introduces theoretical content into the play process. The prototype was reviewed in terms of appropriateness of content, connection between gameplay and study object, and suitability for the target group. According to the adviser's comments, revisions were made to the theoretical content and gameplay before the final prototype.

RESULTS

The results are presented in two phases as follows:

Research result phase 1

The results of descriptive statistics describing rabies risk behavior, pet attitude, Rabies knowledge, and perceived vulnerability were displayed in Table 1.

Table 1 Mean and *SD* of variables

Variables	*M*	*SD*	Level
Rabies risk behavior	2.56	0.89	-
Pet attitude	3.74	1.18	High
Rabies knowledge	2.87	1.11	Low
Perceived vulnerability	3.55	0.81	-

Table 1 reported that the average of Rabies risk behavior is 2.56 (*SD* = 0.89). Pet attitude was considered at a high level (*M* = 3.74, *SD* = 1.18). In contrast, Rabies knowledge was considered at a low level (*M* = 2.87, *SD* = 1.11). The average perceived vulnerability was 3.55 (*SD* = 0.81).

The correlation using Pearson's correlation coefficients among variables following the research objectives was presented in Table 2

Table 2 Correlation matrix among variables

Variables	Rabies risk behavior	Pet attitude	Rabies knowledge	Perceived vulnerability
Rabies risk behavior	1.00			
Pet attitude	.337* (*p* =.002)	1.00		
Rabies knowledge	-.196 (*p* = .073)	-.056 (*p* = .609)	1.00	
Perceived vulnerability	.028 (*p* = .802)	.178 (*p* = .103)	-.044 (*p* = .691)	1.00

Table 2 indicated that pet attitude had a positive significant correlation with rabies risk behavior at the .05 significance level (r = .337, p = .002). In contrast, Rabies risk behavior had a negative, insignificant correlation with Rabies risk behavior at the .05 significance level (r = -.196, p = .073). The correlation between perceived vulnerability and Rabies risk behavior was positive and insignificant at the .05 significance level (r = .028, p = .802).

The results of the assumptions of the multiple regression are demonstrated as follows. 1) The distribution of residuals in the data analysis using the Shapiro-Wilk test did not significantly differ from a normal distribution at the .05 statistical significance level (W = 0.984, p = .391). 2) The Harvey-Collier test (HC(80) = 0.245, p = .807) and the Rainbow test ($Rain$(43,38) = 1.1395, p = .343) showed that the relationship in regression was not significantly different from a linear relationship at the .05 significance level. 3) Breusch-Pagan test (BP(3) = 7.121, p = .068) and Goldfeld-Quandt test (GQ(39,38) = 1.166, p = .319) indicated that the variance of the residuals was significantly constant at the .05 level. 4) The examination of autocorrelation from the Durbin-Watson test revealed that autocorrelation was insignificantly greater than 0 at the .05 significance level (DW = 2.263, p = .880). 5) VIF values ranged from 1.004 to 1.035, indicating that multicollinearity was not a concern. Therefore, multiple regression analysis could be performed.

Multiple regression was conducted to study the influence of pet attitude, rabies knowledge, and perceived vulnerability on rabies risk behavior, which was demonstrated in Table 3.

Table 3 Multiple regression analysis for rabies risk behavior (*p < .05)

Variable	*B*	*Beta*	*SE*	*t*	*p*
Pet attitude	0.25	0.33	0.08	3.19*	.002
Rabies knowledge	-0.14	-0.18	0.08	-1.74	.086
Perceived vulnerability	-0.04	-0.03	0.12	-0.38	.705

R^2 = .15, $R^2_{adjusted}$ = .11, F (3,81) = 4.623, p = .004

Results from Table 3 illustrated that 15% of the variance in rabies risk behavior was significantly explained by pet attitude, rabies knowledge, and perceived vulnerability at the .05 significance level. It can be indicated that pet attitude had a positive significant influence on rabies risk behavior at the .05 significance level ($Beta$ = 0.33, p = .002). Rabies knowledge had a negative, insignificant influence on rabies risk behavior at the .05 significance level ($Beta$ = -018, p = .086), and perceived vulnerability also had a negative, insignificant influence on rabies risk behavior at the .05 significance level ($Beta$ = -0.03, p = .705).

Research result phase 2

1) Board game feature design

The board game feature develops from a literature review and related studies. Each feature was designed to promote caution and reduce rabies risk behaviors as presented in Table 4.

Table 4 Board game feature design

Feature	Detail	Target outcome of board game	
		Pet attitude	Rabies risk behavior
1. Illustration of different mammals' emotional expressions.	Learning to categorize mammals' expressions may increase safe interaction.	Children can learn how to interpret dogs' behaviors, helping avoid dog bites (9).	

Feature	Detail	Target outcome of board game	
		Pet attitude	Rabies risk behavior
2. Portraying mammals as frightening	Presenting serious consequences may increase caution when interacting with mammals.	Messages with high depicted severity positively influenced attitudes, intentions, and behaviors (30).	
3. Rabies risk simulated situation	Learning safe human-animal interaction through simulate situation increasing self-efficacy and may lead to decreased rabies risk behavior.	Interventions have a moderate effect on improving children's safety knowledge around dogs and a relatively large effect on promoting safe interactions between children and dogs (27). Self-efficacy building strategies, such as role-playing wound care or using peer modeling, can help bridge the gap between awareness and behavior (10).	Intervention studies based on PMT should focus on improving self-efficacy and response efficacy, focusing on teaching students not to intervene with fighting animals (11).
4. Basic information about rabies	Basic information about rabies is necessary and may help decrease rabies risk behavior.		Increase knowledge and understanding on the assumption that this will result in a change in child behavior, reducing dog bites (24).

According to Table 4, the board game was developed by incorporating features based on results from Phase 1 and using evidence supported by the previous study. Each feature was selected to target outcomes related to improving pet attitude and reducing rabies risk behavior.

2) Board game prototype and details

The final draft version of the board appearance can be seen in Figure 1

Figure 1 The prototype of the rabies Monopoly board game

The board game was adapted from the Monopoly format. The property spaces have images of mammals displaying various emotions, along with a hand-drawn background. Green and red bars indicate the potential risk of harm.

The display of animal images was intended to support learning and categorize mammals' emotional expression, based on the study of Lakestani and Donaldson (7), which may help increase caution around mammals. The other purpose is to portray mammals as frightening.

In addition, the special spaces represented simulated situations that may lead to rabies risk or proper behaviors in injury-risking situations. Role-playing and simulated situations were designed to increase confidence when facing those in real-life situations.

The bat cave zone at the corner of the board was designed to highlight the severity of outcomes from rabies risk behaviors. There are also rabies-related question spaces that provide basic information about rabies to encourage safer behaviors.

DISCUSSION

Pet attitude had a significant positive influence on rabies risk behavior, considering it a major factor driving these behaviors. This finding is consistent with the Knowledge-Attitude-Practice model from Sivagurunathan (25), which suggests that attitude influences action. People with more positive attitudes towards mammals are more likely to have contact with them (26). Familiarity and affection for pets may reduce caution (10). Accordingly, pet attitudes without appropriate safety awareness may increase rabies risk behavior.

Rabies knowledge had insignificant negative influence on rabies risk behavior, suggesting that knowledge alone may not lead to behavioral change. This is consistent with research by Shaban (27), as risky behaviors in real-life situations are often controlled by other factors that outweigh rational information. The students' high knowledge but lack of behavioral influence highlights a knowledge-practice gap, consistent with Laorujisawat (9).

Perceived vulnerability also had an insignificant negative influence on rabies risk behavior, suggesting that feeling at risk alone may be insufficient to change behavior. According to the Health Belief Model, perceived vulnerability is more effective when combined with perceived severity and self-efficacy (28). Similarly, Kabeta (29) found that awareness of rabies does not necessarily result in appropriate preventive behavior. Overall, pet attitude appeared to have a stronger influence on rabies risk behavior than perceived vulnerability.

The study results led to the design of a Monopoly-style board game on rabies risk behavior. The design was based on the concept of Lakestani and Donaldson (7), who suggested that understanding mammal behavior may reduce bite risk. The game board also includes negative consequences when players encounter risky mammals or dangerous situations. These elements were based on the concept of fear appeal, emphasizing disease severity and its potential influence on attitudes and health behaviors (30). Furthermore, the game incorporates simulated rabies risk scenarios requiring players to respond to risky mammals or answer rabies-related questions. These scenarios were based on self-efficacy and response efficacy from Protection Motivation Theory (12, 31), suggesting that interactive learning may promote safer behaviors. The Rabies Monopoly board game uses question cards to provide essential rabies information and promote appropriate pet attitudes and prevention behaviors through experiential learning rather than knowledge alone. However, the board game has not yet been evaluated. Future intervention research should evaluate its effectiveness in improving rabies-related behaviors and obtain appropriate ethical approval, particularly when involving secondary school students.

CONCLUSION

The findings indicated that secondary school students had a high level of pet attitude, low rabies knowledge, and moderate perceived vulnerability. Pet attitude had a statistically

significant positive influence on rabies risk behavior. Therefore, a Monopoly-style board game was developed to improve pet attitudes and rabies knowledge and promote safer interactions with mammals. Future studies should evaluate its effectiveness in reducing rabies risk behavior among secondary school students.

RECOMMENDATIONS

The findings suggest that rabies risk behavior is influenced by attitudes and perceived vulnerability and severity, particularly pet attitude (28). Therefore, relevant agencies should develop rabies prevention and control measures focusing on pet attitude and community-based strategies to improve awareness and promote appropriate preventive behaviors, such as post-exposure prophylaxis, among adolescents (15, 1). Educational institutions and public health agencies can use the rabies board game to improve risk communication and decision-making, bridging the gap between knowledge and preventive practice.

Future research should develop and evaluate interventions targeting pet attitude and rabies knowledge using randomized controlled trials (RCTs) or other experimental designs, guided by the Health Belief Model and the Knowledge, Attitude, and Practice (KAP) model. This is supported by KAP studies showing that positive attitudes are associated with appropriate rabies prevention behaviors (3, 32).

ETHICAL DECLARATION

No formal ethical review was conducted. However, informed consent was obtained from participants, who were informed of the study purpose, voluntary participation, and confidentiality. Responses were used solely for research purposes, and only consenting participants proceeded.

LIMITATIONS

The limitations of the study lie in the lack of balance between male and female participants. One of the other obvious limitations is the Lack of content validity assessment of the scale being adapted.

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EXPLORING THE FACTORS ASSOCIATED WITH HEALTH-SEEKING BEHAVIORS AMONG TUBERCULOSIS PATIENTS IN HLAING THAR YAR, YANGON, MYANMAR: A CROSS-SECTIONAL STUDY

Ye Htut Naing[1] and Narumol Bhummaphan[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand

***Corresponding author**: Narumol Bhummaphan,*

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, Email: Narumol.B@chula.ac.th

Abstract

Introduction: Tuberculosis (TB) remains a major public health challenge in Myanmar, one of the world's high TB-burden countries. Delayed or inappropriate health-seeking behaviors contribute to continued disease transmission, poor treatment outcomes, and increased risk of drug-resistant TB. Understanding the determinants of health-seeking behaviors among TB patients is essential for designing effective interventions. Despite Myanmar's high TB burden, evidence on determinants of health-seeking behaviors among TB patients remains limited.

Objective: To assess health-seeking behaviors among tuberculosis patients and identify the factors associated with these behaviors in Hlaing Thar Yar Township, Yangon, Myanmar.

Methodology: A cross-sectional study was conducted among 247 pulmonary TB patients aged 35 years and above attending two TB clinics in Hlaing Thar Yar Township. Participants were selected using purposive and convenience sampling methods. Data were collected through face-to-face interviews using a structured questionnaire. Health-seeking behavior was assessed using a composite score based on healthcare utilization practices and categorized as good or poor. Descriptive statistics were used to summarize participant characteristics. Associations between independent variables and health-seeking behaviors were assessed using Pearson's chi-square test, with statistical significance set at $p < 0.05$.

Results: Among the participants, 57.5% demonstrated poor health-seeking behaviors, while 42.5% exhibited good health-seeking behaviors. Significant associations were observed between health-seeking behaviors and age ($p = 0.017$), sex ($p = 0.043$), education level ($p = 0.029$), HIV status ($p = 0.015$), and distance to healthcare facilities ($p < 0.001$). Participants living more than three miles from healthcare facilities were substantially more likely to report poor health-seeking behaviors compared with those residing closer to services. HIV-positive patients also showed poorer health-seeking behaviors than HIV-negative patients. In contrast, marital status, employment status, income level, residence type, household size, and pulmonary comorbidity were not significantly associated with health-seeking behaviors.

Conclusion: Poor health-seeking behaviors were common among TB patients. Healthcare accessibility, HIV status, and some socio-demographic factors such as age, gender, and education significantly influenced health-seeking behaviors. Strengthening community-based TB education, reducing stigma, and improving access to TB care may enhance timely healthcare utilization and TB control outcomes in Myanmar. These findings can guide targeted interventions and policies to improve health-seeking behaviors among vulnerable TB populations.

Keywords:

Tuberculosis; Health-Seeking Behavior; Healthcare Accessibility; HIV, Myanmar

INTRODUCTION

Tuberculosis (TB) remains one of the foremost infectious disease threats to global public health. According to the World Health Organization (WHO), TB was responsible for approximately 1.25 million deaths in 2023 and continues to disproportionately affect low- and middle-income countries (1). Myanmar is classified among the 30 high TB-burden countries identified by the WHO, with an estimated incidence rate of 209 cases per 100,000 population, placing it among the most severely affected nations in Southeast Asia (1).

Health-seeking behavior refers to the actions individuals undertake when they perceive a health problem, including the decision to seek care, the choice of provider, and treatment adherence (2). Among TB patients, delays in care-seeking and reliance on informal or traditional providers are well-documented phenomena that contribute to prolonged disease transmission, poorer treatment outcomes, and heightened risk of drug-resistant TB (3-4). Early and appropriate health-seeking is therefore a critical component of effective TB control.

Multiple determinants have been identified in the literature as influencing health-seeking behaviors among TB patients, including socio-demographic factors (age, sex, education, income), health status (HIV co-infection, comorbidities), and structural barriers such as geographic distance to healthcare facilities (5-6). HIV co-infection, in particular, has been associated with altered health-seeking pathways due to compounding stigma and the complexity of dual disease management (7). Similarly, geographic inaccessibility has been consistently identified as a major barrier to timely TB care-seeking in low-resource settings (8).

Despite Myanmar's high TB burden, evidence on the specific determinants of health-seeking behaviors among TB patients within urban and peri-urban contexts remains limited. Hlaing Thar Yar Township, a densely populated industrial suburb of Yangon, presents a unique epidemiological context characterized by high population density, significant migrant labor populations, and uneven access to healthcare services. Understanding the factors shaping health-seeking behaviors in this context is essential for designing targeted, evidence-based interventions.

This study aimed to assess health-seeking behaviors among pulmonary TB patients attending TB clinics in Hlaing Thar Yar Township, Yangon, and to identify the associated factors of these behaviors.

METHODOLOGY

Study design and setting

A cross-sectional study was conducted in Hlaing Thar Yar Township, Yangon, Myanmar, from September 2025 to October 2025. The study was carried out at two designated TB clinics serving the township. Hlaing Thar Yar is one of the most populous townships in Yangon, with a large proportion of industrial workers and peri-urban residents, making it an important setting for public health research.

Population

The study population comprised pulmonary TB patients aged 35 years and above who were registered and receiving treatment at the two participating TB clinics. A total of 247 participants were recruited using a combination of purposive and convenience sampling methods. Inclusion criteria required a confirmed pulmonary TB diagnosis and current enrollment in TB treatment. Patients who were critically ill or unable to provide informed consent were excluded.

Sample size and sampling methods

The sample size was 247. Purposive and convenience sampling methods were used in this study.

Data collection

Data were collected through structured face-to-face interviews using a pre-tested questionnaire. The questionnaire captured: (1) socio-demographic characteristics (age, sex, marital status, education level, employment status, monthly income, residence type, and

household size); (2) health status (HIV co-infection and pulmonary comorbidity); (3) healthcare accessibility (mode of transportation and distance to the healthcare facility); and (4) health-seeking behaviors. Health-seeking behaviors were assessed using a composite scoring tool based on healthcare utilization practices relevant to TB care. The tool evaluated multiple dimensions of behavior, including the timeliness of seeking care, provider choice, and adherence practices. Composite scores ranged from 3 to 7, with higher scores indicating better health-seeking behaviors. Based on the score distribution, participants were categorized as having 'Good' or 'Poor' health-seeking behaviors, with the median score used as the cut-off point.

Validity and reliability

Item Objective Consistency (IOC) was used to determine the validity and reliability of the questionnaire; the average IOC was 0.7. Cronbach's alpha was used to test the reliability of the SPSS software. Cronbach's alpha was 0.7, so the questionnaire was considered reliable.

Statistical and analysis

Data were entered and analyzed using statistical software. Descriptive statistics, including frequencies, percentages, medians, and interquartile ranges (IQR), were used to summarize participant characteristics. Associations between independent variables and health-seeking behaviors were examined using Pearson's chi-square (χ^2) test. Statistical significance was set at $p < 0.05$.

RESULTS

Socio-demographic Characteristics

A total of 247 pulmonary TB patients were sampled (Table 1). The majority were aged 35–54 years (61.9%), with a median age of 49 years (IQR: 42–58). Males constituted 68.8% of participants. Most participants were married (80.6%), had a middle school education (47.0%), and were self-employed (63.2%). Monthly income for 83.8% of participants fell in the 150,000–500,000 MMK (1USD ≅ 4,000MMK) range. Nearly all participants (93.1%) resided in formal housing, and household sizes were approximately equally distributed between 1–4 persons (50.2%) and 5 or more persons (49.8%).

Table 1 Socio-demographic characteristics of study participants (n = 247)

Socio-demographic Characteristics	n	%
Age Group (Years)		
35–54	153	61.9
55 and above	94	38.1
Median (IQR) = 49 (42–58); Min–Max = 35–84		
Sex		
Male	170	68.8
Female	77	31.2
Marital Status		
Single	13	5.3
Married	199	80.6
Divorced	10	4.0
Widowed	25	10.1
Education Level		
Up to Primary School	84	34.0
Middle School	116	47.0
High School and Higher	47	19.0

Socio-demographic Characteristics	n	%
Employment Status		
Unemployed	69	27.9
Employee	22	8.9
Self-employed	156	63.2
Monthly Income		
< 150,000 MMK	31	12.6
150,000–500,000 MMK	207	83.8
≥ 500,000 MMK	9	3.6
Type of Residence		
Formal Housing	230	93.1
Informal/Temporary Housing	17	6.9
Total Number of People in Household		
1–4	124	50.2
5 and above	123	49.8
Median (IQR): 4 (4–5); Min–Max: 1–9		

Health Status

As shown in Table 2, the majority of participants were HIV-negative (93.1%), with 17 participants (6.9%) reporting HIV-positive status. Pulmonary comorbidities were present in 42 participants (17.0%), while 83.0% had no pulmonary comorbidity.

Table 2 Health status of study participants (n = 247)

Health Status	Yes n (%)	No n (%)
HIV status	17 (6.9)	230 (93.1)
Pulmonary disease status	42 (17.0)	205 (83.0)

Healthcare Accessibility

Table 3 shows that motorcycle (42.5%) and car (51.4%) were the predominant modes of transport used to reach healthcare facilities. Most participants (67.6%) lived within 3 miles of the nearest TB clinic, while 32.4% resided 4 miles or more away.

Table 3 Healthcare accessibility of study participants (n = 247)

Healthcare Accessibility	n	%
Mode of Transportation (multiple responses)		
Walk	6	2.4
Bus	46	18.6
Motorcycle	105	42.5
Car	127	51.4
Distance to Healthcare Facility		
≤ 3 miles	167	67.6
≥ 4 miles	80	32.4

Health-Seeking Behavior

Overall, 57.5% of participants demonstrated poor HSB, while 42.5% exhibited good HSB (Table 4). The composite HSB score ranged from 3 to 7, with a median score of 7 (IQR: 6–7).

Table 4 Distribution of health-seeking behavior score level (n = 247)

Health-Seeking Behavior Score Level	n	%
Good	105	42.5
Poor	142	57.5
Min–Max = 3–7; Median (IQR) = 7 (6–7)		

Association between Socio-demographic Characteristics and Health-Seeking Behavior

Bivariate analysis revealed significant associations between health-seeking behaviors and several socio-demographic factors (Table 5). Age group, gender, and education levels were significant. Older participants aged 55 years and above were more likely to exhibit poor health-seeking behaviors compared to younger participants (χ^2 = 5.74, p = 0.017). Female participants had a higher proportion of poor health-seeking behaviors (51.9%) compared to males (38.2%) (χ^2 = 4.08, p = 0.043). Education level was significantly associated with health-seeking behaviors (χ^2 = 7.09, p = 0.029), with participants who had attained high school education or above demonstrating the highest proportion of good health-seeking behaviors (70.2%). In contrast, marital status (p = 0.685), employment status (p = 0.568), monthly income (p = 0.071), residence type (p = 0.694), and household size (p = 0.740) were not significantly associated with health-seeking behaviors.

Table 5 Association between socio-demographic characteristics and health-seeking behavior (n = 247)

Socio-demographic Characteristics	Poor n (%)	Good n (%)	χ^2	*p*-value
Age Group (Years)			5.74	0.017*
35–54	56 (36.6)	97 (63.4)		
55–84	49 (52.1)	45 (47.9)		
Sex			4.08	0.043*
Male	65 (38.2)	105 (61.8)		
Female	40 (51.9)	37 (48.1)		
Marital Status			1.49	0.685
Single	7 (53.8)	6 (46.2)		
Married	81 (40.7)	118 (59.3)		
Divorced	5 (50.0)	5 (50.0)		
Widowed	12 (48.0)	13 (52.0)		
Education Level			7.09	0.029*
Up to Primary School	32 (38.1)	52 (61.9)		
Middle School	59 (50.9)	57 (49.1)		
High School and Above	14 (29.8)	33 (70.2)		
Employment Status			1.13	0.568
Unemployed	30 (43.5)	39 (56.5)		
Employee	7 (31.8)	15 (68.2)		
Self-employed	68 (43.6)	88 (56.4)		

Socio-demographic Characteristics	Poor n (%)	Good n (%)	χ^2	*p*-value
Monthly Income			5.28	0.071
< 150,000 MMK	19 (61.3)	12 (38.7)		
150,000–500,000 MMK	83 (40.1)	124 (59.9)		
≥ 500,000 MMK	3 (33.3)	6 (66.7)		
Type of Residence			0.15	0.694
Formal Housing	97 (42.2)	133 (57.8)		
Informal/Temporary Housing	8 (47.1)	9 (52.9)		
Household Size			0.11	0.740
1–4 persons	54 (43.5)	70 (56.5)		
5 and above	51 (41.5)	72 (58.5)		

*Note: * Significant at p < 0.05*

Association between Health Status and Health-Seeking Behavior

HIV status was significantly associated with health-seeking behaviors (χ^2 = 5.89, p = 0.015), with HIV-positive participants more frequently exhibiting poor health-seeking behaviors (70.6%) compared to HIV-negative participants (40.4%) (Table 6). Pulmonary comorbidity was not significantly associated with health-seeking behaviors (p = 0.328).

Table 6 Association between health status and health-seeking behavior (n = 247)

Health Status	Poor n (%)	Good n (%)	χ^2	*p*-value
HIV Status			5.89	0.015*
Negative	93 (40.4)	137 (59.6)		
Positive	12 (70.6)	5 (29.4)		
Pulmonary Disease Status			0.96	0.328
Negative	90 (43.9)	115 (56.1)		
Positive	15 (35.7)	27 (64.3)		

*Note: * Significant at p < 0.05*

Association between Healthcare Accessibility and Health-Seeking Behavior

Distance to the healthcare facility was the strongest association with health-seeking behaviors in this study, with a highly significant association (χ^2 = 43.55, p < 0.001) (Table 7). Among participants residing within 3 miles of a TB clinic, 71.9% demonstrated good health-seeking behaviors. Conversely, among those living 4 miles or more away, 72.5% exhibited poor health-seeking behaviors.

Table 7 Association between healthcare accessibility and health-seeking behavior (n = 247)

Healthcare Accessibility	Poor n (%)	Good n (%)	χ^2	*p*-value
Distance to Healthcare Facility			43.55	< 0.001*
≤ 3 miles	47 (28.1)	120 (71.9)		
≥ 4 miles	58 (72.5)	22 (27.5)		

*Note: * Significant at p < 0.05*

DISCUSSION

This cross-sectional study examined health-seeking behaviors and their associated factors among 247 pulmonary TB patients in Hlaing Thar Yar Township, Yangon, Myanmar. The key finding was that poor health-seeking behaviors were prevalent, affecting 57.5% of participants. Significant determinants included age, sex, education level, HIV status, and distance to healthcare facilities.

The high prevalence of poor health-seeking behaviors observed in this study is consistent with findings from other high-burden settings. Studies from sub-Saharan Africa and South Asia have similarly reported that a substantial proportion of TB patients experience delays in care-seeking and suboptimal utilization of TB services (3,5). In Myanmar specifically, qualitative studies have highlighted stigma, cost of transport, and limited TB awareness as key drivers of delayed and inadequate health-seeking (10).

The significant association between age and health-seeking behaviors, with older patients (55 years and above) more frequently exhibiting poor health-seeking behaviors, aligns with evidence suggesting that elderly individuals may face compounding barriers, including reduced mobility, fixed incomes, and lower health literacy (6). The finding that females more frequently demonstrate poor health-seeking behaviors is also consistent with literature documenting gender-based barriers to TB care, including social stigma, caregiver responsibilities, and reduced decision-making autonomy (11).

Education level emerged as a significant associated factor, with higher educational attainment associated with better health-seeking behaviors. This reflects the established relationship between health literacy, disease recognition, and healthcare utilization (12). Individuals with higher education are more likely to recognize TB symptoms early, understand the importance of prompt care-seeking, and navigate the healthcare system effectively.

The strong association between HIV co-infection and poor health-seeking behaviors is an important finding. HIV-positive TB patients face compounding stigma related to both conditions, which may deter them from seeking care (7). Additionally, the complexity of managing dual infection and concerns about disclosure may further impede timely health-seeking. These findings underscore the importance of integrated TB-HIV services that are designed to reduce stigma and facilitate seamless care (13).

Among all factors examined, distance to healthcare facilities had the strongest association with health-seeking behaviors ($\chi^2 = 43.55$, $p < 0.001$). Participants residing 4 miles or more from TB clinics were more than twice as likely to report poor health-seeking behaviors. This finding is consistent with the broader literature on geographic accessibility as a structural barrier to TB care (8). In peri-urban settings such as Hlaing Thar Yar, where public transportation may be limited and transportation costs constitute a meaningful expenditure for low-income households, distance represents a particularly salient barrier.

In contrast, marital status, employment status, income level, residence type, household size, and pulmonary comorbidity were not significantly associated with health-seeking behaviors in this study. These null findings may reflect the socioeconomic homogeneity of the sample, with the majority self-employed and earning in the middle-income bracket, or may point to the overriding influence of structural and disease-specific factors.

This study has several limitations. The cross-sectional design precludes causal inference. Purposive and convenience sampling may limit generalizability to all TB patients in Myanmar. The use of a composite health-seeking behaviors score, while enabling categorization, may not fully capture the multidimensional nature of health-seeking behaviors. Future studies employing longitudinal designs, validated health-seeking behaviors instruments, and multivariate analytical approaches would strengthen the understanding of these determinants.

CONCLUSIONS

Poor health-seeking behaviors were highly prevalent among TB patients in Hlaing Thar Yar Township, Yangon, Myanmar, with 57.5% of participants classified as having poor health-seeking behaviors. Significant determinants included older age, female sex, lower education level, HIV co-infection, and living more than 3 miles from TB healthcare facilities. These findings highlight the multifactorial nature of health-seeking behaviors among TB patients and point to priority areas for intervention.

RECOMMENDATION

To improve health-seeking behaviors and, consequently, TB control outcomes in Myanmar, a multi-pronged strategy is recommended. First, community-based TB education and awareness campaigns, particularly targeting older adults, women, and those with lower educational attainment, should be strengthened. Second, integrated TB-HIV services with embedded stigma-reduction components are essential to sUPPort the health-seeking of HIV-positive TB patients. Third, structural interventions to improve geographic accessibility, including mobile TB units, decentralized testing and treatment points, and transport subsidies, should be prioritized for communities living at greater distances from TB facilities. Together, these strategies have the potential to reduce barriers to timely care-seeking and improve TB treatment outcomes in high-burden urban settings.

ETHICAL DECLARATION

Ethical approval was obtained from Chulalongkorn University Research Ethics Review Committee for Research Involving Human Research Participants, Group I (RECCU), with COA No.297/68. Written informed consent was obtained from all participants before data collection. Confidentiality of participant data was maintained throughout the study.

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FACTORS ASSOCIATED WITH CHILDHOOD VACCINATION COMPLETENESS AMONG MYANMAR MIGRANTS IN MAE SOT, TAK PROVINCE

Htoo Mu Phaw[1], Jukkrit Wungrath[1]*, Orapin Laosee[1], Syarifah Aqilah[1]

[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand

***Corresponding Author**: Jukkrit Wungrath,*

ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73170, Thailand ,

Email: jukkrit.wun@mahidol.ac.th

ABSTRACT

Introduction: Myanmar migrant children along the Thailand-Myanmar border face barriers to healthcare, including irregular legal status, mobility, cost, and language. Evidence on age-appropriate vaccination completeness, as distinct from single-dose coverage, among these children in Mae Sot, Tak Province, remains limited.

Objective: To describe participant characteristics and examine factors associated with age-appropriate vaccination completeness among Myanmar migrant children in Mae Sot, Tak Province, and to generate evidence to improve vaccination services for migrant children in border areas.

Methodology: A cross-sectional study was conducted among 205 migrant caregiver-child pairs (children aged 0–59 months) using multistage stratified cluster sampling from urban/semi-urban, industrial, and agricultural communities. Data were collected through face-to-face interviews using a validated Myanmar-language questionnaire (IOC ≥ 0.66; Cronbach's α = 0.70) via Kobo Toolbox. Vaccination status was verified from vaccination cards against the Thai immunization schedule; completeness was defined as receipt of all age-due doses. Associations were examined using chi-square, Fisher's exact, or Fisher-Freeman-Halton exact tests ($p < 0.05$); multivariable analysis was not performed because of the small number of complete cases.

Results: Of 205 children, 48 (23.4%) achieved age-appropriate vaccination completeness, although the mean completion proportion (doses received/doses due) was 83.7% (SD = 21.0%). Most caregivers were female (89.8%) and mothers (87.3%), 43.4% were undocumented, and the mean knowledge score was 10.21/12 (SD = 1.10). Completeness was lower among children whose caregivers reported a Thai language barrier (6.5% vs 29.4%; $p < 0.001$), used motorbike taxis rather than public transport (13.4% vs 39.6%; $p = 0.004$), were undocumented rather than holding other documentation (18.0% vs 41.8%; $p = 0.006$), travelled 15–30 rather than <15 minutes (16.8% vs 41.3%; $p = 0.008$), or did freelance/seasonal work rather than being housewives (8.3% vs 29.4%; $p = 0.015$). Main caregiver of child ($p = 0.009$), vaccine availability ($p = 0.011$), and kinship to child ($p = 0.023$) were also significant. Knowledge and other socio-demographic characteristics were not significant. All associations are bivariate and unadjusted.

Conclusion: This study contributes to child health by showing that incomplete vaccination was common and appeared to reflect interrupted rather than absent vaccination. Language, documentation, access-related, and caregiving factors were associated with completeness; these should be confirmed in larger multivariable studies. Myanmar-language education with interpreter support, mobile outreach, flexible scheduling for caregivers in informal or seasonal work, and stronger follow-up systems may improve completeness, supporting Immunization Agenda 2030 and Sustainable Development Goals 3, 10, and 17.

Keywords:

Migrants; Childhood Vaccination; Immunization Completeness; Maternal and Child Health; Mae Sot

INTRODUCTION

Childhood vaccination is among the most effective and cost-effective public health interventions available, estimated to have averted some 154 million deaths worldwide over the past five decades (1,2). Global coverage has nonetheless stalled in recent years, and the largest remaining gaps are concentrated among marginalized and mobile populations (3,4,5). Vaccination coverage and age-appropriate vaccination completeness are not the same outcome: coverage typically refers to receipt of at least one dose of a given vaccine, the indicator most commonly reported in national and global immunization statistics (3), while completeness refers to whether a child has received all vaccine doses due for their age, reflecting the cumulative effect of access barriers across the entire schedule rather than a single dose. A child may therefore appear adequately covered under a coverage-based indicator while remaining incompletely vaccinated under a completeness-based indicator, particularly as delays and missed opportunities for catch-up doses accumulate (6,7). Migrant children along the Thailand-Myanmar border face compounding barriers to healthcare, including irregular legal status, mobility, cost, and language, that place them at risk of incomplete vaccination (8,9). Thailand hosts one of the largest Myanmar migrant populations in the region, and although migrant health insurance schemes and migrant-focused services exist, effective coverage remains uneven, particularly for undocumented families (10,11,12). Mae Sot District, on the Thailand-Myanmar border, hosts one of the largest concentrations of Myanmar migrants in Thailand and is served by a mix of Thai public health facilities and migrant-focused services operating under resource constraints, making it an important and policy-relevant setting in which to examine immunization gaps that may be indicative of broader vulnerabilities affecting migrant children across similar border districts (13,14). Studies in comparable settings have identified caregiver socio-demographic characteristics, migration-related factors, and health service accessibility as recurring correlates of childhood immunization (15,16,17). However, evidence on age-appropriate vaccination completeness specifically, rather than coverage alone, among Myanmar migrant children in Mae Sot remains limited, and it is unclear which factors are related to incomplete vaccination in this vulnerable group (13,15).

To describe participant characteristics and examine factors associated with age-appropriate vaccination completeness among Myanmar migrant children in Mae Sot, Tak Province, and to generate evidence to improve vaccination services for migrant children in border areas.

METHODOLOGY

A cross-sectional study was conducted among 205 migrant caregivers of children aged 0–59 months using multistage stratified cluster sampling across urban/semi-urban, industrial/factory-based, and agricultural-based communities. The sample size was calculated using the formula for estimating a single population proportion, assuming an expected vaccination completeness proportion of 50% in the absence of prior local estimates, a 95% confidence level ($Z = 1.96$), and a margin of error of 7%. A design effect of 1.5 was applied to account for the cluster sampling design. Mae Sot District was stratified into three strata based on community type, and one community cluster was randomly selected from each stratum using simple random sampling. Eligible caregiver–child pairs within each selected cluster were recruited using convenience sampling. Caregivers unable to present an official vaccination card were excluded, and any entries that remained unverified were excluded from the relevant denominator. Vaccination status was verified against the Thai Expanded Program on Immunization (EPI) schedule using the official vaccination card. A child was classified as complete if all age-due vaccine doses were received, on time or with delay, with zero missed doses; vaccines not yet due were excluded. A continuous vaccination completion proportion was also calculated as the ratio of doses received

to doses due. Data were collected via structured face-to-face interviews using a validated Myanmar-language questionnaire administered through Kobo Toolbox. The questionnaire comprised items covering four domains of independent variables: (1) caregiver and child socio-demographic characteristics (caregiver age, sex, education, household income, family type; child sex, birth order, place of birth); (2) migration-related factors (documentation status, duration of stay, language barrier); (3) health service accessibility (distance to facility, travel time, transport cost, mode of transport, vaccine availability); and (4) immunization knowledge, assessed using a 12-item instrument (score range 0–12) and categorized as poor (≤6), medium (7–10), or good (≥11). The dependent variable was age-appropriate vaccination completeness, assessed through vaccination card verification against the Thai EPI schedule and classified as complete or incomplete. Content validity was assessed using the Index of Item-Objective Congruence (IOC ≥ 0.66), and internal consistency of the knowledge scale was evaluated using Cronbach's alpha (α = 0.70, acceptable reliability). Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB), and informed consent was obtained from all participants prior to data collection. Bivariate associations were examined using Pearson chi-square or Fisher's exact tests; for tables larger than 2×2, the Fisher-Freeman-Halton exact test was applied whenever any expected cell count was below five. Significance was set at $p < 0.05$, using IBM SPSS Statistics version 31. Multivariable logistic regression was considered but deliberately not performed: with only 48 complete cases, a model containing the eight variables significant at the bivariate level would have had approximately six events per variable, below the conventional minimum of ten, and several variables contained sparse cells. The analysis was therefore restricted to bivariate testing, and all associations are reported as unadjusted.

RESULTS

Of 205 children, 48 (23.4%) achieved age-appropriate vaccination completeness, while 157 (76.6%) were classified as incomplete. The mean vaccination completion proportion, defined as the proportion of age-due doses actually received, was 83.7% (SD = 21.0%), indicating that although most children had received the majority of their age-due vaccines, only a minority had completed the full schedule. Most caregivers were female (89.8%) and had middle school education (45.9%); 43.4% were undocumented, 25.4 % reported other documentation, 22.4% held a pink card, 5.9 % held a work permit, and 3.9% were documented with a temporary or long-term visa. Among caregivers with available data on language barriers in communicating in Thai, 87.3% reported no barrier, 8.8% reported a barrier, and 3.9% reported a partial barrier. The majority demonstrated medium-to-good immunization knowledge, with a mean score of 10.21 (SD = 1.10) out of 12(Table 1). Caregiver occupation, kinship to child, main caregiver of child, documentation status, language barrier, vaccine availability, travel time to the health facility, and mode of transport were statistically associated with vaccination completeness in bivariate analysis(Table 2), but these findings should be interpreted cautiou-sly given the relatively small number of completely vaccinated children and the absence of multivariable adjustment.

Table 1 Socio-demographic and study characteristics of participants (N = 205)

Variable	n (%) or Mean (SD)
Caregiver characteristics	
Caregiver sex	
Female	184 (89.8)
Male	21 (10.2)
Education level	
Did not attend school	13 (6.3)
Primary school	75 (36.6)
Middle school	94 (45.9)
High school	19 (9.3)
University or higher	4 (2.0)
Caregiver occupation	
Housewife	96 (46.8)
Freelance/seasonal work	65 (31.7)
Unemployed	22 (10.7)
Farmer	2 (1.0)
Other	20 (9.8)
Family type	
Nuclear family	176 (85.9)
Extended family	26 (12.7)
Single-parent family	3 (1.5)
Kinship to child	
Mother	179 (87.3)
Sibling	21 (10.2)
Grandparent	3 (1.5)
Uncle/Aunt	2 (1.0)
Main caregiver of child	
Mother	176 (85.9)
Grandparent	27 (13.2)
Aunty/Uncle	1 (0.5)
Sibling	1 (0.5)
Child characteristics	
Child sex	
Male	115 (56.1)
Female	90 (43.9)
Birth order	
1st	96 (46.8)
2nd	71 (34.6)
3rd	24 (11.7)
4th or above	14 (6.8)
Place of birth	
Hospital/Health center	194 (94.6)
Home	9 (4.4)
Village health station	2 (1.0)
Migration-related factors	
Documentation status	
Undocumented	87 (42.4)
Other	52 (25.4)
Pink card	46 (22.4)
Work permit	12 (5.9)

Variable	n (%) or Mean (SD)
Temporary/Long-term visa	8 (3.9)
Language barrier (communicating in Thai)	
No	179 (87.3)
Yes	18 (8.8)
Partially	8 (3.9)
Health service accessibility	
Travel time	
<15 minutes	42 (20.5)
15–30 minutes	131 (63.9)
31–60 minutes	29 (14.1)
>1 hour	3 (1.5)
Vaccine availability	
Always available	170 (82.9)
Often available	35 (17.1)
Immunization knowledge	
Knowledge score, mean (SD)	10.21 (1.10)
Vaccination completeness	
Complete	48 (23.4)
Incomplete	157 (76.6)
Completion proportion, mean (SD)	83.7% (21.0%)

Table 2 Bivariate analysis of factors associated with age-appropriate vaccination completeness (N = 205)

Variable	Complete	Incomplete	Test statistic	p-value
Socio-demographic factors				
Caregiver sex			Fisher's exact	0.418
Female	45 (24.5)	139 (75.5)		
Male	3 (14.3)	18 (85.7)		
Education level			FFH exact	0.304
Primary school	23 (30.7)	52 (69.3)		
Middle school	15 (18.1)	68 (81.9)		
High school	3 (20.0)	12 (80.0)		
University	1 (25.0)	3 (75.0)		
Caregiver occupation			FFH exact	0.015*
Housewife	25 (29.4)	60 (70.6)		
Freelance/seasonal work	4 (8.3)	44 (91.7)		
Unemployed	2 (11.8)	15 (88.2)		
Other	7 (33.3)	14 (66.7)		
Family type			FFH exact	0.709
Nuclear family	43 (24.3)	134 (75.7)		
Single-parent family	0 (0.0)	2 (100.0)		
Extended family	5 (19.2)	21 (80.8)		
Kinship to child			FFH exact	0.023*
Mother	37 (20.6)	143 (79.4)		
Sibling	10 (50.0)	10 (50.0)		
Grandparent	1 (33.3)	2 (66.7)		
Main caregiver of child			χ^2=6.738	0.009*
Mother	36 (20.5)	140 (79.5)		
Grandparent/Other relative	12 (42.9)	16 (57.1)		

Variable	Complete	Incomplete	Test statistic	p-value
Child sex			χ^2=1.532	0.216
Male	21 (20.6)	81 (79.4)		
Female	22 (28.6)	55 (71.4)		
Birth order			FFH exact	0.174
1st	27 (29.0)	66 (71.0)		
2nd	12 (17.9)	55 (82.1)		
3rd	6 (26.1)	17 (73.9)		
4th or above	0 (0.0)	7 (100.0)		
Place of birth			Fisher's exact	1.000
Hospital/Health center	44 (23.5)	143 (76.5)		
Home or other	4 (22.2)	14 (77.8)		
Migration-related factors				
Documentation status			FFH exact	0.006*
Undocumented	16 (18.0)	73 (82.0)		
Pink card	7 (15.6)	38 (84.4)		
Work permit	2 (16.7)	10 (83.3)		
Other	23 (41.8)	32 (58.2)		
Documented (visa)	0 (0.0)	4 (100.0)		
Language barrier (Thai)			χ^2=12.476	<0.001*
No	32 (29.4)	77 (70.6)		
Yes	4 (6.5)	58 (93.5)		
Health service accessibility				
Travel time			FFH exact	0.008*
<15 minutes	19 (41.3)	27 (58.7)		
15–30 minutes	21 (16.8)	104 (83.2)		
31–60 minutes	8 (25.8)	23 (74.2)		
>1 hour	0 (0.0)	3 (100.0)		
Mode of transport			FFH exact	0.004*
Motorbike taxi	13 (13.4)	84 (86.6)		
Public transport	21 (39.6)	32 (60.4)		
Walking	8 (21.6)	29 (78.4)		
Private car	4 (28.6)	10 (71.4)		
Vaccine availability			χ^2=6.474	0.011*
Always available	34 (20.0)	136 (80.0)		
Often available	14 (40.0)	21 (60.0)		
Immunization knowledge				
Knowledge score, mean (SD)	10.40 (1.05)	10.15 (1.12)	t=1.339	0.182

*Note: FFH = Fisher-Freeman-Halton exact test. Exact significance (2-sided). * $p < 0.05$; ** $p < 0.01$*

DISCUSSION

This study examined factors associated with age-appropriate vaccination completeness among Myanmar migrant children in Mae Sot District (13,14). Using a definition that considered children as complete when all age-due vaccines were received either on time or within the allowable delay, 23.4% of children achieved vaccination completeness (6,15). Eight variables were significantly associated with completeness in bivariate analysis: caregiver occupation, kinship to child, main caregiver of child, documentation status, language barrier, vaccine availability, travel time, and mode of transport. Because no multivariable model was fitted, these are unadjusted associations rather than independent or causal effects. Several of the eight variables are also plausibly correlated with one another: caregiver occupation, kinship to child, and main caregiver identity describe overlapping features of the same household, and mode of transport is likely related to both occupation and

travel time. Their respective contributions therefore cannot be separated here, and confounding among them cannot be excluded. This caution, together with the modest number of completely vaccinated children (n = 48), applies to every association discussed below and is not repeated for each variable.

Language barrier in communicating in Thai was significantly associated with vaccination completeness. Children whose caregivers reported a language barrier had a lower completion rate (6.5%) than those whose caregivers reported no language barrier (29.4%). This finding is consistent with previous studies showing that language barriers limit access to health information and reduce effective communication with healthcare providers regarding vaccination schedules and follow-up appointments (8,14). In Mae Sot, these challenges may be further influenced by the limited availability of interpreter services and health education materials in Myanmar languages at vaccination facilities.

Documentation status was also significantly associated with vaccination completeness. The highest completion rate was observed among caregivers classified as having "other documentation" (41.8%), compared with undocumented caregivers (18.0%), pink card holders (15.6%), work permit holders (16.7%), and caregivers with temporary or long-term visas (3.9%). The associations between vaccine availability and travel time and vaccination completeness are consistent with previous studies describing geographic and health system barriers affecting migrant populations along the Thailand–Myanmar border (13,14).

Mode of transport was also significantly associated with vaccination completeness. Children whose caregivers mainly used motorbike taxis had a lower completion rate (13.4%) than those using public transport (39.6%). Although motorbike taxis offer flexibility for individual trips, the repeated cost of travelling for multiple vaccination visits may discourage caregivers from completing the vaccination schedule. Public transport may provide a more affordable option for repeated clinic attendance (6,14). Other factors, such as transport reliability and scheduling flexibility, were not assessed in this study but may also influence vaccination completion.

Caregiver occupation was significantly associated with vaccination completeness, with lower completion among children of freelance or seasonal workers than among children of housewives. This finding is broadly consistent with previous studies suggesting that informal employment may reduce caregivers' ability to attend vaccination services offered at fixed times because of work-related constraints (15,17). Significant associations were also observed for kinship to the child and the identity of the main caregiver. These findings may reflect differences in household decision-making and caregiving responsibilities, although the underlying mechanisms could not be explored using the present cross-sectional design and warrant further qualitative research.

Several variables commonly associated with vaccination outcomes in the literature were not statistically significant in this study, including caregiver sex, education level, family type, child sex, birth order, place of birth, and knowledge score. This should not be interpreted as evidence that these factors are unimportant. Statistical power was limited, making it less likely that moderate associations would reach significance even if they exist, and near-uniform distributions in some variables, such as vaccine availability (82.9% always available), further reduce within-sample variability and attenuate the ability to detect associations. Knowledge scores differed in the expected direction (10.40 among complete versus 10.15 among incomplete children) but did not reach significance ($p = 0.182$); caregiver knowledge and risk perception remain theoretically relevant and may show clearer patterns in larger samples or with multivariable adjustment (18,19).

The mean vaccination completion proportion of 83.7% (SD = 21.0%), considerably higher than the 23.4% binary completeness rate, indicates that most children had received the

majority of their age-due vaccines without completing the full schedule. The primary problem in this population therefore appears to be interrupted rather than absent vaccination (1,6). A binary complete/incomplete classification obscures the difference between children who received most of their age-appropriate doses and those who received few or none, whereas the completion proportion captures these gradations; using the two measures together gives a fuller picture than either alone.

CONCLUSION

Fewer than one in four Myanmar migrant children in Mae Sot District (23.4%) had received all age-due vaccine doses, although the mean completion proportion was 83.7%. Incomplete vaccination therefore appears to reflect interruption of the schedule rather than an absence of vaccination. Completeness was associated in bivariate analysis with factors spanning three domains: communication and legal status (language barrier and documentation status), physical access to services (travel time, mode of transport, and vaccine availability), and household caregiving arrangements (caregiver occupation, kinship to the child, and main caregiver). Because these associations are unadjusted and based on a small number of completely vaccinated children, they should be regarded as hypothesis-generating rather than causal. Nevertheless, most of these barriers are modifiable at the service-delivery level, suggesting that efforts to help children complete, rather than merely begin, the schedule are likely to benefit migrant children in this border setting. Larger studies supporting multivariable analysis, complemented by qualitative research on caregiving and household decision-making, are needed to confirm which factors independently influence completeness.

RECOMMENDATIONS

The following recommendations follow from the associations observed and should be read as service-delivery priorities suggested by unadjusted findings rather than as interventions of demonstrated effect. Vaccination facilities in areas with large Myanmar migrant populations could provide linguistically appropriate vaccine education materials in Myanmar languages together with interpreter support. Community-based and mobile outreach vaccination services could be organized in migrant communities, particularly where caregivers report longer travel times or limited vaccine availability at their usual facility. Flexible vaccination appointment systems could be considered for caregivers in informal or seasonal employment, who may face greater difficulty attending fixed-schedule sessions. Systematic follow-up and reminder systems for children with incomplete vaccination records could be strengthened, particularly given the high mean completion proportion observed, which suggests that many children are close to completing their schedule rather than entirely unvaccinated. These measures align with the equity commitments of Immunization Agenda 2030 and Sustainable Development Goals 3, 10, and 17 (20).

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Mahidol University Review Board (MUCIRB) on May 7th, 2026, with COA No. MU-CIRB 2026/192.0304, and informed consent was obtained from all participants prior to data collection.

LIMITATIONS

Several limitations should be acknowledged. The cross-sectional design precludes causal inference, and all findings represent associations rather than causal relationships. The most important limitation is the absence of multivariable adjustment. Only 48 children met the completeness criterion, giving approximately six events per variable for the eight variables significant at the bivariate level, below the conventional minimum of ten, and several variables contained sparse cells; a logistic

regression model was therefore judged likely to yield unstable and overfitted estimates and was not fitted. As a result, the reported associations are unadjusted; confounding among correlated predictors such as caregiver occupation, mode of transport, and travel time cannot be excluded, and the contribution of any single factor cannot be isolated. These findings are accordingly best regarded as hypothesis-generating, and a larger study with sufficient events to support multivariable modelling is needed to establish which factors are independently associated with completeness. Limited statistical power may also have prevented moderate associations from reaching significance. Selecting only one cluster per stratum may limit the representativeness of the sample relative to the full diversity of communities within each stratum. Caregivers unable to present a vaccination card or clinic record were excluded, which may have introduced selection bias toward more health-engaged caregivers and away from highly mobile or undocumented families. Finally, the study was conducted within three community clusters in Mae Sot District, and findings may not be generalizable to other border districts or to Myanmar migrant populations in urban or non-border settings.

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FACTORS ASSOCIATED WITH FULL IMMUNIZATION STATUS AMONG CHILDREN AGED 12 TO 23 MONTHS IN SELECTED TOWNSHIPS, YANGON REGION, MYANMAR

Yamon[1] and Anchalee Prasansuklab[1]*

[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

***Corresponding Author**: Anchalee Prasansuklab,*

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, E-mail: Anchalee.Pr@chula.ac.th

ABSTRACT

Introduction: Immunization is a highly effective public health intervention for preventing vaccine-preventable diseases (VPDs) and reducing childhood illness and death. Full immunization status indicates whether a child has received all vaccines recommended for their age according to the national Expanded Program on Immunization (EPI) schedule and is essential for preventing VPD outbreaks. Although routine immunization services are available in Myanmar, full immunization coverage remains below the global target. Evidence on caregiver-related behavioral factors influencing full immunization is limited, particularly in Yangon Region, which includes urban, peri-urban, and rural populations with diverse socioeconomic and healthcare access conditions. Assessing full immunization status among children aged 12 to 23 months can help identify modifiable factors to improve vaccination coverage.

Objectives: To identify the prevalence of full immunization status and to identify associated predisposing, enabling, and need factors among children aged 12 to 23 months in selected urban, peri-urban, and rural townships in Yangon Region, Myanmar.

Methodology: A cross-sectional study was conducted among caregivers of children aged 12 to 23 months from Thingangyun (urban), North Okkalapa (peri-urban), and Hlegu (rural) townships of Yangon Region. Based on a multistage sampling technique, a total of 133 caregivers who participated in the study were interviewed face-to-face using a structured questionnaire assessing socio-demographic characteristics, predisposing factors, enabling factors, need factors, and immunization status. The data were analyzed using descriptive statistics, binary logistic regression of each socio-demographic characteristic and each factor as the explanatory variable for full immunization status, and multiple logistic regression. The level of statistical significance was set at 0.05.

Results: Among 133 children, 98 (73.7%) were fully immunized. From binary analysis, caregiver's knowledge level (predisposing factor) and VPDs severity perception level (need factor) are significantly associated with full immunization status of children. In multiple logistic regression analysis, children whose caregivers had good knowledge of VPDs, vaccines, and Adverse Events Following Immunization (AEFI) were more likely to be fully immunized [Adjusted Odds Ratio (AOR) = 2.965, 95% Confidence Interval (CI): 1.190–7.388, p = 0.020]. High perceived severity of VPDs was negatively associated with full immunization status (AOR = 0.174, 95% CI: 0.037–0.808, p = 0.026).

Conclusion: Full immunization coverage was suboptimal at 73.7%, mainly due to missed Hepatitis B birth doses within health facilities. Caregiver's knowledge was the primary positive determinant, whereas high perceived disease severity among caregivers unexpectedly reduced uptake through psychological avoidance. Public health strategies should change from fear-based messaging toward increasing caregivers' education regarding vaccine schedules, efficacy, and AEFI management during maternal health visits. Additionally, health facilities must enforce immediate delivery-room vaccination protocols to eliminate missed birth doses and achieve global targets.

Keywords:

Childhood; Vaccine; Infectious Diseases; Caregiver; Family

INTRODUCTION

Immunization is recognized globally as one of the most successful and cost-effective public health interventions. It can prevent children's deaths annually by protecting children from life-threatening vaccine-preventable diseases (VPDs) such as measles, poliomyelitis, diphtheria, pertussis, tetanus, hepatitis B, and pneumococcal infections (1), and contributes to achieving Sustainable Development Goals (SDGs) by reducing child mortality, promoting healthy lives, and strengthening health systems (2). Despite considerable progress in immunization coverage over the recent decades, approximately 14.5 million children worldwide remained zero-dose in 2023, and millions more failed to complete the recommended immunization schedules (3). The Immunization Agenda 2030 emphasizes equitable access to immunization services and aims to ensure that everyone benefits from vaccines throughout life everywhere (4).

Myanmar has been implementing routine childhood immunization through the Expanded Program on Immunization (EPI) since 1978 (5). The national schedule includes Bacillus Calmette–Guérin (BCG) vaccine, hepatitis B vaccine birth dose, oral polio vaccine (OPV), inactivated polio vaccine (IPV), pneumococcal conjugate vaccine (PCV), rotavirus vaccine, pentavalent vaccine, Japanese encephalitis (JE) vaccine, and measles-rubella (MR) vaccine (6). Among the regions and divisions of Myanmar, Yangon Region has diverse socioeconomic layers with different levels of access to health services (7). Although national vaccination coverage in Myanmar has improved, disparities across urban, peri-urban, and rural areas persist due to unequal healthcare access, geographic barriers, and varying levels of caregiver education and health literacy (8, 9). National and subnational studies indicate that maternal continuum of care, antenatal service utilization, and maternal education strongly promote complete childhood immunization (8-11). A Study in urban informal settlements highlights that limited health literacy, socioeconomic disadvantages, and inadequate healthcare contact remain major barriers to timely vaccine uptake (10).

Full immunization status refers to the immunization status of a child, whether he or she has received all vaccines recommended under the national immunization schedule at the respective age within a specified age period, typically 12 to 23 months (8, 12). Fully immunized children are better protected against VPDs, while incomplete immunization increases the risk of outbreaks. Andersen's Behavioral Model of Health Service Utilization (13), helps explain healthcare utilization through predisposing, enabling, and need factors. This model provides a useful framework for understanding how caregiver characteristics, access to immunization services, and perceptions of VPDs influence the likelihood of children complying with the recommended immunization schedule.

Existing literature focuses on national datasets or urban slums, lacking comparative data across urban, peri-urban, and rural populations within a single region, and on the enabling and need factors influencing child immunization. This study aimed to fill these gaps by providing primary evidence on the prevalence of full immunization status and identifying associated predisposing, enabling, and need factors among children aged 12 to 23 months across selected urban, peri-urban, and rural townships in Yangon Region, Myanmar, using Andersen's Behavioral Model.

METHODOLOGY

Target population and setting

A cross-sectional study was conducted among caregivers who were responsible for making vaccination decisions for the children aged 12 to 23 months in Thingangyun, North Okkalapa, and Hlegu townships in Yangon Region, Myanmar, from April to May 2026.

Sample size estimate and sampling technique

The sample size was calculated based on the prevalence of full immunization reported by Nozaki et al.(8), including consideration for potential non-response, and a final total sample

size of 133 caregivers was determined. A multistage sampling technique was employed, in which Yangon townships were first stratified into urban, peri-urban, and rural areas, selected purposively based on the population of children aged under two years, followed by random selection of immunization posts within each township and convenience sampling of eligible caregivers attending the selected immunization posts until the required sample size was achieved.

Measurement tools and data collection method

The questionnaire was reviewed by three experts for content validity, then translated into the Myanmar language, and pilot-tested among 30 caregivers from a township not included in the study. All questionnaire domains achieved Cronbach's alpha coefficients above 0.7. The questionnaire consisted of three parts: socio-demographic characteristics (child's age and sex, caregiver's age, sex and relation with the child), factors associated with full immunization, including predisposing factors [antenatal care visits, institutional delivery, and caregiver's knowledge of VPDs, vaccines, and Adverse Events Following Immunization (AEFI)], enabling factors (caregiver's perception on immunization service and provider, and distance to vaccination site), and need factors (perceived susceptibility to and severity of VPDs), and full immunization status. Caregiver's knowledge (16 items, maximum possible score 16) and perception of service and provider (10 Likert-scale statements, maximum possible score 50) were categorized using modified Bloom's cut-offs. Scores were classified as good or positive (≥ 75%, which means scores 12 to 16 and 38 to 50, respectively), moderate or neutral (50 to 74%, which means scores 8 to 11 and 25 to 37), and low or negative (< 50%, which means scores 0 to 7 and 10 to 24). Data were collected by the researcher and trained data collectors with permission from the Yangon Region Public Health Department.

Data analysis

Data were analyzed using descriptive statistics, binary logistic regression, and multiple logistic regression. Children were categorized into months of 18, 12 to 17, and 19 to 23, according to the age cutoff points in the national immunization schedule (6), maintaining balanced subgroup sizes for statistical analysis. Variables with p-values less than 0.10 in bivariate analyses were entered into the multivariable model. Statistical significance was determined at $p < 0.05$ for the multivariable model.

RESULTS

Socio-demographic characteristics

A total of 133 caregivers participated in the study. Most children were aged 18 months (63.2%) (mean = 16.94, SD = 2.749), and the distribution of male (51.1%) and female (48.9%) children was nearly equal. The majority of caregivers were aged between 16 and 36 years (81.2%) (mean = 32.17, SD = 7.294), female (97.0%), and biological mothers (91.0%) of the children, indicating that mothers were the primary caregivers and decision-makers for childhood immunization in the study population (Table 1).

Table 1 Percentage of children and caregivers by socio-demographic characteristics (n=133)

Characteristics	Frequency	Percent (%)
Child's age (mean = 16.94, SD = 2.749)		
18 months	84	63.2
Other than 18 months (12 to 17 months and 19 to 23 months)	49	36.8
Child's sex		
Female	65	48.9
Male	68	51.1

Characteristics	Frequency	Percent (%)
Caregiver's age (mean = 32.17, SD = 7.294)		
16 to 36 years	108	81.2
37 to 63 years	25	18.8
Caregiver's sex		
Female	129	97
Male	4	3
Caregiver's relation with the child		
Biological mother	121	91
Others (Biological father/ Grandparent/ Other relative such as aunt)	12	9

Factors associated with full immunization status

Most caregivers attended four or more antenatal care visits (89.5%) and delivered their children at health facilities (93.2%). More than one-third of caregivers had good knowledge of VPDs, vaccines, and AEFI (38.3%). The majority reported positive perceptions of the immunization services and providers (88.7%), lived within 30 minutes of a vaccination site (88.0%), and had high perceptions of both susceptibility to VPDs (88.7%) and severity of VPDs (82.0%) (Table 2).

Table 2 Percentage of caregivers by factors associated with full immunization status of the children (n=133)

Characteristics	Frequency	Percent (%)
Predisposing factors		
Antenatal care facility visits		
Less than four visits	14	10.5
More than or equal to four visits	119	89.5
Institutional delivery		
Yes	124	93.2
No	9	6.8
Caregiver's knowledge level on VPDs, vaccines and AEFI		
Low or moderate	82	61.7
Good	51	38.3
Enabling factors		
Caregiver's perception of service and provider		
Negative or neutral	15	11.3
Positive	118	88.7
Distance from residence to vaccination place		
More than 30 minutes	16	12
Less than or equal to 30 minutes	117	88
Need Factors		
Caregiver's perception of susceptibility to VPDs		
Low or moderate	15	11.3
High	118	88.7
Caregiver's perception of severity of VPDs		
Low or moderate	24	18
High	109	82

Full Immunization Status

Among the 133 children, 98 (73.7%) were fully immunized, while 35 (26.3%) were not fully immunized. Coverage for most routine childhood vaccines was very high, with more than 90% of children completing the recommended doses of OPV, IPV, PCV, rotavirus vaccine, pentavalent vaccine, JE vaccine, and MR vaccine. In contrast, Hepatitis B birth-dose coverage was comparatively lower at 75.2%, suggesting that failure to receive the birth dose was a major contributor to children not having full immunization status. BCG vaccination coverage was 94.7% (Table 3).

Table 3 Percentage of full immunization status and vaccine coverage

Status and vaccines	Frequenc	Percent (%)
Full Immunization status		
No	35	26.3
Yes	98	73.7
Bacillus Calmette–Guérin (BCG) vaccine		
Not done	7	5.3
Done (at birth)	34	25.6
Done (at 2nd month of age)	92	69.2
Hepatitis B birth dose		
Not done	33	24.8
Done (at birth)	100	75.2
Oral Polio Vaccine (OPV)		
Not done	0	0
Only first dose	2	1.5
First and second doses	3	2.3
Completed all three doses	128	96.2
Inactivated Polio Vaccine (IPV)		
Not done	0	0
Only first dose	4	3
Completed two doses	129	97
Pneumococcal Conjugate Vaccine (PCV)		
Not done	0	0
Only first dose	2	1.5
First and second doses	3	2.3
Completed all three doses	128	96.2
Rotavirus vaccine		
Not done	0	0
Only first dose	2	1.5
Completed two doses	131	98.5
Pentavalent vaccine		
Not done	0	0
Only first dose	2	1.5
First and second doses	3	2.3
Completed all three doses (< 18 months)	3	2.3
Completed all three doses but not first booster (≥ 18 months)	3	2.3
Completed all three doses and first booster (≥ 18 months)	122	91.7

Status and vaccines	Frequenc	Percent (%)
Japanese encephalitis (JE) vaccine		
Not done	1	0.8
Done	132	99.2
Measles-Rubella (MR) vaccine		
Not done	1	0.8
Completed first dose (< 18 months)	3	2.3
Only first dose (≥ 18 months)	7	5.3
Completed two doses	122	91.7

Simple logistic regression (Bivariate analysis)

Each of the socio-demographic characteristics, predisposing factors, enabling factors, and need factors was analyzed against the full immunization status in simple logistic regression as a binary analysis. Child's age and caregiver's age were analyzed categorically to produce odds ratios that can compare real-world categories, preventing the model from assuming an exact linear pattern. Variables with a p-value of less than 0.10 in the bivariate analysis were selected for the multivariable analysis, preventing exclusion of important confounders and overfitting, while restricting the total number of predictors. These variables included institutional delivery (p=0.052), caregiver's knowledge level (p = 0.031), and perceived severity of VPDs (p = 0.042) (Table 4).

Table 4 Simple logistic regression of factors associated with full immunization status (n=133)

Characteristics	Full immunization status (n=133)		COR	95% CI		p-value
	No n (%)	Yes n (%)		Lower	Upper	
Child's age						
18 months	22 (16.5)	62 (46.6)	(Ref)			
Other than 18 months	13 (9.8)	36 (27.1)	0.983	0.442	2.185	0.966
Child's sex						
Female	18 (13.5)	47 (35.3)	(Ref)			
Male	17 (12.8)	51 (38.3)	1.149	0.531	2.487	0.725
Caregiver's age						
16 to 36 years	26 (19.5)	82 (61.7)	(Ref)			
37 to 63 years	9 (6.8)	16 (12)	0.564	0.223	1.426	0.256
Caregiver's sex						
Female	34 (25.6)	95 (71.4)	(Ref)			
Male	1 (0.8)	3 (2.3)	1.074	0.108	10.675	0.952
Caregiver's relation with the child						
Biological mother	31 (23.3)	90 (67.7)	(Ref)			
Others (Biological father/ Grandparent/ Other relative such as aunt)	4 (3)	8 (6)	0.689	0.194	2.447	0.565

Characteristics	Full immunization status (n=133)		COR	95% CI		p-value
	No n (%)	Yes n (%)		Lower	Upper	
Predisposing Factors						
Antenatal care facility visits						
Less than four visits	6(4.5%)	8(6%)	(Ref)			
More than or equal to four visits	29(21.8%)	90(67.7%)	2.328	0.746	7.265	0.146
Institutional delivery						
No	5(3.8%)	4(3%)	(Ref)			
Yes	30(22.6%)	94(70.7%)	3.917	0.988	15.53	**0.052**
Caregiver's knowledge level on VPDs, vaccines and AEFI						
Low or Moderate	27(20.3%)	55(41.4%)	(Ref)			
Good	8(6%)	43(32.3%)	2.639	1.090	6.388	**0.031***
Enabling factors						
Caregiver's perception level of service and provider						
Neutral or Negative	1(0.8%)	14(10.5%)	(Ref)			
Positive	34(25.6%)	84(63.2%)	0.176	0.022	1.395	0.1
Distance from residence to vaccination place						
Less than or equal to 30 min	30(22.6%)	87(65.4%)	(Ref)			
More than 30 minutes	5(3.8%)	11(8.3%)	0.759	0.244	2.362	0.634
Need Factors						
Caregiver's perception level of VPD susceptibility						
Low or Moderate	4(3%)	11(8.3%)	(Ref)			
High	31(23.3%)	87(65.4%)	1.021	0.303	3.442	0.974
Caregiver's perception level of VPD severity						
Low or Moderate	2(1.5%)	22(16.5%)	(Ref)			
High	33(24.8%)	76(57.1%)	0.209	0.047	0.942	**0.042***

AEFI: Adverse Event Following Immunization, CI: Confidence Interval, COR: Crude Odds Ratio, Ref: Reference category, VPDs: Vaccine-Preventable Diseases
**Statistically significant (p-value <0.05)*

Multiple logistic regression analysis

The multiple logistic regression analysis included three predictor variables for a sample size of 133, according to the standard recommendations and the Events-Per-Variable rule (14). After adjusting for potential confounders, caregivers' knowledge level on VPDs, vaccines, and AEFI, and perceived severity of VPDs remained significant, with p-values of less than 0.05. Children whose caregivers had good knowledge were approximately three times more likely to be fully immunized than those whose caregivers had low or moderate knowledge [Adjusted Odds Ratio (AOR) = 2.965, 95% Confidence Interval (CI): 1.190–7.388, p = 0.020]. In contrast, caregivers with high perceived severity of VPDs were less likely to have fully immunized children compared with those with low or moderate perceived severity (AOR = 0.174, 95% CI: 0.037–0.808, p = 0.026) **(Table 5)**.

Table 5 Multiple logistic regression of factors associated with full immunization status (n=133)

Characteristics	Full immunization status (n=133)		AOR	95% CI		p-value
	No n (%)	Yes n (%)		Lower	Upper	
Predisposing Factors						
Institutional delivery						
No	5(3.8%)	4(3%)	(Ref)			
Yes	30(22.6%)	94(70.7%)	3.354	0.789	14.255	0.101
Caregiver's knowledge level on VPDs, vaccines, and AEFI						
Low or Moderate	27(20.3%)	55(41.4%)	(Ref)			
Good	8(6%)	43(32.3%)	2.965	1.190	7.388	**0.020***
Need Factor						
Caregiver's perception level of VPD severity						
Low or Moderate	2(1.5%)	22(16.5%)	(Ref)			
High	33(24.8%)	76(57.1%)	0.174	0.037	0.808	**0.026***

AEFI: Adverse Event Following Immunization, AOR: Adjusted Odds Ratio, CI: Confidence Interval, Ref: Reference category, VPDs: Vaccine-Preventable Diseases
**Statistically significant (p-value <0.05)*

DISCUSSION

This study found that 73.7% of children aged 12 to 23 months in the selected townships were fully immunized, showing missed Hepatitis B birth doses as the primary barrier. Two significant determinants of full immunization were identified: good caregiver knowledge as the primary facilitator, while a high perceived severity of VPDs was unexpectedly associated with a reduced chance of full immunization. Socio-demographic characteristics and enabling factors, including institutional delivery, were not significant, which is consistent with previous literature (7, 8), likely because maternal service utilization is already high in the communities.

The suboptimal immunization coverage, due to missed Hepatitis B birth doses, despite a high institutional delivery rate, indicates that missed vaccination opportunities are occurring within the health facilities. This finding aligns with other Myanmar studies (7, 11), showing that fragmented care disrupts the 24-hour vaccination period and highlighting an urgent need to enforce immediate delivery-room vaccination protocols and better integration of maternity and newborn services. The importance of good caregiver knowledge matches findings from Bangladesh, Ghana, and Lao PDR (15-17), showing that those caregivers can understand schedules and manage minor side effects. Therefore, public health interventions must prioritize building immunization knowledge at points of antenatal care, postnatal care, and routine counseling.

The negative relation between high perceived disease severity and full immunization contrasts with previous literature (18). Beyond the small reference group size, this negative association indicates that awareness of disease severity alone is insufficient to complete immunization without adequate knowledge, vaccine confidence, and service access. Behaviorally, an increased perception of disease severity can cause fear and psychological avoidance, leading caregivers away from routine immunization services to cope with the anxiety (19). Consequently, future interventions should focus on reducing fear and avoidance by improving practical knowledge of vaccine efficacy and building caregiver confidence.

CONCLUSION

In conclusion, full immunization coverage among children aged 12 to 23 months in the

selected townships remains suboptimal at 73.7%, which is below the global target of 90%, primarily due to missed Hepatitis B birth doses within health facilities. This study demonstrates that specific caregivers' knowledge is the critical driver of full immunization status. Furthermore, the findings reveal that emphasizing the high perceived VPD severity is ineffective, as overwhelming fear can cause psychological avoidance and reduce immunization uptake.

RECOMMENDATIONS

Public health programs should consider shifting their strategic focus from fear-based behavioral intervention and prioritize improving caregivers' knowledge. Routine maternal health services, including antenatal and postnatal care, should systematically provide clear education about vaccine schedules, efficacy, and side-effect management to build caregiver confidence. Additionally, health facilities should enforce immediate delivery-room vaccination protocols to eliminate missed opportunities for the Hepatitis B birth dose. Ultimately, providing caregivers with practical knowledge, rather than using fear, is the key to achieving full childhood immunization.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group 1, Chulalongkorn University, Thailand [Certificate of Approval (COA) No.172/69] and the Institutional Review Board, Ministry of Health, Myanmar (COA No. MOH-IRB/2026-1).

LIMITATIONS

The cross-sectional design cannot establish causal relationships between the identified factors and full immunization status. Convenience sampling at immunization posts also introduces selection bias toward caregivers with higher healthcare engagement, likely missing caregivers who hesitate to vaccinate or cannot easily access health clinics. Additionally, the study was conducted in selected townships of Yangon Region, which may limit the generalizability of the findings to other regions of Myanmar. Some comparison groups, particularly caregivers with low-to-moderate perceived severity of VPDs, had relatively small sample sizes, which may have affected the precision of the estimates.

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FACTORS ASSOCIATED WITH PERCEPTION OF ANTIMICROBIAL STEWARDSHIP AMONG MEDICAL DOCTORS IN YANGON, MYANMAR

Chan Nyein Thet Tun[1*], Wandee Sirichokchatchawan[1]
[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.
*[*]**Corresponding Author**: Chan Nyein Thet Tun,*
College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand,
Email: 6874007053@student.chula.ac.th

ABSTRACT

Introduction: Antimicrobial resistance (AMR) is a growing global public health problem that threatens the effective treatment of infectious diseases. Antimicrobial stewardship (AMS) is an important strategy to promote appropriate antibiotic use and reduce the development of AMR. Medical doctors play a key role in implementing AMS practices; however, their perception of AMS may be associated with individual, professional, and work-related factors.

Objective: This study aimed to assess the factors associated with perception of AMS among medical doctors in Yangon, Myanmar.

Methodology: A cross-sectional study was conducted among 403 medical doctors in Yangon. Data were collected online using a pretested structured questionnaire and analyzed using descriptive statistics, Chi-square test, and multiple logistic regression.

Results: Among the 403 participants, the majority were aged 31–36 years (57.1%) and most had 7–12 years of clinical experience (57.3%) and held a bachelor's degree (61.0%). Participants were mainly working in private hospitals (45.1%) and clinics (43.7%), with a relatively balanced distribution of clinical settings, internal medicine (24.1%), surgery (23.1%) and other specialties (25.5%). Most reported no AMS training (75.2%) and no audit and feedback in their workplace (79.2%), while around half had access to antibiotic guidelines (51.8%) and monitoring systems (53.8%) at their clinical workplaces. Approximately half had learned about AMS (49.6%), mainly from textbooks (60.0%), and more than half demonstrated a high perception of AMS (55.8%), with 47.1% showing good knowledge of AMS. In the Chi-square test, there were statistically significant associations between level of perception of AMS and specific clinical setting, AMS training, antibiotic guidelines, audit and feedback, monitoring, laboratory results, learning AMS, and level of knowledge on AMS (all $p < 0.05$). In the multiple logistic regression analysis, audit and feedback (aOR = 2.695, $p = 0.008$) and knowledge on AMS (moderate: aOR = 2.793, $p = 0.002$; good: aOR = 6.546, $p < 0.001$) were factors associated with high perception of AMS.

Conclusion: More than half of the participants were classified as having high perception of AMS. Audit and feedback and higher AMS knowledge were independently associated with high perception after adjustment for the variables included in the model. These findings may inform the future development and evaluation of AMS education and implementation strategies in Yangon. However, the cross-sectional design does not establish causal relationships.

Keywords:
Antimicrobial Stewardship; Medical Doctors; Yangon; Myanmar

INTRODUCTION

Antimicrobial resistance (AMR) is a global threat, and since 1990, it has contributed significantly to global mortality. Data from 2019 showed that AMR was associated with approximately 4.95 million deaths worldwide, including 1.27 million deaths directly attributable to resistant infections (1). AMR has also remained a significant cause of mortality in Myanmar, with more than 10,000 deaths reported annually since 1990. In 2021, AMR was associated with nearly 42,500 deaths, while approximately 11,100 deaths were directly attributable to AMR (2).

According to the WHO, antimicrobial stewardship (AMS) is a coordinated approach that helps healthcare professionals prescribe and use antibiotics and other antimicrobial medicines based on evidence-based guidelines (3). Although AMS programs can reduce inappropriate antibiotic use, their success relies heavily on medical doctors because they make clinical decisions regarding antimicrobial initiation, selection, dose, route, and duration.

Previous studies have shown that prescribing behavior, together with knowledge and perception of AMR and AMS, was associated with factors including age, duration of clinical experience, clinical settings, professional position, laboratory result waiting time, antibiotic guidelines, and audit and feedback practices (4-11). Nevertheless, these relationships may differ across healthcare systems and resource settings.

Although previous studies have explored AMS among healthcare professionals, evidence regarding factors associated specifically with medical doctors' perception of AMS remains limited in Myanmar. Healthcare facilities in Yangon include public hospitals, private hospitals, clinics, and telemedicine services that differ in access to training, antibiotic guidelines, laboratory services, monitoring systems, and audit-and-feedback mechanisms. Examining these individual and workplace-related factors may provide context-specific evidence for future stewardship planning and evaluation. Therefore, this study aimed to assess the level of AMS perception and identify factors associated with high perception among medical doctors practicing in Yangon, Myanmar.

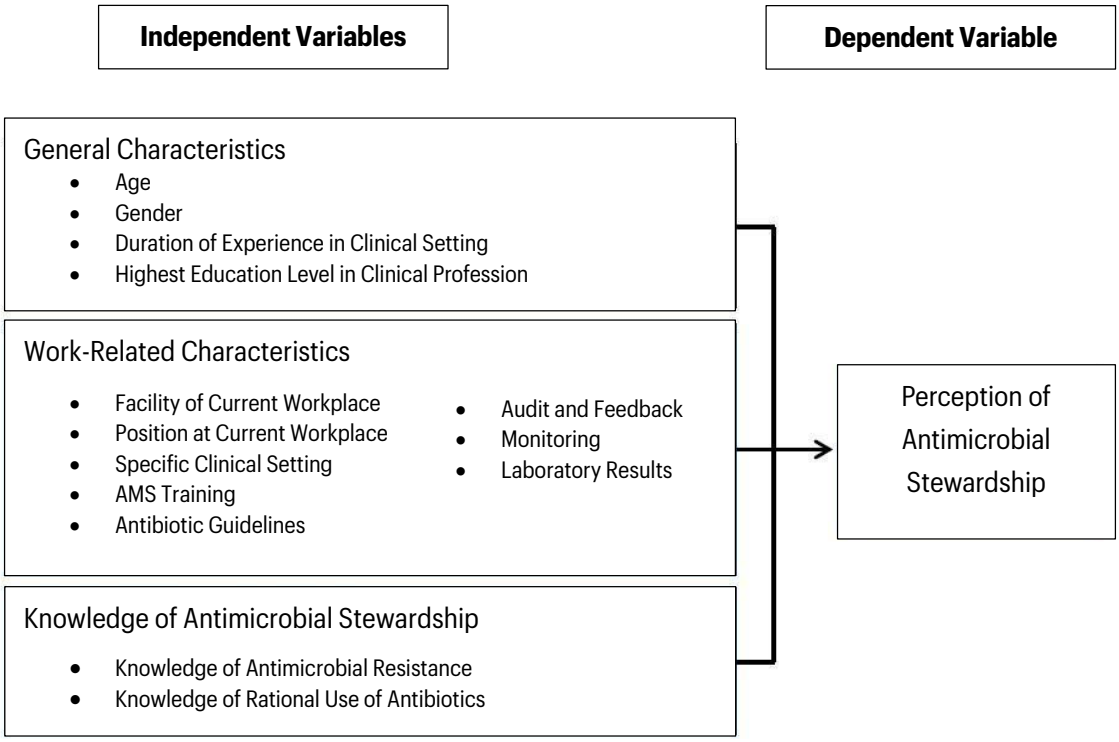

Figure 1 Conceptual Framework

METHODOLOGY

Study Design

This study employed a quantitative cross-sectional design to investigate factors associated with perceptions of AMS among medical doctors in Yangon, Myanmar.

Study Area

The study was conducted in Yangon, the largest city in Myanmar with concentrated healthcare facilities. Moreover, according to 2016 data, Yangon has approximately 3900 medical doctors in the public sector (14).

Study Population

The target population for this study comprised medical doctors in Yangon, Myanmar.

Inclusion Criteria

- Myanmar medical doctors who were working in a clinical workplace in Yangon with experience in a clinical workplace for at least 6 months after graduation with a bachelor's degree and were willing to participate in this study.

Exclusion Criteria

- Those who could not access and complete the online questionnaire.

Sample Size

The sample size was calculated using Cochran's Sample Size Formula.

$$n = \frac{Z^2_{1-\alpha/2}\, p(1-p)}{d^2}$$

n = Required sample size
Z = Z – score for chosen confidence level (1.96 for 95% CI)
p = expected prevalence (0.5)
D = degree of error (0.05 for 5%)
n = 384

To account for potential non-response, refusal to participate, or incomplete questionnaire responses, an additional 5% (19 participants) was added, and the final sample size was 403 participants.

Sampling

Yangon was purposively selected as the study area because it has a large and diverse population of medical doctors working across public hospitals, private hospitals, clinics, and other clinical settings. Convenience sampling was subsequently used to recruit eligible medical doctors.

Measurement Tools

For measurement tools, a self-structured online questionnaire with Google Forms was developed. It was based on the "Myanmar Antibiotic Guidelines (2021), the Standard Treatment Guidelines for General Practitioners by Myanmar Medical Association (MMA) (2024), and the Myanmar National Action Plan for AMR (2017–2022)" (15-17). Moreover, it was also adapted from the findings of previous research articles (4-8, 10, 11). The questionnaire consisted of 5 sections covering general characteristics, work-related characteristics, learning AMS, knowledge on AMS, and perceptions of AMS.

Knowledge on AMS was assessed using 10 items. Each correct response was assigned one point, while incorrect and "do not know" responses were assigned zero points, producing a possible total score of 0–10. Knowledge levels were classified using Bloom's cutoff criteria: scores of 8–10 were categorized as good knowledge, scores of 6–7 as moderate knowledge, and scores of 0–5 as poor knowledge.

Perceptions of AMS were assessed using 9 Likert-scale items. Response options were strongly disagree, disagree, neutral, agree, and strongly agree. Negatively worded items were reverse-scored, where applicable, and item scores were summed to produce a total perception score. The observed scores ranged from 25 to 45. Because no externally validated cutoff was available for this questionnaire, the sample median of 35 was used to classify perception level. Scores below 35 were categorized as low perception, and scores of 35 or higher were categorized as high perception.

Validity and Reliability

Questionnaire validity was assessed using the Item-Objective Congruence (IOC) method. Three experts, who were Myanmar medical doctors, evaluated each questionnaire item and rated it from −1 to +1, and items with an average IOC score greater than 0.5 were considered acceptable. All items of the questionnaire in this study achieved an IOC value greater than 0.5, and the overall IOC of the questionnaire was 0.89.

Questionnaire reliability was assessed through a pilot test involving 41 medical doctors from Mandalay, representing 10% of the calculated sample size. Internal consistency was evaluated separately for the knowledge and perception scales. KR-20 value for knowledge on AMS was 0.813, while Cronbach's Alpha value for perceptions of AMS was 0.844.

Data Collection

Data were collected through an online questionnaire distributed via a QR code and a direct survey link. The survey invitation and questionnaire link were disseminated through professional medical networks, Myanmar Medical Association networks, hospital communication channels, and verified social-media groups used by medical doctors. The platforms included Facebook, Telegram, and Viber.

An eligibility-screening section was placed at the beginning of the online questionnaire. Participants were required to confirm that they were Myanmar medical doctors currently practicing in Yangon, had at least six months of clinical experience after graduation, held a medical degree, and voluntarily agreed to participate. Responses from individuals who did not meet the eligibility criteria were excluded.

Duplicate-response prevention was implemented by using the one-response setting. Potential duplicate submissions were reviewed before analysis, and confirmed duplicates were excluded. Moreover, incomplete responses were also excluded from the analysis for missing data handling. Responses were considered "incomplete" when one or more required items were missing. The number of incomplete questionnaires excluded was 7.

Because the survey invitation was disseminated through professional and social-media networks, the total number of eligible medical doctors who received or viewed the invitation could not be determined. Therefore, a conventional response rate could not be calculated. A total of 403 eligible participants submitted complete questionnaires and were included in the analysis.

Data Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences software version 29.0.2.0.

Descriptive Statistics

For descriptive analysis, the Kolmogorov–Smirnov test was used to assess the normality of continuous variables. Normally distributed data were presented as mean and standard deviation, while non-normally distributed data were reported as median and interquartile range (IQR). Categorical variables were summarized using frequencies and percentages.

Inferential Statistics

For bivariate analysis, the Chi-square test was used to examine the association between each independent variable and the dependent variable. Variables with a p-value < 0.20 in the Chi-Square test were included in the multiple logistic regression model. A p-value threshold of 0.20 was chosen to avoid excluding variables that may not appear significant in unadjusted analyses but might demonstrate meaningful conditional associations after adjustment for other covariates.

Multiple logistic regression analysis was performed to estimate adjusted odds ratios (AORs) with 95% confidence intervals (CIs). No additional potential confounding variables were included regardless of their statistical significance. Statistical significance was determined at a p-value < 0.05.

RESULTS

Descriptive Analysis

In Table 1, a total of 403 medical doctors participated. The median age was 33 years, with most aged 31–36 years (57.1%). The gender distribution was nearly equal (50.9% male, 49.1% female). Median clinical experience was 8 years, with 57.3% having 7–12 years of experience. The majority held a Bachelor's degree (61.0%).

Table 1 Number and percentage distribution of general characteristics

General Characteristics	Study participants (n=403)	
	Number	Percentage (%)
Age (Years)		
≤30	90	22.3%
31-36	230	57.1%
≥37	83	20.6%
Median = 33, IQR = 5, (Min : Max) = (26 : 49)		
Gender		
Male	205	50.9%
Female	198	49.1%
Duration of Experience in Clinical Setting (Years)		
≤6	98	24.3%
7-12	231	57.3%
≥13	74	18.4%
Median = 8, IQR = 5, (Min : Max) = (<1 : 25)		
Highest Education Level in Clinical Profession		
Bachelor's Degree (M.B., B.S)	246	61.0%
Above Bachelor's Degree (M.Med.Sc, MRCP/MRCS, Dr.Med.Sc, PhD)	157	39.0%

In Table 2, most participants worked in private hospitals (45.1%), followed by clinics (43.7%) and public hospitals (11.2%). Specialist doctors predominated in public hospitals (68.9%), medical officers in private hospitals (71.4%), and teleclinic doctors in clinics (52.8%).

Participants were working in clinical settings such as internal medicine (24.1%), surgery (23.1%), obstetrics and gynecology (16.6%), pediatrics (10.7%), and other specialties (25.5%). Only 24.8% had received AMS training. 51.8% of participants had access to national antibiotic guidelines at their clinical workplaces, while audit and feedback were implemented in only 20.8% of workplaces. Antibiotic use monitoring systems were reported by 53.8%, and 40.2% waited for laboratory results before prescribing antibiotics.

Table 2 Number and percentage distribution of work-related characteristics

Work-Related Characteristics	Study participants (n=403)	
	Number	Percentage (%)
Facility of Current Workplace		
Public Hospital	45	11.2%
Private Hospital	182	45.1%
Clinic	176	43.7%
Position At Current Workplace		
At Public Hospital	**Total 45**	
Assistant Surgeon	8	17.8%
Post-Graduate Student	4	8.9%
Specialist Doctor	31	68.9%
Consultant	2	4.4%
At Private Hospital	**Total 182**	
Medical Officer	130	71.4%
Senior Medical Officer	4	2.2%
Specialist Doctor	48	26.4%
At Clinic	**Total 176**	
Doctor working at a teleclinic	93	52.8%
Medical Doctor working at a clinic	63	35.8%
Specialist Doctor working at a clinic	20	11.4%
Specific Clinical Setting		
Internal Medicine	97	24.1%
Surgery	93	23.1%
Pediatrics	43	10.7%
OG-GYN	67	16.6%
Others (Emergency, General Practice, Aesthetic, ICU, Psychiatric, Mental Health, Orthopedic)	103	25.5%
AMS Training		
Yes	100	24.8%
No	303	75.2%
Antibiotic Guidelines		
Yes	209	51.8%
No	93	23.1%
Don't Know	101	25.1%
Audit and Feedback		
Yes	84	20.8%
No	319	79.2%
Monitoring		
Yes	217	53.8%
No	186	46.2%
Laboratory Result		
Yes	162	40.2%
No	241	59.8%

In Table 3, about half of the participants (49.6%) had learned about AMS, mainly through textbooks (60.0%). 47.1% of participants demonstrated good knowledge on AMS, while 29.5% had moderate knowledge and 23.4% had poor knowledge. More than half of the participants (55.8%) exhibited a high level of perception on AMS, whereas 44.2% had a low level of perception.

Table 3 Number and percentage distribution of learning AMS, channels for AMS knowledge, knowledge on AMS and perception of AMS

	Study participants (n=403)	
	Number	**Percentage (%)**
Learning AMS		
Yes	200	49.6%
No	203	50.4%
Channels for AMS Knowledge (Multiple Choice)	**Total 200**	
Textbooks	120	60.0%
At Work	97	48.5%
Television	3	1.5%
Radio	1	0.5%
Social Media Platform (e.g. Facebook)	18	9.0%
Training	72	36.0%
Others (Seniors)	3	1.5%
Knowledge on AMS (categorized by Bloom's cutoff point)		
Good (8-10)	190	47.1%
Moderate (6-7)	119	29.5%
Poor (0-5)	94	23.4%
Median = 7, IQR = 3, (Min : Max) = (1 : 10)		
Perception of AMS		
High (≥35)	225	55.8%
Low (<35)	178	44.2%
Median = 35, IQR = 4 , (Min : Max) = (25 : 45)		

Inferential Analysis

In Table 4, in the Chi-square test, there was no significant association between participants' general characteristics and their perception on AMS. Age ($p = 0.479$), gender ($p = 0.195$), duration of clinical experience ($p = 0.627$), and highest education level ($p = 0.502$) were not significantly associated with the level of perception on AMS (all $p > 0.05$).

Among work-related characteristics, only the facility of the current workplace was not associated with AMS perception ($p = 0.445$). Significant associations were found for clinical setting, AMS training, antibiotic guidelines, audit and feedback, monitoring systems, laboratory results, and previous AMS learning (all $p < 0.05$).

Knowledge on AMS was significantly associated with AMS perception ($p < 0.001$), which means participants with good AMS knowledge were more likely to have a high level of AMS perception (74.7%), whereas those with poor knowledge were more likely to have a low level of AMS perception (74.5%).

Table 4 Chi-Square test between general characteristics, work-related characteristics, learning AMS, knowledge on AMS and perception of AMS

	Study participants (n= 403)					
	Perception of AMS				χ2	p-value
	Low		High			
	No.	(%)	No.	(%)		
General characteristics						
Age (Years)					1.474	0.479
≤30	44	48.9%	46	51.1%		
31-36	101	43.9%	129	56.1%		
≥37	33	39.8%	50	60.2%		
Gender					1.677	**0.195**
Male	97	47.3%	108	52.7%		
Female	81	40.9%	117	59.1%		
Duration of Experience in Clinical Setting (Years)					0.934	0.627
≤6	45	45.9%	53	54.1%		
7-12	104	45.0%	127	55.0%		
≥13	29	39.2%	45	60.8%		
Highest Education Level in Clinical Profession					0.450	0.502
Bachelor's Degree (M.B., B.S)	105	42.7%	141	57.3%		
Above Bachelor's Degree (M.Med.Sc, MRCP/MRCS, Dr.Med.Sc, PhD)	71	46.1%	83	53.9%		
Work Related Characteristics						
Facility of Current Workplace					1.620	0.445
Public Hospital	17	37.8%	28	62.2%		
Private Hospital	86	47.3%	96	52.7%		
Clinic	75	42.6%	101	57.4%		
Specific Clinical Setting					21.570	**<0.001**
Internal Medicine	27	27.8%	70	72.2%		
Surgery	55	59.1%	38	40.9%		
Pediatric	16	37.2%	27	62.8%		
OG-GYN	35	52.2%	32	47.8%		
Others (Emergency, General Practice, Aesthetic, ICU, Psychiatric, Mental Health, Orthopedic)	45	43.7%	58	56.3%		
AMS Training					28.952	**<0.001**
Yes	21	21.0%	79	79.0%		
No	157	51.8%	146	48.2%		
Antibiotic Guidelines					22.537	**<0.001**
Yes	69	33.0	140	67.0		
No	55	59.1	38	40.9		
Don't Know	54	53.5	47	46.5		

	Study participants (n= 403)					
	Perception of AMS				χ2	p-value
	Low		High			
	No.	(%)	No.	(%)		
Audit and Feedback					27.157	**<0.001**
Yes	16	19.0	68	81.0		
No	162	50.8	157	49.2		
Monitoring					7.762	**0.005**
Yes	82	37.8	135	62.2		
No	96	51.6	90	48.4		
Laboratory Result					27.332	**<0.001**
Yes	46	28.4	116	71.6		
No	132	54.8	109	45.2		
Learning AMS					37.046	**<0.001**
Yes	58	29.0	142	71.0		
No	120	59.1	83	40.9		
Knowledge on AMS					64.419	**<0.001**
Good	48	25.3	142	74.7		
Moderate	60	50.4	59	49.6		
Poor	70	74.5	24	25.5		

Variables with p-values < 0.20 in the Chi-square test were included in multiple logistic regression.

In Table 5, multiple logistic regression showed that access to audit and feedback (aOR = 2.695, 95% CI: 1.295–5.611, p = 0.008) and moderate (aOR = 2.793, 95% CI: 1.461–5.339, p = 0.002) and good AMS knowledge (aOR = 6.546, 95% CI: 3.216–13.323, p < 0.001) were significantly associated with high AMS perception. No other variables remained significant after adjustment.

Table 5 Multiple logistic regression between associated independent variables and perception of AMS

Variables	B	S.E	Adjusted Odds Ratio (aOR)	95% C.I. for aOR		p-value
				Lower	Upper	
Hosmer and Lemeshow Test p value = 0.478, VIF value <5 (max:1.679) , Tolerance>0.1 (min:0.596), Nagelkerke R Square = 0.286						
Gender (not associated in Chi-Square Test, but p-value is 0.195)						
Male	Reference group					
Female	0.111	0.243	1.117	0.693	1.801	0.648
Specific Clinical Setting						
Internal Medicine	Reference group					
Surgery	-0.663	0.361	0.515	0.254	1.046	0.066
Pediatric	-0.385	0.434	0.680	0.291	1.594	0.375
OG-GYN	-0.558	0.374	0.572	0.275	1.192	0.136

Variables	B	S.E	Adjusted Odds Ratio (aOR)	95% C.I. for aOR		p-value
				Lower	Upper	
Others (Emergency, General Practice, Aesthetic, ICU, Psychiatric, Mental Health, Orthopedic)	-0.006	0.352	0.994	0.499	1.982	0.987
AMS Training						
No	Reference group					
Yes	0.330	0.339	1.391	0.715	2.704	0.331
Antibiotic Guidelines						
No	Reference group					
Don't Know	0.495	0.326	1.641	0.866	3.108	0.129
Yes	0.258	0.316	1.294	0.697	2.403	0.414
Audit and Feedback						
No	Reference group					
Yes	0.992	0.374	2.695	1.295	5.611	**0.008**
Monitoring						
No	Reference group					
Yes	-0.338	0.268	0.713	0.422	1.205	0.206
Learning AMS						
No	Reference group					
Yes	0.318	0.282	1.374	0.791	2.389	0.260
Knowledge on AMS						
Poor	Reference group					
Moderate	1.027	0.331	2.793	1.461	5.339	**0.002**
Good	1.879	0.363	6.546	3.216	13.323	**<0.001**

DISCUSSION

Association between Audit and Feedback and Perception on AMS

In this study, multiple logistic regression showed there was a significant association between the availability of audit and feedback in the clinical workplace and medical doctors' perception on AMS (aOR = 2.695, 95% CI: 1.295–5.611, p = 0.008). This finding aligns with the research conducted in a Norwegian hospital (Høgli, J.U., et al. 2016). The research concluded that providing audit and feedback, along with easy access to antibiotic guidelines, increased appropriate empirical antibiotic prescribing and may contribute to reducing AMR and improving clinical outcomes, suggesting that regular performance feedback strengthens clinicians' engagement with stewardship principles (18).

Ongoing challenges in Myanmar's healthcare system may limit the availability of trained healthcare providers, time, and resources required for regular prescription reviews and individualized feedback. Therefore, cost-effective strategies, such as periodic departmental audits, case-based discussions, and targeted feedback on antibiotic prescriptions, may provide practical alternatives. These approaches may increase doctors' awareness of their prescribing behavior and support adherence to AMS principles in resource-limited settings.

Association Between Knowledge and Perception on AMS

In this study, multiple logistic regression showed that there was a significant association between medical doctors' level of knowledge on AMS and level of perception on AMS (Moderate- aOR=2.793, 95% CI: 1.461–5.339, p = 0.002, Good- aOR=6.546, 95% CI: 3.216–13.323, p <0.001). Similarly, previous research in India reported that the majority of doctors had good knowledge on AMS and recognized the importance of ASP in hospitals, suggesting that adequate AMS knowledge is accompanied by positive perceptions towards stewardship (19). Moreover, a previous study conducted in Eastern China found that physicians' knowledge, attitudes, and prescribing practices were significantly associated ($p < 0.05$). The study also reported that appropriate antimicrobial prescribing depended on adequate knowledge and regular training. Although it examined prescribing practices rather than perception on AMS, the findings suggest that good AMS knowledge supports responsible antimicrobial use (20).

The findings suggest that improving AMS knowledge through continuous education, regular training, and dissemination of national antibiotic guidelines may help strengthen positive perceptions on AMS among medical doctors in Myanmar.

STRENGTH

This study included a relatively large sample of 403 medical doctors from different healthcare facilities and clinical specialties in Yangon, providing a broad representation of medical doctors involved in antimicrobial prescribing. The questionnaire also underwent expert validation by Myanmar medical doctors to ensure its validity and appropriateness for the Myanmar clinical context.

CONCLUSION

More than half of the participants were classified as having high perception of AMS. Audit and feedback and higher AMS knowledge were independently associated with high perception after adjustment for the variables included in the model. These findings may inform the future development and evaluation of AMS education and implementation strategies in Yangon. However, the cross-sectional design does not establish causal relationships.

LIMITATION

This study has several limitations. First, the cross-sectional design does not allow causal relationships to be established between the associated factors and perception of AMS. Second, convenience sampling and online data collection may have introduced self-selection bias and potential information bias. Moreover, there is limitation in the generalizability of the findings beyond Yangon. Finally, the use of self-reported responses may lead to recall and social desirability bias.

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Research Ethics Review Committee for Research Involving Human Participants, Group I, Chulalongkorn University (COA No. 177/69).

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FOOD HYGIENE PRACTICES AND ASSOCIATED FACTORS AMONG CAREGIVERS OF CHILDREN AGED 6–59 MONTHS IN PERI-URBAN YANGON, MYANMAR

Myat Piti[1], Cheerawit Rattanapan[1,2], Orapin Laosee[1,2], Kwang Mo Yang[1,2]*

[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand

[2]Center for Global Health, Mahidol University, Nakhon Pathom, Thailand

Corresponding author: *Kwang Mo Yang,*

ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73170, Thailand,

E-mail: kwangmo.yan@mahidol.ac.th

ABSTRACT

Introduction: Foodborne illnesses remain a leading cause of under-five morbidity and mortality in Myanmar, with household food hygiene practices critically influencing enteric disease risk. Yet, these practices remain understudied in peri-urban Myanmar, where rapid urbanization and inconsistent infrastructure create distinct behavioral contexts.

Objectives: This study estimated the prevalence of food hygiene practices among caregivers of children aged 6–59 months in peri-urban Yangon, Myanmar. It also evaluated associated factors including water, sanitation, and hygiene (WASH) access alongside caregivers' psychological constructs from the Protection Motivation Theory (PMT).

Methodology: A cross-sectional household survey was conducted among 281 caregivers. Food hygiene practice was measured using five self-reported behavioral items: washing utensils before feeding, washing fruits and vegetables with safe or treated water, reheating leftover food, keeping cooked food covered, and separating raw meat and vegetables during preparation. Each of the five items was dichotomized as a "doer" behavior if the caregiver reported performing it often or always (Likert 4–5) and as a "non-doer" otherwise. The five binary items were then summed into a composite score (range 0–5), and caregivers scoring ≥4 (i.e., 4–5 of the 5 behaviors) were classified as having good food hygiene practice. Household food hygiene environments were also assessed via direct observation. Binary logistic regression was initially used for bivariate analysis, and variables with $p < 0.25$ were entered into a multivariable logistic regression model to identify independent determinants and adjusted odds ratios (AOR) with 95% confidence intervals (CI).

Results: Overall, 89.0% of caregivers demonstrated good food hygiene practice. Regarding specific food hygiene behaviors, keeping cooked food covered demonstrated the highest compliance (96.8%), whereas adequate reheating of leftover food had the lowest (67.3%). In the multivariable analysis, consistent household water availability was positively associated with good food hygiene practice (AOR = 16.75, 95% CI: 5.05–55.59). Higher perceived vulnerability to foodborne disease was positively associated with good food hygiene practice (AOR = 1.43 per unit, 95% CI: 1.13–1.80). Caregivers of children receiving a full solid diet had higher odds of good practice than those receiving breastmilk, with or without complementary foods (AOR = 7.39, 95% CI: 1.76–31.05). Conversely, a negative association was observed between child age 36–59 months and good food hygiene practice (AOR = 0.09, 95% CI: 0.02–0.46).

Conclusion: Water availability and perceived vulnerability to foodborne disease are principal modifiable determinants of household food hygiene in this peri-urban setting. Interventions should prioritize improving water infrastructure, strengthening risk communication, and targeted behavioral messaging for caregivers of older children (36–59 months).

Keywords:

Food Hygiene; Caregivers; Under-Five Children; Protection Motivation Theory; WASH.

INTRODUCTION

Foodborne illnesses remain a major cause of morbidity among children under five years of age, particularly in low- and middle-income countries (LMICs) where inadequate food hygiene increases the risk of enteric infections (1, 2). In household settings, key preventive behaviors include safe food preparation, proper washing of fruits and vegetables, child feeding utensils, adequate reheating of leftovers, and safe food storage (3). These behavioral interventions complement physical infrastructure, serving as the critical barrier protecting young children from infection (4, 5). Despite their importance, food hygiene practices have received far less attention than water, sanitation, and hygiene (WASH) infrastructure, especially in rapidly urbanizing peri-urban communities (6).

In Myanmar, diarrheal disease continues to be a persistent public health burden among young children (7, 8). Hlaing Thar Yar Township, one of the largest peri-urban areas of Yangon, is characterized by rapid population growth, informal settlements, overcrowding, shared sanitation facilities, and inconsistent water access (9, 10). These environmental conditions exacerbate the challenges in maintaining safe food hygiene practices among households with young children (3).

While structural factors such as water access and housing conditions heavily influence hygiene behaviors, caregivers living in similar environments often demonstrate different levels of food hygiene practice (3). This variation suggests that individual psychological and behavioral factors are also crucial determinants. Protection Motivation Theory (PMT) proposes that health-protective behaviors are driven by two main cognitive processes: threat appraisal and coping appraisal (11, 12). Although PMT has been widely applied to explain preventive health behaviors, including hygiene- and food-safety-related behaviors, it has rarely been utilized to examine food hygiene practices among caregivers in low-resource peri-urban settings (3, 12, 13).

To address these critical gaps, this study evaluated household food hygiene practices among caregivers of children aged 6–59 months in peri-urban Yangon and identified socio-demographic, contextual, and PMT-driven psychological factors associated with good food hygiene practices in Hlaing Thar Yar Township.

METHODOLOGY

Study Design and Setting

This quantitative cross-sectional analytical study was conducted in Hlaing Thar Yar Township, located in the western Yangon Region, Myanmar. This peri-urban township comprises 34 administrative wards and is characterized by informal housing, shared sanitation facilities, and limited access to reliable water services (14, 15).

Study Population and Sampling

Participants were primary caregivers aged ≥18 years of children aged 6–59 months who had resided in the selected wards for at least three months, and provided informed consent. Primary caregivers included mothers, fathers, grandparents, or other individuals primarily responsible for the child's daily care. Caregivers of children with severe chronic illnesses affecting routine hygiene practices and individuals not primarily responsible for daily childcare were excluded.

A total of 281 caregivers were recruited from eight wards using a multistage community-based sampling approach. The approach involved three stages. First, eight wards from both the Eastern and Western parts of Hlaing Thar Yar were purposively selected based on predefined peri-urban criteria, including the presence of at least 500 children under five years, and limited WASH infrastructure, such as shared sanitation facilities or unreliable water access. Second, the planned sample using Cochran's formula was allocated across the selected wards in proportion to the number of under-five children. Third, trained research assistants who had primary experience in health and nutrition surveys in the local context recruited eligible caregivers through a systematic

door-to-door procedure until the ward's allocated quota was reached; where more than one eligible caregiver was present, the mother was prioritized. The present analysis reports preliminary findings from the 281 caregivers enrolled during the first few weeks of data collection, out of a planned total of 420. Consistent with this purposive, proportionally allocated multistage design, the data were analyzed unweighted and without a design effect; this is acknowledged as a limitation.

Research Instrument

Data were collected using a structured interviewer-administered questionnaire adapted from the Protection Motivation Theory framework (11) and the WHO/UNICEF Joint Monitoring Program (JMP) guidelines(16). The instrument included sections on sociodemographic characteristics, water, sanitation, and hygiene (WASH) and contextual factors, PMT constructs, food hygiene practices, and household observations.

Threat appraisal was assessed through perceived severity and perceived vulnerability, while coping appraisal was evaluated through response efficacy, self-efficacy, and response cost. All PMT constructs and food hygiene practice items were measured using five-point Likert scales. A standardized household observational checklist was completed immediately after each interview.

Validity and Reliability

Content validity was assessed using the Index of Item-Objective Congruence (IOC) by three public health experts. IOC values ranged from 0.67–1.00, indicating acceptable content validity. The questionnaire was pilot-tested among 30 caregivers in a community with characteristics similar to the study area. Internal consistency was good, yielding a Cronbach's α of 0.904 for threat appraisal, 0.935 for coping appraisal, and 0.866 for food hygiene practice, all of which exceeded the acceptable threshold of 0.70 (17).

Data Collection

Face-to-face household interviews were conducted by trained research assistants using KoBoToolbox on mobile devices. The questionnaire was translated into Burmese and back-translated to ensure conceptual equivalence. Electronic informed consent was obtained prior to each interview, which took approximately 25–30 minutes. Submitted data were reviewed daily for completeness and consistency.

Statistical Analysis

Data was exported from KoBoToolbox and analyzed using IBM SPSS Statistics (version 31). Composite scores were calculated by summing items for each PMT construct; negatively worded items were reverse-coded prior to analysis.

Food hygiene practice was assessed using five self-reported behaviors: washing utensils before feeding, washing fruits and vegetables with safe or treated water, reheating leftover food, keeping cooked food covered, and separating raw meat and vegetables during preparation. Each item was first dichotomized as a binary score (1 = doer [often/always] and 0 = non-doer [never, rarely, or sometimes]). A composite score was then calculated by summing these five binary items (range 0–5), and caregivers scoring ≥ 4 were classified as having good food hygiene practices. Observational checklist data were analyzed descriptively and were not included in the composite food hygiene practice score used as the primary outcome. For the multivariable analysis, the two youngest child-age groups (6–11 and 12–23 months) were combined into a single 6–23-month reference category because the 6–11-month group was small (8.9%). Likewise, main food type was collapsed into two groups, breastmilk only or with complementary foods versus a full solid diet, to avoid an unstable estimate from the small breastmilk-only group (1.8%). PMT constructs, including perceived vulnerability, were analyzed as continuous composite scores, with adjusted odds ratios expressed per one-unit increase.

Univariable logistic regression was used to analyze each independent variable, with crude odds ratios (CORs) and 95% confidence intervals (CIs) reported. Variables with $p < 0.25$ in the univariable analysis were entered into the multivariable model. Multivariable logistic regression was conducted to identify independent determinants of good food hygiene practice, with adjusted odds ratios (AORs) and 95% CIs reported. Multicollinearity was assessed using variance inflation factors (VIF), with VIF > 5 indicating problematic collinearity. Model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test, where an adequate fit was defined as $p > 0.05$. Statistical significance was set at $p < 0.05$.

RESULTS

Among the 281 caregivers included in the study, most were mothers (69.0%); the remaining 31.0% were fathers, grandparents, or other relatives primarily responsible for the child's daily care. Most caregivers were aged 20–40 years (65.5%). Caregivers with poor food hygiene practices were more likely to have lower educational attainment, lower household income, and insecure housing conditions than those with good practices. Children aged 36–59 months comprised the largest age group (38.1%) and were more frequently represented among caregivers with poor food hygiene practices (51.6% vs. 36.4%), column percentages (Table 1).

Table 1 Sociodemographic and household characteristics of study participants by food hygiene practice (n = 281)

Variables	Classification	Caregiver Food Hygiene Practice		
		Total n (%)	Poor Hygiene n (%)	Good Hygiene n (%)
Caregiver relationship to the child	Mother	194 (69.0%)	20 (64.5%)	174 (69.6%)
	Other Caregivers	87 (31.0%)	11 (35.5%)	76 (30.4%)
Caregiver age group (years)	20-40	184 (65.5%)	20 (64.5%)	164 (65.6%)
	41-50	44 (15.7%)	5 (16.1%)	39 (15.6%)
	51-60	36 (12.8%)	5 (16.1%)	31 (12.4%)
	61-79	17 (6.0%)	1 (3.2%)	16 (6.4%)
Caregiver education level	No formal education and Primary School	110 (39.1%)	17 (54.8%)	93 (37.2%)
	Middle school (Grade 6-9)	105 (37.4%)	11 (35.5%)	94 (37.6%)
	High School and Above	66 (23.5%)	3 (9.7%)	63 (25.2%)
Caregiver occupation	Unemployed / Housewife	178 (63.3%)	18 (58.1%)	160 (64.0%)
	Vendor / Trader/ Daily Wage Laborer	60 (21.4%)	11 (35.5%)	49 (19.6%)
	Factory worker (including garment)	35 (12.5%)	2 (6.5%)	33 (13.2%)
	Employee (Government/Private) and other	8 (2.8%)	0 (0.0%)	8 (3.2%)
Child age group (months)	6-11	25 (8.9%)	4 (12.9%)	21 (8.4%)
	12-23	91 (32.4%)	6 (19.4%)	85 (34.0%)
	24-35	58 (20.6%)	5 (16.1%)	53 (21.2%)
	36-59	107 (38.1%)	16 (51.6%)	91 (36.4%)
Sex of index child	Boy	150 (53.4%)	20 (64.5%)	130 (52.0%)
	Girl	131 (46.6%)	11 (35.5%)	120 (48.0%)

Variables	Classification	Caregiver Food Hygiene Practice		
		Total n (%)	Poor Hygiene n (%)	Good Hygiene n (%)
Main food type	Breastmilk only	5 (1.8%)	2 (6.5%)	3 (1.2%)
	Breastmilk + complementary foods	111 (39.5%)	12 (38.7%)	99 (39.6%)
	Solid feeding (Full diet, no breastmilk)	165 (58.7%)	17 (54.8%)	148 (59.2%)
Monthly household income (MMK)	≤300,000 kyats	17 (6.0%)	4 (12.9%)	13 (5.2%)
	300,001-500,000 kyats	169 (60.1%)	23 (74.2%)	146 (58.4%)
	>500,000 kyats	95 (33.8%)	4 (12.9%)	91 (36.4%)
Type of housing	Temporary/informal (bamboo, plastic, makeshift, hut)	47 (16.7%)	9 (29.0%)	38 (15.2%)
	Semi-permanent (wood)	91 (32.4%)	5 (16.1%)	86 (34.4%)
	Semi-permanent (some brick/tin)	64 (22.8%)	7 (22.6%)	57 (22.8%)
	Permanent (brick/concrete)	79 (28.1%)	10 (32.3%)	69 (27.6%)
Household ownership status	Owned (family owns the house)	87 (31.0%)	3 (9.7%)	84 (33.6%)
	Rented (room/apartment)	84 (29.9%)	10 (32.3%)	74 (29.6%)
	Leased (long-term lease agreement)	15 (5.3%)	3 (9.7%)	12 (4.8%)
	Hostel	71 (25.3%)	9 (29.0%)	62 (24.8%)
	Temporary shelter / Informal settlement	24 (8.5%)	6 (19.4%)	18 (7.2%)
Number of under-five children in the household	1	244 (86.8%)	26 (83.9%)	218 (87.2%)
	2 and above	37 (13.2%)	5 (16.1%)	32 (12.8%)

Most households reported receiving hygiene education during the previous 12 months (70.5%), treating drinking water before consumption (93.6%), and using improved sanitation facilities (96.4%). Water was available on premises for 69.4% of households, and 94.0% reported that drinking water was always available when needed. Compared with caregivers reporting good food hygiene practices, those with poor practices were less likely to have water available on premises (41.9% vs. 72.8%) and more likely to report intermittent water availability (32.3% vs. 2.8%) (Table 2).

Table 2 Water, sanitation, and hygiene (WASH) and contextual characteristics of households according to caregiver food hygiene practice

Variables	Classification	Caregiver Food Hygiene Practice		
		Total n (%)	Poor Hygiene n (%)	Good Hygiene n (%)
Child illness symptoms in the past 2 weeks	No	224 (79.7%)	22 (71.0%)	202 (80.8%)
	Yes	57 (20.3%)	9 (29.0%)	48 (19.2%)
Hygiene education in the past 12 months	No	83 (29.5%)	14 (45.2%)	69 (27.6%)
	Yes	198 (70.5%)	17 (54.8%)	181 (72.4%)

Variables	Classification	Caregiver Food Hygiene Practice		
		Total n (%)	Poor Hygiene n (%)	Good Hygiene n (%)
Drinking water source (JMP)	Unimproved (Unimproved from Primary)	57 (20.3%)	8 (25.8%)	49 (19.6%)
	Limited (Improved from primary+ unimproved from secondary)	83 (29.5%)	9 (29.0%)	74 (29.6%)
	Improved (Improved from both)	141 (50.2%)	14 (45.2%)	127 (50.8%)
Drinking water treatment	No	18 (6.4%)	4 (12.9%)	14 (5.6%)
	Yes	263 (93.6%)	27 (87.1%)	236 (94.4%)
Water collection time (round trip)	Water available on premises	195 (69.4%)	13 (41.9%)	182 (72.8%)
	Less than 30 minutes (round trip)	77 (27.4%)	17 (54.8%)	60 (24.0%)
	30 minutes or more (round trip)	9 (3.2%)	1 (3.2%)	8 (3.2%)
Drinking water available whenever needed	Sometimes	17 (6.0%)	10 (32.3%)	7 (2.8%)
	Always	264 (94.0%)	21 (67.7%)	243 (97.2%)
Toilet Facility (JMP)	Unimproved (open pit, bucket, open defecation)	10 (3.6%)	2 (6.5%)	8 (3.2%)
	Improved (flush/pour flush, VIP, pit with slab)	271 (96.4%)	29 (93.5%)	242 (96.8%)
Number of households sharing the same toilet facility	Not shared (only 1 Household)	117 (41.6%)	10 (32.3%)	107 (42.8%)
	Shared (more than 1 HH)	164 (58.4%)	21 (67.7%)	143 (57.2%)

Note: WASH = Water, Sanitation, and Hygiene. VIP = Ventilated improved pit latrine.

Compliance with recommended food hygiene practices was generally high (Table 3). More than 90% of caregivers reported washing child feeding utensils with soap before feeding (91.1%), washing fruits and vegetables with safe or treated water (90.4%), keeping cooked food covered (96.8%), and separating raw meat and vegetables during preparation (90.7%). Adequate reheating of leftover food was less commonly reported, with 32.7% of caregivers classified as non-doers. Overall, 89.0% of caregivers achieved a composite score of ≥4 out of 5 and were classified as having good food hygiene practices.

Observed household food hygiene conditions were also generally favorable and consistent with self-reported practices. Most households had visibly clean food preparation areas (92.9%), clean child feeding utensils (94.3%), and cooked food stored in covered containers (96.4%). Overall, 85.8% of households met all four observational criteria for good food hygiene conditions, which was slightly lower than the prevalence of good food hygiene practices based on self-report (89.0%).

Table 3 Self-reported food hygiene practices and observed household food hygiene conditions among caregivers of children aged 6–59 months

Self-reported food hygiene practices	**n (%)**
Washing child feeding utensils with soap before feeding (E3.1)	256 (91.1)
Washing fruits and vegetables with safe or treated water (E3.2)	254 (90.4)
Reheating leftover food adequately (E3.3)	189 (67.3)
Keeping cooked food covered (E3.4)	272 (96.8)
Separating raw meat and vegetables during preparation (E3.5)	255 (90.7)
Overall good food hygiene practice (composite score ≥4 of 5)	250 (89.0)
Observed household food hygiene conditions	**n (%)**
Food preparation area visibly clean	261 (92.9)
Child feeding utensils visibly clean	265 (94.3)
Cooked food stored in a covered container	271 (96.4)
Cutting boards and cooking utensils visibly clean	247 (87.9)
Overall: good food hygiene conditions (all 4 criteria met)	241 (85.8)

Note: Good food hygiene practice was defined as a composite score of ≥4 out of 5 self-reported food hygiene behaviors. Good food hygiene condition was defined as meeting all four observational criteria during the household visit.

Several socioeconomic and WASH variables were associated with good food hygiene practice in the bivariate analyses. Caregivers from households earning more than 500,000 MMK per month had higher odds of good food hygiene practices than those in the lowest income group (COR = 7.00, 95% CI: 1.56–31.46). Household ownership status was also associated with food hygiene practices, with non-homeowners generally exhibiting lower odds of good practices than homeowners. Among WASH factors, caregivers reporting that drinking water was always available had substantially higher odds of good food hygiene practices than those reporting intermittent availability (COR = 16.53, 95% CI: 5.71–47.89). Households requiring off-premises water collection had lower odds of good practices than those with water available on premises (COR = 0.25, 95% CI: 0.12–0.55). Caregivers who had received hygiene education within the previous 12 months also had higher odds of good food hygiene practices (COR = 2.16, 95% CI: 1.01–4.62).

Although all PMT constructs showed positive associations in preliminary analyses, only perceived vulnerability remained significant after adjustment. This suggests that caregivers' perception of their child's susceptibility to foodborne illness may be a more important determinant of food hygiene behavior than perceived severity, response efficacy, self-efficacy, or response cost. No evidence of multicollinearity was identified among the variables included in the multivariable model (VIF range: 1.05–2.56). After adjustment, water availability, perceived vulnerability, child age group, and main food type remained independently associated with good food hygiene practices (Table 4).

Table 4 Multivariable logistic regression analysis of factors associated with good food hygiene practices.

Variable	Classification	AOR 95% CI	p-value
Main food type	Receiving breastmilk (only or with complementary foods)	Ref	
	Solid feeding (Full diet, no breastmilk)	7.39 (1.76-31.05)	**0.006****
Availability of drinking water	Sometimes	Ref	
	Always	16.75 (5.05-55.59)	**<0.001*****
Perceived vulnerability (continuous variable, per 1-unit)		1.43 (1.13-1.80)	**0.003****
Child age group (in months)	6-23	Ref	
	24-35	0.30 (0.07-1.29)	0.106
	36-59	0.09 (0.02-0.46)	**0.003****

Outcome variable: Good food hygiene practice (composite score ≥ 4 of 5; 1 = good, 0 = poor). Reference categories (Ref) are shown without a p-value; p-values are for non-reference levels from the multivariable model. Perceived vulnerability was analyzed as a continuous score; its odds ratio is per one-unit increase and has no reference category. The 6–23-month reference combines the 6–11 and 12–23-month groups. Main food type was classified into two categories (reference = any breastmilk).

Caregivers who reported that water was always available had significantly higher odds of practicing good food hygiene than those reporting intermittent availability (AOR = 16.75, 95% CI: 5.05–55.59, p < 0.001). Perceived vulnerability was also positively associated with good food hygiene practices (AOR = 1.43, 95% CI: 1.13–1.80, p = 0.003). Compared with caregivers of children aged 6–23 months, those caring for children aged 36–59 months had significantly lower odds of good food hygiene practices (AOR = 0.09, 95% CI: 0.02–0.46, p = 0.003). Finally, caregivers whose child received a full solid diet had higher odds of good food hygiene practices than those whose child was still receiving breast milk (AOR = 7.39, 95% CI: 1.76–31.05, p = 0.006).

DISCUSSION

This study examined food hygiene practices among caregivers of children aged 6–59 months in peri-urban Yangon using Protection Motivation Theory (PMT). Most caregivers reported good food hygiene practices, although observed household conditions were slightly less favorable, suggesting some over-reporting of desirable hygiene behaviors, as reported in previous studies (18, 19). This discrepancy is common in resource-limited settings. For instance, a study in rural Malawi also reported that hygienic behaviors are significantly more frequent than what is actually verified by direct household observation (18). Nevertheless, the relatively small difference between self-reported practice (89.0%) and observed household conditions (85.8%) suggests that the overall pattern of favorable food hygiene was broadly consistent, although some degree of social desirability bias cannot be excluded.

Despite generally favorable hygiene practices, reheating leftover food emerged as a notable behavioral gap. Unlike other food hygiene behaviors that require minimal additional resources, reheating often depends on the availability of time and fuel. Similar barriers have been reported in other low-resource settings such as in Nepal and Western Kenya, where acute cooking fuel scarcity, heavy maternal workloads, and time poverty directly prevent caregivers from thoroughly reheating food to safe temperatures before feeding (20, 21). This finding suggests that the lower prevalence of adequate reheating may reflect practical resource constraints in addition to knowledge or awareness. Hence, interventions

should address practical constraints rather than focusing solely on knowledge and awareness.

As expected, the structural determinant of hygiene behaviors was the strongest predictor of good food hygiene. This is consistent with previous studies demonstrating that access to water is fundamental to maintaining hygienic food preparation, utensil cleaning, and handwashing practices (22, 23). The strong effect of water availability may also explain why coping-appraisal constructs, such as self-efficacy and response efficacy, did not remain significant in the adjusted model. Although caregivers may have sufficient motivation or confidence to perform recommended behaviors, environmental constraints may limit their ability to do so consistently. In fact, within Myanmar's context, large-scale structural or infrastructural development of WASH systems may not be immediately feasible in all peri-urban communities (9, 10). Instead, equipping caregivers with practical and low-cost strategies to optimize safe food preparation within their existing environmental limitations offers a more viable alternative.

Although all PMT constructs were associated with food hygiene practices in bivariate analyses, only perceived vulnerability remained significant after adjustment. This suggests that caregivers who perceive their children to be at greater risk of foodborne illness may be more likely to adopt protective behaviors. In general, the PMT framework often identifies self-efficacy as the dominant predictor of health-protective behavior. However, in resource-constrained environments, an individual's confidence (self-efficacy) to perform a behavior is rendered secondary if they lack the physical means to execute it (24). Consequently, perceived risk becomes the primary psychological driver, motivating caregivers to maximize hygiene within the bounds of their severe environmental limitations.

The lower odds of good food hygiene practices observed among caregivers of older children indicate a sharp decline in hygiene vigilance after infancy. This finding suggests that food hygiene promotion should not be limited to the complementary feeding period but should continue throughout early childhood (3). The observed association may indicate that food hygiene receives less attention as children become older, although the cross-sectional design does not allow the temporal mechanisms underlying this pattern to be established. Feeding type was also associated with food hygiene practice. Caregivers whose child was on a full solid diet had higher odds of good practice than those whose child was still receiving breastmilk. This likely reflects the additional preparation, handling, and storage that solid foods require, which may increase caregivers' attention to hygiene.

Finally, household income, housing tenure, and hygiene education were not independently associated with food hygiene practice after adjustment. Together with the strong effect of water availability, these findings suggest that providing decentralized structural support and access to basic services may be as important as educational interventions in supporting safe food hygiene practices among caregivers.

This study has a few limitations. First, its cross-sectional design prevents causal inference. Second, reliance on self-reported data introduces potential social desirability bias. Third, the localized sample in Hlaing Thar Yar limits nationwide generalizability. Furthermore, only 31 participants were classified as having poor food hygiene practices, which may have contributed to the wide confidence intervals and instability of some adjusted estimates. Nevertheless, this study provides vital, context-specific insights into Protection Motivation Theory (PMT) by demonstrating how standard psychological drivers shift under resource constraints, offering a more nuanced understanding of PMT's behavioral mechanisms in developing regions.

CONCLUSION

Reliable household water access and perceived child vulnerability to foodborne illness were the principal determinants of good food hygiene practices among caregivers in peri-

urban Yangon, while reheating leftover food emerged as the primary behavioral gap. Given the practical challenges of rapidly improving household-level WASH infrastructure in this setting, interventions should also consider decentralized and low-cost strategies. Public health programming should pivot toward risk communication that elevates caregivers' perceived vulnerability to foodborne illness, explicitly targeting caregivers of older children (36–59 months) who demonstrate a sharp decline in hygiene vigilance. Crucially, rather than focusing solely on education, these programs must equip families with practical tools to optimize safe food preparation within their existing environmental limitations, such as household point-of-use water treatment, safe domestic storage, and fuel-efficient reheating methods. Finally, future longitudinal research is needed to evaluate whether integrated interventions combining these localized, low-cost adaptations with PMT-informed behavioral strategies can produce sustained food hygiene improvements across early childhood.

ETHICAL DECLARATION

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB; Approval No. MU-CIRB 2026/143.1603). Electronic informed consent was obtained from all participants prior to data collection, and all data were anonymized and reported in aggregate to protect confidentiality.

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KNOWLEDGE, ATTITUDE AND PRACTICE OF ADVERSE DRUG REACTION REPORTING AMONG HEALTHCARE PROFESSIONALS AT THE NATIONAL REFERRAL HOSPITAL IN BHUTAN: A CROSS-SECTIONAL STUDY

Kinley Penjor Tshomo[1], Pramon Viwattanakulvanid*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

***Corresponding Author:** Pramon Viwattanakulvanid,*

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, Email: Pramon.V@chula.ac.th

ABSTRACT

Background: Adverse Drug Reactions (ADRs) are major public health concerns contributing to increased morbidity, mortality, and financial burden on the healthcare system. ADRs are underreported globally, limiting pharmacovigilance efforts and patient safety. In Bhutan, there is limited data on healthcare professionals' knowledge, attitude, and practice towards ADR reporting.

Objectives: To determine the level of ADR reporting practice; assess the socio-demographic characteristics, knowledge and attitude associated with ADR reporting; examine the association between these factors and ADR reporting practice; and explore barriers to ADR reporting among healthcare professionals at the National Referral Hospital in Bhutan.

Methodology: A hospital-based cross-sectional study was conducted among 303 healthcare professionals consisting of nurses, physicians, pharmacists, and pharmacy technicians at the National Referral Hospital. Data were collected during April-May 2026 using a self-administered online questionnaire. The questionnaire assessed the socio-demographic characteristics, knowledge, attitude, practice, and barriers related to ADR reporting and pharmacovigilance. Descriptive analysis and multivariable binary logistic regression were performed, with statistical significance set at $p<0.05$.

Results: Among 303 participants, 56.5% demonstrated good knowledge and 52.1% demonstrated a positive attitude towards ADR reporting, while 63.4% showed an overall good ADR reporting practice. Although nearly 80% encountered ADR during their practice, only about half of them reported the ADR. Pharmacists and pharmacy technicians had higher odds of good ADR reporting practice as compared to nurses (AOR=10.03, 95% CI=2.24-44.88, p=0.003). Similarly, participants with experience between 6-10 years and over 10 years were more likely to report ADR as compared to those with experience of ≤5 years (AOR=2.60, 95% CI=1.12-6.03, p=0.027 and AOR=3.11, 95% CI=1.12-8.65, p=0.029, respectively). Furthermore, participants with good knowledge had almost two times higher odds of demonstrating good ADR reporting practice as compared to those with poor knowledge (AOR=1.71, 95% CI=1.02-2.86, p=0.042). The main barriers identified were insufficient knowledge (79.2%), high workload (57.8%), and coworkers not reporting ADR (55.1%).

Conclusion: The study revealed encouraging levels of knowledge, attitude, and practice regarding ADR reporting among healthcare professionals. However, formal ADR reporting remained suboptimal despite overall good practice, indicating a need for improvement in reporting behavior. Good knowledge was significantly associated with ADR reporting practice, while insufficient knowledge, high workload, and coworkers not reporting ADRs were key barriers. These findings suggest that enhancing pharmacovigilance education, addressing workload-related constraints, and integrating ADR reporting into routine clinical practice may help improve ADR reporting and strengthen the pharmacovigilance system in Bhutan.

Keywords:

Adverse Drug Reaction; Pharmacovigilance; ADR Reporting; Healthcare Professionals; Bhutan

INTRODUCTION

Medicines undergo rigorous clinical trials before approval; however, their complete safety profile cannot be fully established during clinical trials due to the limited sample sizes and duration of trials (1). Consequently, some harmful effects may only become evident after a medicine is widely used in the population. This highlights the requirement of an effective post-marketing surveillance system to detect and monitor any harmful responses. The World Health Organization (WHO) defines these responses to a medicine that are noxious, unintended and occur at a normal dose as an Adverse Drug Reaction (ADR) (1). ADRs are a major public health concern, contributing to morbidity, mortality, hospital admissions, increased healthcare costs, and reduced quality of life (2, 3).

Pharmacovigilance plays a critical role in ensuring medicine safety by facilitating the detection, assessment, understanding, and prevention of ADR and other medicine-related problems (2-4). Central to pharmacovigilance is the spontaneous reporting of suspected ADRs by healthcare professionals, who play a pivotal role in identifying, documenting, and reporting suspected ADRs (5). Their ability to recognize and report ADRs depends largely on their knowledge, attitudes, and reporting practices (5-7).

Despite the importance of ADR reporting, underreporting remains a major challenge to pharmacovigilance systems worldwide, particularly in low- and middle-income countries such as Pakistan, Sri Lanka, and Timor-Leste, where limited awareness, inadequate training, and resource constraints often hinder reporting (1, 8). Studies from Pakistan, Turkey, and Sri Lanka have demonstrated that healthcare professionals' knowledge, attitudes, and practices (KAP) significantly influence ADR reporting behavior. Furthermore, these studies reported inadequate knowledge and poor reporting practices among healthcare professionals, despite generally favorable attitudes toward ADR reporting (6, 7). Common barriers include heavy workload, uncertainty regarding reporting procedures, lack of awareness, and fear of reporting incorrectly (5, 6, 9). However, evidence on ADR reporting behavior among healthcare professionals in Bhutan remains limited.

In Bhutan, the Bhutan Food and Drug Authority serves as the National Pharmacovigilance Centre and coordinates the national ADR reporting system (10). ADR detection and reporting are shared responsibilities of physicians, nurses, pharmacists, and pharmacy technicians, although pharmacists often coordinate pharmacovigilance activities. The National Referral Hospital has served as a pharmacovigilance sub-centre since 2012; however, despite an established reporting framework, no ADR reports were submitted from the hospital between 2023 and 2025 (11). This suggests potential gaps in healthcare professionals' knowledge, attitudes, reporting practices, and engagement with pharmacovigilance activities. Therefore, this study assessed the knowledge, attitude, and practice of ADR reporting among healthcare professionals at the National Referral Hospital, identified factors associated with ADR reporting practice, and explored barriers to reporting to inform strategies for strengthening pharmacovigilance and medication safety in Bhutan.

METHODOLOGY

Study design

A cross-sectional online survey was conducted between April and May 2026 among healthcare professionals at the National Referral Hospital in Bhutan.

Study population and sample size

The study was conducted at the National Referral Hospital, the country's main tertiary healthcare institution, which employed 907 healthcare professionals, including physicians, nurses, pharmacists, and pharmacy technicians (12, 13). The sample size was calculated using the finite proportion formula with a conservative proportion (p=0.5) and a 10% missing rate, yielding a required sample size of 298 participants. A non-probability quota convenience sampling method was used, with participants recruited proportionally from the four professional groups. Consequently, nurses constituted the largest

proportion of the study sample because they represent the largest healthcare professional group within the hospital workforce, whereas pharmacists accounted for a much smaller proportion. Eligible participants were healthcare professionals employed at the National Referral Hospital on regular or contract appointments with at least one year of work experience. Interns and those who did not provide informed consent were excluded.

Measurement tool

Data were collected using a structured self-administered questionnaire adapted from previous studies (14, 15). Content validity was assessed by three pharmacovigilance experts using the Item-Objective Congruence (IOC). A pilot study involving 40 healthcare professionals from a regional referral hospital was conducted to assess reliability, and the reliability coefficients were 0.729 for knowledge after removing one item, 0.705 for attitude after removing two items, and 0.722 for practice, indicating acceptable reliability.

The questionnaire consisted of five sections, i.e., socio-demographic characteristics, knowledge of ADR and pharmacovigilance, attitude toward ADR reporting, ADR reporting practices, and barriers to ADR reporting. The knowledge section comprised 13 multiple-choice questions scored as "1" for correct or "0" for incorrect. The attitude section included 6 statements measured on a five-point Likert scale. ADR reporting practice was assessed using 5 items measured on a three-point Likert scale. Barrier-related questions were analyzed descriptively using categorical response options. Participants with practice scores equal to or above the median score were classified as having good ADR reporting practice, whereas those scoring below the median were classified as having poor ADR reporting practice. Similar median-based classifications were used for knowledge and attitude scores.

Statistical Analysis

Data were analyzed using IBM SPSS version 29. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were calculated. Bivariate logistic regression was initially performed to identify variables associated with ADR reporting practice at a significance level of $p<0.20$. Variables meeting this criterion were included in a multivariable binary logistic regression model. Adjusted odds ratios (AORs) with 95% confidence intervals were reported, and statistical significance was set at $p<0.05$.

RESULTS

Table 1 Characteristics of respondents (n=303)

Socio-demographic characteristics	Frequency	Percentage (%)
Age in Years		
(Mean ±SD: 33.58±7.42; Min-Max: 22-56)		
20-30 years old	107	35.3
31-40 years old	152	50.1
41-50 years old	35	11.6
51-60 years old	9	3.0
Gender		
Female	169	55.8
Male	134	44.2
Profession		
Nurse	223	73.6
Pharmacist	8	2.6
Pharmacy Technician	20	6.6

Socio-demographic characteristics	Frequency	Percentage (%)
Physician	52	17.2
Years of experience		
(Mean ±SD: 9.28±7.45; Min-Max: 1-33)		
≤5	116	38.3
6-10	85	28.1
>10	102	33.6

Table 1 shows the socio-demographic characteristics of the participants. Among 303 participants, 55.8% were female while the remaining 44.2% were male. The majority of the participants were in the age group of 31-40 years (50.1%). Participants aged over 51 years showed the least participation (3.0%). The mean (±SD) for age was 33.58±7.42. More than half of healthcare professionals were nurses (73.6%), followed by physicians (17.2%), pharmacy technicians (6.6%), and pharmacists (2.6%). Regarding years of experience, the participants were almost equally distributed across the groups of ≤5 years (38.3%), 6-10 years (28.1%), and >10 years (33.6%). The mean (±SD) for years of experience was 9.28±7.45.

Table 2 Frequencies and distribution of knowledge score (correct and incorrect answers) related to ADR reporting (n=303)

Statement	Frequencies (%)	
	Incorrect answer	Correct answer
Pharmacovigilance Knowledge		
What is pharmacovigilance	68 (22.4)	235 (77.6)
The primary purpose of carrying out pharmacovigilance activities is to enhance patient safety and care in relation to the use of medicines	2 (0.7)	**301 (99.3)**
What incidents led to the establishment of drug monitoring systems in many nations by 1960?	**131 (43.2)**	172 (56.8)
Which organization is responsible for monitoring Adverse Drug Reactions in Bhutan?	69 (22.8)	234 (77.2)
ADR Knowledge		
What is the appropriate definition of an Adverse Drug Reaction according to WHO?	54 (17.8)	249 (82.2)
What does "type A" adverse drug reaction mean?	72 (23.8)	231 (76.2)
What does a "type B" adverse drug reaction mean?	**108 (35.6)**	195 (64.4)
All ADR are known before the drug gets into the market for use*	**92 (30.4)**	211 (69.6)
All ADR experienced by a patient taking a drug should be reported and documented	9 (3.0)	**294 (97.0)**
There is no need to report an ADR that is already documented in the drug literature insert*	43 (14.2)	260 (85.8)
Serious ADR in Pharmacovigilance results in a congenital anomaly/birth defect	30 (9.9)	**273 (90.1)**
Spontaneous reporting method is the most frequently used method to report ADR	42 (13.9)	261 (86.1)
Vigiflow is the system used to report ADR in Bhutan	59 (19.5)	244 (80.5)

56.4% demonstrated good knowledge of ADR reporting, while 43.6% showed poor knowledge. Most participants correctly recognized the role of pharmacovigilance in enhancing patient safety (99.3%) and the importance of documenting and reporting ADRs (97.0%), as presented in Table 2. However, knowledge gaps were identified in specific areas, particularly ADR classification and pharmacovigilance concepts. 52.1% showed a positive attitude towards ADR reporting, while the remaining 47.9% showed a negative attitude. Most participants strongly agreed that ADR reporting is necessary, beneficial to public health, and a shared responsibility among healthcare professionals, as presented in Table 3. Overall, 63.4% of participants demonstrated good ADR reporting practice. The majority had encountered ADRs during routine clinical practice, and ADR documentation and patient counselling were commonly performed as shown in Table 4. Despite this, formal reporting to the pharmacovigilance unit remained suboptimal, with only 23.8% reporting ADRs often and 34.0% reporting sometimes.

Table 3 Frequencies and distribution of attitude towards ADR reporting (n=303)

Statement	Frequencies (%)				
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Attitude towards the importance of ADR reporting					
I think reporting of ADR is necessary	267 (88.1)	33 (10.9)	2 (0.7)	1 (0.3)	0 (0)
I think monitoring ADR is beneficial to public health	258 (85.1)	43 (14.2)	2 (0.7)	0 (0)	0 (0)
Pharmacovigilance should be included as a core topic in medical education	227 (74.9)	69 (22.8)	6 (2.0)	0 (0)	1 (0.3)
Attitude towards ADR reporting responsibility					
I think it's the responsibility of all healthcare professionals to identify and report ADR	250 (82.5)	45 (14.9)	8 (2.6)	0 (0)	0 (0)
There should be collaboration between healthcare professionals while reporting ADR	232 (76.6)	63 (20.8)	7 (2.3)	1 (0.3)	0 (0)
Only Pharmacists have the responsibility to report ADR*	36 (11.9)	49 (16.2)	77 (25.4)	56 (18.5)	85 (28.1)

Table 4 Frequencies of ADR reporting practice (n=303)

Statement	Frequencies (%)		
	Often	**Sometimes**	**Never**
Have you ever experienced adverse drug reactions in your patient during your professional practice?	44 (14.5)	197 (65.0)	62 (20.5)
Have you documented the ADR you encountered in the patient's clinical record?	95 (31.3)	119 (39.3)	89 (29.4)
Have you ever reported ADR to the Pharmacovigilance centre or unit of your hospital?	72 (23.8)	103 (34.0)	128 (42.2)
Have you ever counselled patients about the side effects and possible ADRs of drugs?	172 (56.8)	111 (36.6)	20 (6.6)
Do you read any article on prevention of adverse drug reactions?	84 (27.7)	177 (58.4)	42 (13.9)

Figure 1 shows the most commonly identified barrier to ADR reporting. Insufficient knowledge of ADR and pharmacovigilance was reported by the majority of participants (79.2%) as a major barrier to ADR reporting. This was followed by a high workload of healthcare professionals (57.8%) that was also perceived as a barrier to ADR reporting. Further, 55.1% of the participants considered that coworkers not reporting ADR hindered ADR reporting.

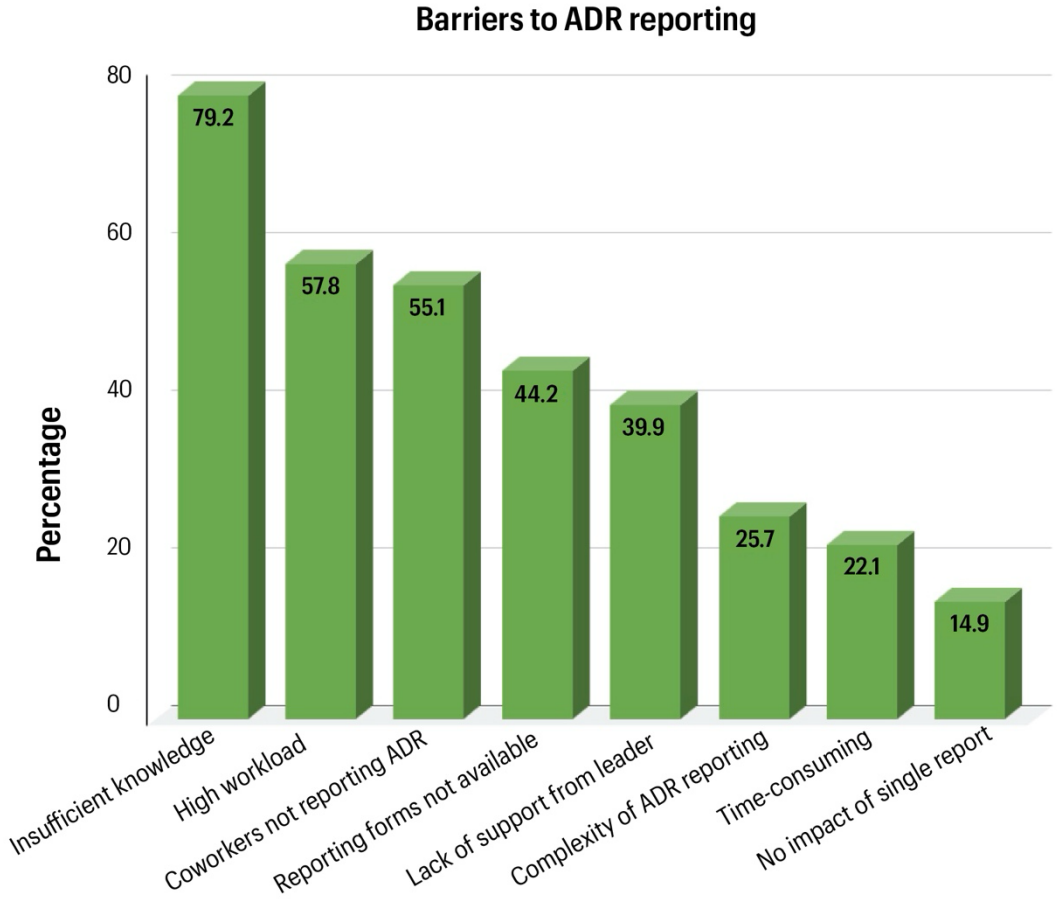

Figure 1 Barriers to ADR reporting

Simple logistic regression was performed at a cut-off p-value <0.2 to determine the unadjusted odds ratio between each independent variable and the dependent variable. The results of the simple logistic regression described the significant association of all independent variables under socio-demographic characteristics, which included age (p-value=0.103), gender (p-value=0.144), profession (p-value=0.008), and years of experience (p-value=0.055). Knowledge and attitude related to ADR reporting were also found to be significantly associated with ADR reporting practice level with p-values of 0.021 and 0.061, respectively.

Table 5 Multivariable binary logistic regression analysis of factors associated with ADR reporting practice

Variable	B	SE	AOR [a]	95% CI		p-value [b]
				Lower	Upper	
Age (20-30 [Ref])						0.166
31-40	-0.679	0.434	0.51	0.22	1.19	0.118
41-50	-0.553	0.66	0.58	0.16	2.10	0.402
51-60	1.164	1.194	3.20	0.31	33.29	0.33
Gender (Male [Ref])						
Female	0.535	0.276	1.71	0.99	2.93	0.053
Profession (Nurse [Ref])						0.009*
Pharmacist/ Pharmacy Technician	2.306	0.764	10.03	2.24	44.88	0.003*
Physician	0.353	0.383	1.42	0.67	3.01	0.356
Years of experience (≤5 years [Ref])						0.056
6-10 years	0.954	0.43	2.60	1.12	6.03	0.027*
>10 years	1.137	0.521	3.11	1.12	8.65	0.029*
Knowledge on ADR reporting (Poor [Ref])						
Good	0.536	0.263	1.71	1.02	2.86	0.042*
Attitude towards ADR reporting (Negative [Ref])						
Positive	0.473	0.256	1.61	0.97	2.65	0.065

Model chi-square =37.549 (df =10 p<0.001); Nagelkerke R Square =0.159 ; Hosmer and Lemeshow Test chi-square =2.891 (df =8 , p=0.941)

[ab] AOR (adjusted odds ratio) and p-value from multiple logistic regression including significant variables at the bivariate analysis

** Significance level p<0.05*

Table 4 shows the results of multivariable binary logistic regression, which examined the association between independent variables that were statistically significant in the bivariate analysis. From the results, profession was found to be significantly associated with ADR reporting practice (p=0.009). Pharmacists and pharmacy technicians had 10 times higher odds of good ADR reporting practice as compared to the nurses (AOR=10.03, 95% CI=2.24-44.88, p=0.003). However, physicians did not differ significantly from the nurses when it comes to ADR reporting practice (AOR=1.42, 95% CI=0.67-3.01, p=0.356). Healthcare professionals with experience between 6 and 10 years had 2.6 times higher odds of good ADR reporting practice as compared to the healthcare professionals with experience of ≤5 years (AOR=2.60, 95% CI=1.12-6.03, p=0.027). Likewise, healthcare professionals with experience over 10 years had 3.1 times higher odds of good ADR reporting practice as compared to the healthcare professionals with experience of ≤5 years (AOR=3.11, 95% CI=1.12-8.65, p=0.029). Furthermore, healthcare professionals with good knowledge had 1.7 times higher odds of demonstrating good ADR reporting practice as compared to healthcare professionals with poor knowledge (AOR=1.71, 95% CI=1.02-2.86, p=0.042). Healthcare professionals with a positive attitude had 1.6 times higher odds of having a good ADR

reporting practice as compared to healthcare professionals with a negative attitude; however, the association was not statistically significant (AOR=1.61, 95% CI=0.97-2.65, p=0.065). Gender and age were not significantly associated with ADR reporting practice.

DISCUSSION

The findings of this study revealed that healthcare professionals demonstrated good ADR reporting practice, adequate knowledge, and a positive attitude towards ADR reporting.

This study found that 63.4% of healthcare professionals demonstrated good ADR reporting practice, which was higher than those reported in studies from Turkey and Pakistan (5, 6). The overall good practice may reflect the tertiary hospital setting, greater exposure to ADRs, and ongoing pharmacovigilance initiatives in Bhutan. However, despite nearly 80% of participants encountering ADRs, formal reporting remained suboptimal, with only 57.8% of the participants reporting ADRs at least sometimes and no official ADR reports submitted from the National Referral Hospital between 2023 and 2025. This discrepancy may reflect differences between self-reported and formally submitted ADR reports, potentially influenced by recall and social desirability bias. Moreover, although ADR documentation and patient counselling were common, these activities did not consistently translate into formal reporting, likely due to insufficient pharmacovigilance knowledge, heavy workload, a weak reporting culture, and reliance on documentation or verbal communication instead of official reporting procedures.

More than half of the participants demonstrated good knowledge of ADR reporting and pharmacovigilance, consistent with findings from a systematic review in Malaysia (16) but contrasting with studies from Pakistan and Turkey that reported majority of healthcare professionals had poor knowledge (5, 6). The good level of knowledge in this study may reflect the pharmacovigilance training opportunities available at the National Referral Hospital. However, gaps were identified in participants' understanding of advanced pharmacovigilance concepts and ADR classifications, which may lead to inaccurate identification and reporting, compromising pharmacovigilance effectiveness. The significant association between knowledge and ADR reporting practice highlights the importance of strengthening both foundational and advanced pharmacovigilance training.

Participants generally demonstrated a positive attitude towards ADR reporting, with most agreeing that ADR reporting is necessary, beneficial to public health, and a shared responsibility among healthcare professionals. They also supported multidisciplinary collaboration and inclusion of pharmacovigilance in healthcare education. Similar findings have been reported in studies from Sri Lanka, Pakistan, Turkey, and Timor-Leste (5-7, 14). Although attitude was not significantly associated with ADR reporting practice, the favorable attitude observed in this study may reflect healthcare professionals' willingness to support pharmacovigilance initiatives and patient safety efforts.

The majority of participants were female and nurses, reflecting the healthcare workforce composition in Bhutan. While age and gender were not significantly associated with ADR reporting practice, profession and years of experience were significant predictors. Pharmacists and pharmacy technicians demonstrated better ADR reporting practice compared with nurses, likely due to their greater involvement in medication management and pharmacovigilance activities. Similarly, healthcare professionals with more years of experience were more likely to report ADRs, suggesting that clinical exposure and professional maturity contribute to reporting behavior.

The major barriers identified were insufficient knowledge, heavy workload, and coworkers not reporting ADRs. Although overall knowledge levels were good, participants may lack confidence in more advanced aspects of ADR. Heavy workload likely limits the time available for reporting, while coworkers not reporting ADRs may reflect a weak reporting culture. Encouragingly, most participants did not

perceive ADR reporting as complex, time-consuming, or ineffective. Addressing the identified barriers through targeted training, workload management, and strengthened multidisciplinary collaboration may improve ADR reporting and the pharmacovigilance system in Bhutan.

RECOMMENDATIONS

Despite the good overall ADR reporting practice among healthcare professionals at the National Referral Hospital, formal ADR reporting remained suboptimal. Given that good knowledge was significantly associated with ADR reporting practice, and that insufficient knowledge, high workload, and coworkers not reporting ADRs were identified as key barriers, healthcare institutions should strengthen awareness of ADR reporting procedures, integrate ADR reporting into routine clinical practice, and foster a supportive reporting culture among healthcare professionals.

The Ministry of Health should support the implementation of healthcare quality standards related to ADR reporting through effective monitoring while addressing workload challenges. The Bhutan Food and Drug Authority should continue pharmacovigilance training initiatives, supportive supervision, and feedback mechanisms to encourage consistent reporting. Future multicenter studies across Bhutan and qualitative research related to ADR reporting are recommended to improve generalizability and provide deeper insights into reporting behavior.

ETHICAL DECLARATION

The study obtained ethical approval from the Institutional Review Board of the Khesar Gyalpo University of Medical Sciences of Bhutan (IRB/Approval/PN/2026-006/ 237 dated 19 March 2026). Administrative clearance was granted by the Ministry of Health and the National Referral Hospital.

STRENGTHS AND LIMITATIONS

This study is the first KAP study in Bhutan assessing healthcare professionals' knowledge, attitudes, practices, and barriers to ADR reporting using real-time primary data, and it also identified associated factors through multivariable binary logistic regression while adjusting for confounders. However, convenience sampling, a higher proportion of nurses as compared to the pharmacy profession, and the use of self-administered online surveys may introduce selection and response bias. In addition, the cross-sectional design limits causal inference, and the single-hospital setting restricts generalizability to all healthcare professionals in Bhutan.

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KNOWLEDGE, ATTITUDES AND PRACTICES ON SUBSTANDARD AND FALSIFIED MEDICAL PRODUCTS AMONG NURSING PROFESSIONALS IN BHUTAN

Gyelwa Kuenzom[1], Tarinee Buadit[1*], Cheerawit Rattanapan[1], Orapin Laosee[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Nakhon Pathom, 73170, Thailand
****Corresponding Author:** Tarinee Buadit,*
ASEAN Institute for Health Development, MahidolUniversity, Nakhon Pathom 73170, Thailand,
E-mail: tarinee.bud@mahidol.ac.th

ABSTRACT

Introduction: Substandard and Falsified (SF) medical products pose a significant threat to patient safety and progress towards Universal Health Coverage. The World Health Organization has reported increasing SF medical product incidents worldwide, particularly in the South-East Asia region. Bhutan faces similar challenges, with evidence of SF medical products in the supply chain. Despite efforts to combat SF medical products, underreporting continues to hinder timely detection and response. While existing studies have largely focused on regulatory and supply chain aspects, relatively few have examined the role of healthcare professionals, particularly nurses, who are often the first to identify and report SF medical products. Assessing their knowledge, attitudes, and practices can identify gaps in detection and reporting and inform interventions to strengthen surveillance systems.

Objective: To determine the levels of knowledge, attitudes, and practices on SF medical products among nursing professionals in Bhutan and assess their associations.

Methodology: A cross-sectional study was conducted among nursing professionals in Bhutan with more than 6 months of experience. Data were collected using an online survey questionnaire (Google Forms). Stratified proportional allocation followed by purposive and voluntary sampling was employed. Descriptive analysis, chi-square test, bivariate and multiple logistic regression were performed using SPSS version 31.

Results: A total of 357 nurses participated. Overall, 50.4% demonstrated good knowledge, 54.3% positive attitudes, and 54.1% good practices toward SF medical products. However, gaps remained in reporting knowledge and practice. Only 57.4% were aware of reporting systems and 50.4% of reporting forms. Furthermore, 52.1% informed relevant authorities when SF medical products were suspected, while 66.9% rarely or never used the reporting form. A total of 71.7% had never received training. Multiple logistic regression identified years of professional experience, knowledge level, and attitude level as significant factors associated with good practice. Respondents with 21-30 years of experience (AOR=2.860, 95% CI =1.235-6.626, p=0.014), good knowledge (AOR = 1.684, 95% CI = 1.065-2.662, P=0.026) and positive attitude (AOR=1.627, 95% CI = 1.023-2.589, p=0.040) were more likely to demonstrate good practice towards SF medical products.

Conclusion: Despite moderate levels of knowledge, attitudes, and practices, regulatory knowledge and reporting practices were limited. These findings highlight the need for enhanced training, increased awareness programmes, and integration of SF medical product-related content into education and professional development programmes. The findings provide evidence to inform strategies for strengthening surveillance and reporting systems in Bhutan.

Keywords:
Substandard and Falsified Medical Products; Knowledge; Attitude and Practices; Nursing Professional; Bhutan

INTRODUCTION

The availability of safe and effective medical products is essential for global health and achieving Universal Health Coverage under Sustainable Development Goal (SDG) 3.8, which emphasizes ensuring access to safe, quality, and affordable medicines and vaccines (1-4). However, Substandard and Falsified (SF) medical products limit access to safe and effective medicines, pose a significant risk to patient safety, and impede the progress towards achieving the SDGs (5, 6).

The World Health Organization (WHO) defines substandard medical products as those that fail to meet quality standards and falsified medical products as those that deliberately misrepresent their identity, composition, or origin (5-7). SF medical products have been reported across all income settings (3, 6, 8-11), affecting a wide range of medical products (3, 12, 13). Globally, reported incidents have increased by an average of 36.3% annually, with WHO South-East Asia Region accounting for over 20% of reported cases in 2021 (3). Furthermore, around one-tenth of medicines in low- and middle-income countries (LMICs) are substandard or falsified (5).

Bhutan, as an LMIC (14), also faces challenges related to SF medical products. A five-year trend analysis conducted by the Royal Centre for Disease Control revealed reported medicine quality non-compliance rates, peaking at 10.6% in 2020 (15). In addition, SF medical products are a leading cause of product recalls, with recalls increasing from five in 2021 to twelve in 2025 (16-18).

SF medical products increase morbidity and mortality rates, financial losses and socioeconomic repercussions (5-7, 19). Despite global efforts, their prevention, detection, and response remain major public health challenges, with underreporting hindering timely action (7, 10). Healthcare professionals serve as a key source of accurate and reliable reports given their daily engagement with medical products and observation of patient outcomes (3, 10, 19, 20).

Existing research on SF medical products is largely focused on the supply chain aspects, with limited studies focused on end users (11). A significant gap remains in studies evaluating the knowledge, attitudes, and practices (KAP) of healthcare professionals regarding SF medical products (11, 21). While KAP studies have been conducted in other countries (12, 13, 19, 20, 22), no published studies have systematically examined this issue in Bhutan.

This study therefore aims to assess KAP on SF medical products among nursing professionals in Bhutan. Nurses play a pivotal role in patient care, medication management and health education (23-25). In Bhutan, nurses constitute more than half of the healthcare workforce, with a density of 20.22 per 10,000 population (23, 26). This provides a practical and representative baseline of the healthcare workforce. Identifying gaps in their KAP may inform targeted interventions to strengthen detection, reporting, and control of SF medical products in Bhutan.

METHODOLOGY

Study Design and population

A cross-sectional study was conducted among nurses in Bhutan with more than 6 months of professional experience to determine the levels of KAP on SF medical products and assess their associations. The sample size for this study was computed using Krejcie & Morgan (1970) formula for a finite population with a 95% confidence interval and a 5% margin of error. After adjusting for a 10% non-response rate, the calculated sample size was 356 participants.

The study area included 22 healthcare centers across Bhutan, as shown in Figure 1. A stratified approach was used in this study to ensure adequate representation of nursing professionals across different levels of healthcare centers. The total nursing workforce in each stratum was used to determine proportional sample allocation.

Table 1 Proportional allocation of samples.

Level of healthcare centers	Total number of nurses	Allocation
Referral	1067	198
60 bedded	151	28
40 bedded	266	49
20 bedded	195	37
10 bedded	227	42
PHC/Sub-post	13	2

Within each stratum, healthcare centers were purposively selected based on the pharmacy-to-nursing ratio, as nurses have greater responsibility for medical product management in facilities with fewer pharmacists.

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Eligible nurses from the selected facilities were then invited to participate voluntarily through an online survey, facilitating participation across geographically dispersed healthcare centers

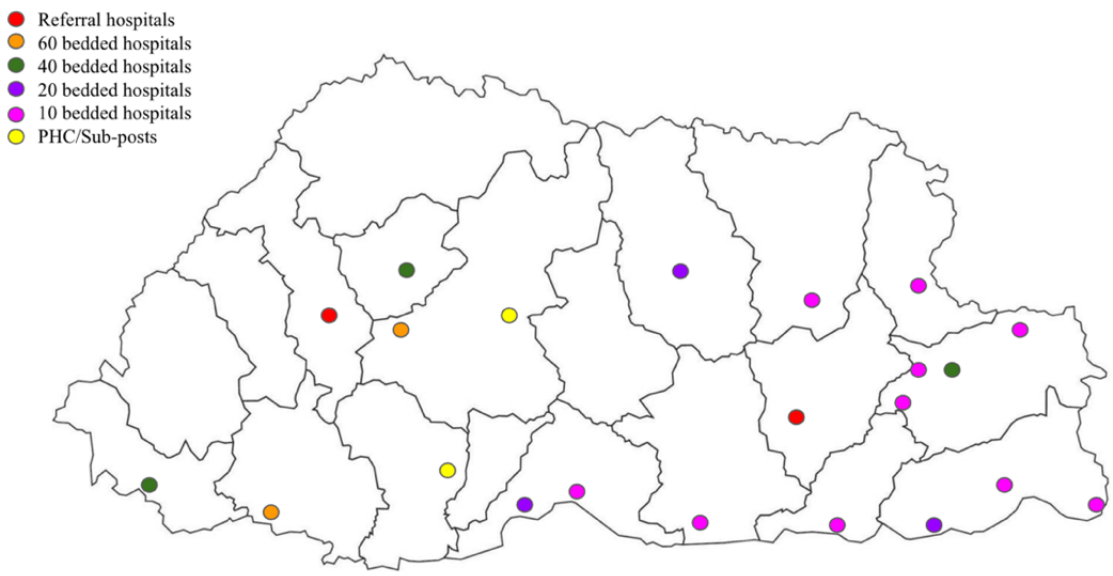

Figure 1 Map of Bhutan showing the selected study areas.

Research instrument

An online survey questionnaire was administered using Google Forms. The questionnaire was constructed based on the review of previous studies (12, 13, 19, 21, 22) and adapted to the Bhutanese context. The knowledge section was assessed using 18 items, scored as 1 for correct and 0 for incorrect responses. Total knowledge scores were categorized as poor (< median) or good (≥ median). The attitude section was assessed using 16 items rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Negatively worded items were reverse-coded. Overall attitude scores were classified as negative (< median) or positive (≥ median). Practice was assessed using 9 items rated on a five-point Likert scale, 1 (Not at all), 2 (Rarely), 3 (Sometimes), 4 (Often), and 5 (Always). Total practice scores were categorized as poor (< median) or good (≥ median). The median was used as the cut-off value because the knowledge, attitude, and practice scores were not normally distributed.

Content validity was evaluated by three experts for relevance and clarity. All items achieved an Item–Objective Congruence (IOC) value of ≥ 0.50. To assess reliability, the questionnaire was pretested among 37 nurses from healthcare centers not included in the study. Internal consistency, assessed using Cronbach's alpha, was 0.535 for knowledge, 0.751 for attitude, and 0.712 for practice. The relatively low reliability of the knowledge scale likely reflects the use of independent factual items and binary response options. Following the pilot study, the "Not sure" response option was added, and ambiguous or overly easy items were revised to improve response accuracy.

Data collection procedures

Data were collected after obtaining approval from Mahidol University – Central Institutional Review Board (MUCIRB) and Research Ethics Board of Health (REBH), Bhutan. After obtaining the necessary permissions, the online survey link was disseminated. The survey link included the participation information sheet and informed consent. Only participants who provided consent were directed to the questionnaire.

The survey link was distributed via email and messaging platforms (WeChat, WhatsApp, Messenger, and Telegram) within nurse groups. Data collection was monitored to achieve the required sample size across healthcare center levels. Although the calculated sample size was 356, a total of 357 responses were received and included in the final analysis.

Statistical analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 31. Data were cleaned, coded, checked, and verified for completeness, consistency, and accuracy. Descriptive analysis was used to summarize the socio-demographic characteristics. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using medians and interquartile ranges.

Associations were examined using Chi-square tests. Bivariate analysis to test the predictive effect of each independent variable on the dependent variable was conducted. Variables with P-value < 0.25 were included in Multiple Logistic Regression Analysis to identify independent factors of good practice. Multicollinearity was assessed using Spearman correlation. Adjusted odds ratios (AORs) with 95% confidence intervals were reported, with statistical significance set at $p<0.05$.

RESULTS

Characteristics of the respondents

Table 2 summarizes the respondents' socio-demographic characteristics. Most respondents were aged 30–39 years (41.2%), female (56.0%), held a diploma (63.6%), had 1–10 years of experience (63.0%), and worked at referral hospitals (55.5%).

Table 2 Socio-demographic characteristics (n=357)

Variable	Classification	Frequency (n)	Percentage (%)
Age			
	20-29 years	135	37.8
	30-39 years	147	41.2
	40-49 years	63	17.6
	50+ years	12	3.4
	Median=33, IQR=12, Min=20, Max=59		
Gender			
	Female	200	56.0
	Male	157	44.0

Variable	Classification	Frequency (n)	Percentage (%)
Highest Level of Education			
	Certificate	38	10.6
	Diploma	227	63.6
	Bachelor	87	24.4
	≥ Master's	5	1.4
Years of experience			
	1-10 years	225	63
	11-20 years	95	26.6
	21-30 years	37	10.4
	Median=7, IQR=11, Min=1, Max=30		
Level of healthcare facility			
	PHC	3	0.8
	10 bedded	42	11.8
	20 bedded	37	10.4
	40 bedded	49	13.7
	60 bedded	28	7.8
	Referral	198	55.5

Knowledge on SF medical products

The proportion of respondents with a good level of knowledge was 50.4%. Figure 2 shows the correct response percentages for knowledge statements. Knowledge was high regarding the definitions of substandard (82.6%) and falsified (67.2%) products, health impacts (84.9%), product identification (84.9%), healthcare professionals' reporting responsibilities (82.4%), and the Bhutan Food and Drug Authority's (BFDA) regulatory role (82.6%). However, awareness of reported SF medical product cases in Bhutan was moderate (50.7%). Knowledge of reporting systems (57.4%), procedures (63.0%), and reporting forms (50.4%) was limited, with the lowest correct response for reporting form submission requirements (31.4%), indicating gaps in regulatory and reporting knowledge.

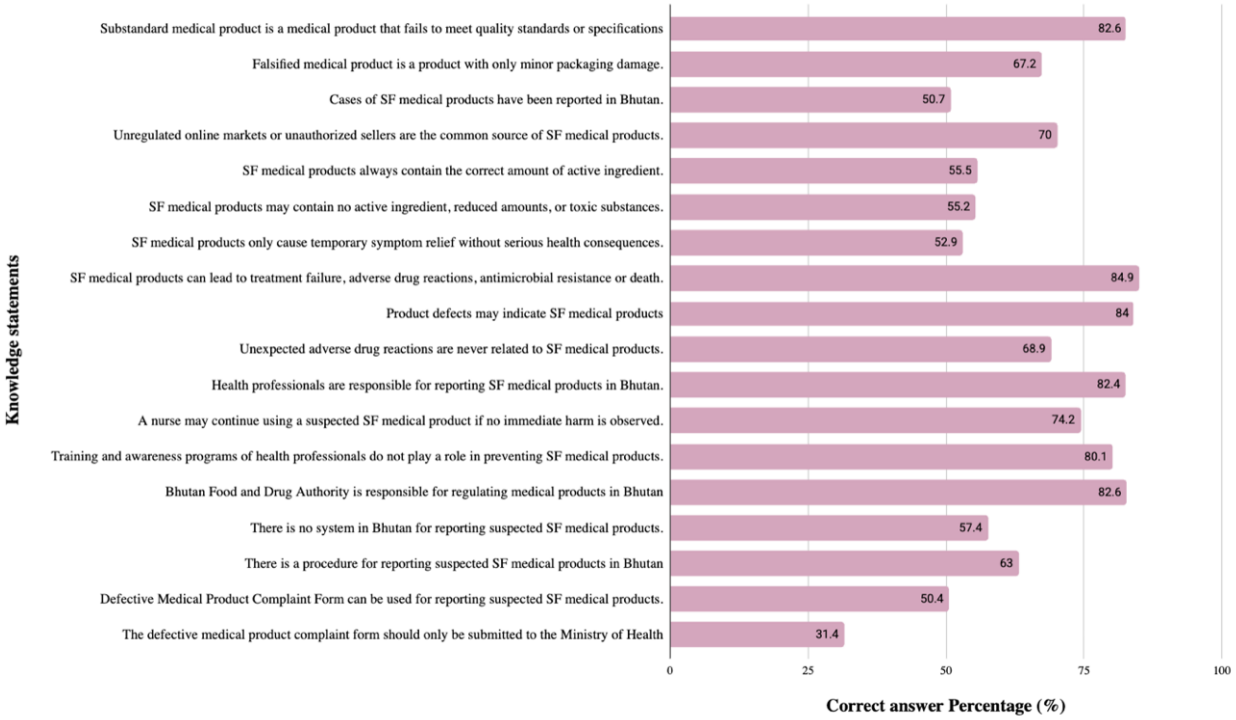

Figure 2 Correct response percentages for knowledge statements

Attitudes toward SF medical products

Overall, 54.3% of respondents demonstrated positive attitudes toward SF medical products, while 45.7% had negative attitudes. Figure 3 presents respondents' attitudes. 84.9% of respondents recognized SF medical products as a global public health concern. 75% rejected the statement that SF medical products are not a concern in Bhutan. Respondents acknowledged the impacts of SF medical products and considered their use unethical. The majority agreed that nurses have a professional responsibility towards SF medical products. Strong support was expressed for regulatory enforcement and training. However, uncertainty remained regarding regulatory responsibilities and reporting burden, particularly the BFDA's role and the perceived workload associated with reporting.

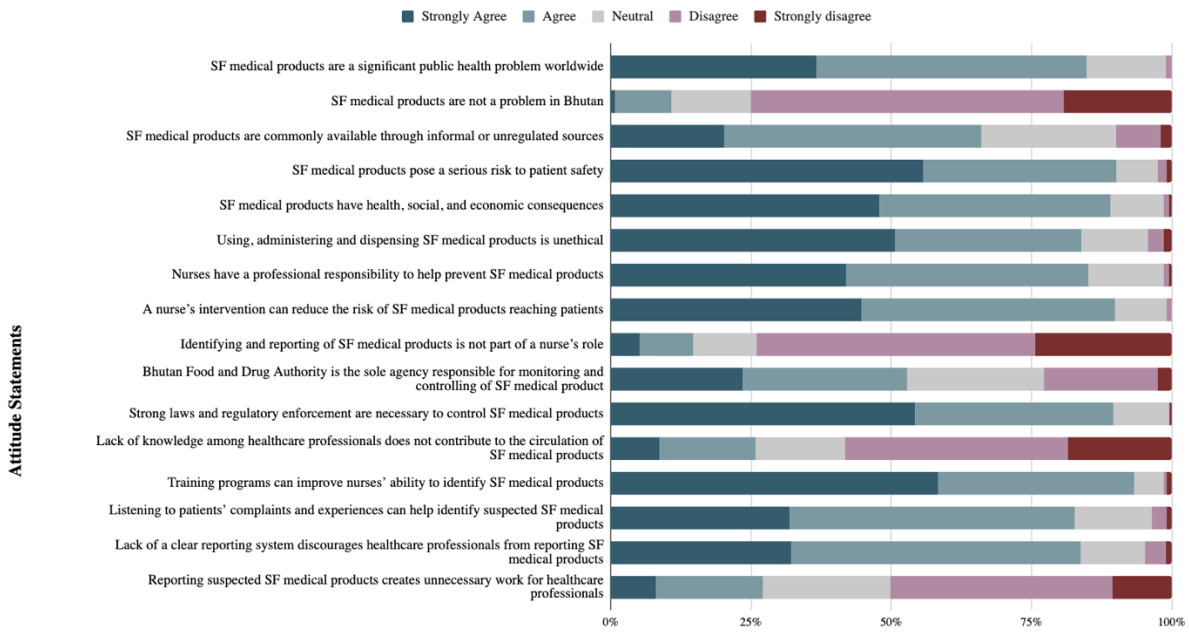

Figure 3 Respondents' level of attitudes towards SF medical products.

Practices toward SF medical products

The proportion of respondents with good practice was 54.1%. Figure 4 presents respondents' practice levels. More than half of the respondents always checked product packaging and labeling (52.4%), assessed for unusual appearance (59.1%), and avoided using suspected SF medical products (54.9%). Patient education practices were also common, with 63.3% always or often advising patients against purchasing products from unlicensed sources. However, reporting practices were limited, with only 52.1% always or often informing relevant authorities upon encountering SF medical products. Furthermore, 66.9% had rarely or never used the defective medical product complaint form and 71.7% had never received training on SF medical products.

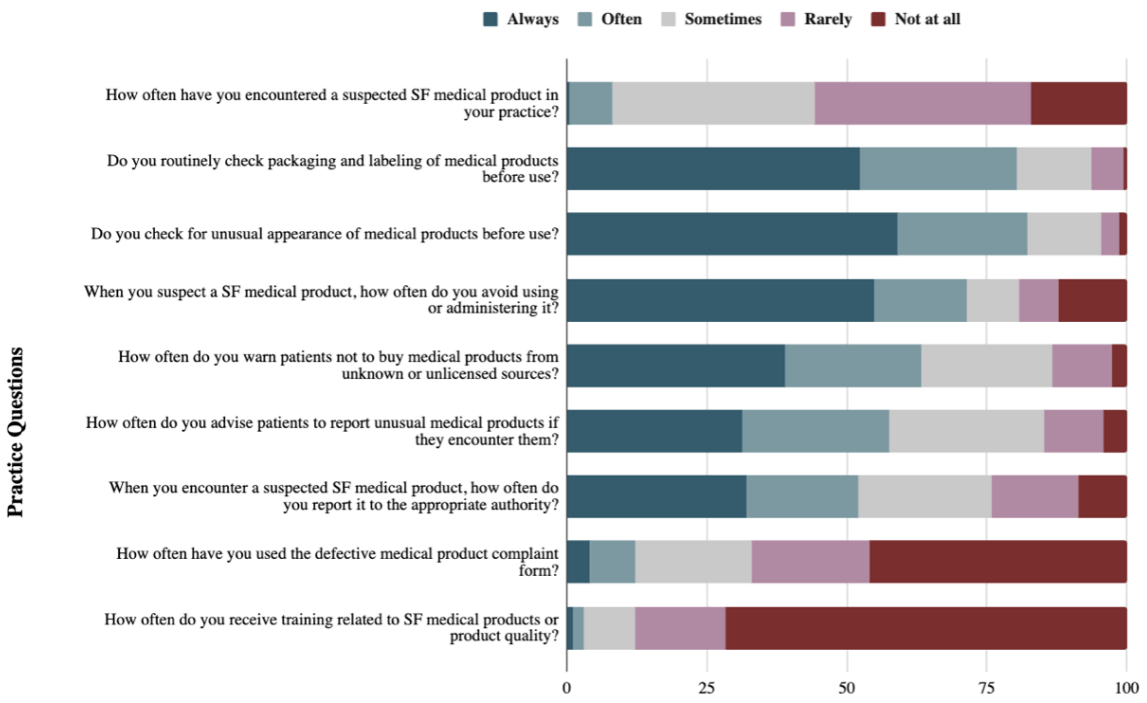

Figure 4 Respondents' level of practices towards SF medical products.

Association between independent variables and practice towards SF medical products.

Table 3 presents the Chi-square analysis of factors associated with practices toward SF medical products. Good knowledge and positive attitudes were significantly associated with good practices. Respondents with good knowledge were more likely to demonstrate good practices than those with poor knowledge (62.8% vs. 45.2%, p<0.001). Similarly, positive attitudes were associated with better practices (60.8% vs. 45.7%, p=0.005).

Table 3 Chi-square analysis of factors associated with practices toward SF medical products (n=357)

Variables	Level of Practice		$\chi 2$	p-value (by Chi-square test)
	Poor n (%)	Good n (%)		
Age Group			2.208	0.530
20-29 years	64 (47.4)	71 (52.6%)		
30-39 years	71 (48.3)	76 (51.7)		
40-49 years	25 (39.7)	38 (60.3)		
50 + years	4 (33.3)	8 (66.7)		
Gender			3.607	0.058
Female	83 (41.5)	117 (58.5)		
Male	81 (51.6)	76 (48.4)		
Education Level			0.258	0.879
Certificate	16 (42.1)	22 (57.9)		
Diploma	105 (46.3)	122 (53.7)		
≥ Bachelor's	43 (46.7)	49 (53.3)		

Variables	Level of Practice		$\chi 2$	p-value (by Chi-square test)
	Poor n (%)	Good n (%)		
Years of Experience			5.630	0.060
1-10 years	103 (45.8)	122 (54.2)		
11-20 years	50 (52.6)	45 (47.4)		
21-30 years	11 (29.7)	26 (70.3)		
Healthcare facility level			1.997	0.736
≤ 10 bedded	20 (44.4)	25 (55.6)		
20 bedded	15 (40.5)	20 (59.5)		
40 bedded	26 (53.1)	23 (46.9)		
60 bedded	11 (39.3)	17 (60.7)		
Referral	92 (46.5)	107 (53.5)		
Knowledge Level			11.106	*<0.001**
Poor	97 (54.8)	80 (45.2)		
Good	67 (37.2)	113 (62.8)		
Attitude Level			7.825	*0.005**
Negative	88 (54.0)	75 (46.0)		
Positive	76 (39.2)	118 (60.8)		

**Variables that show significant association (P<0.05)*

Factors associated with practices towards SF medical products

Bivariate analysis identified four variables (gender, years of experience, knowledge level, and attitude level) associated with good practices toward SF medical products (p<0.25). Spearman's correlation test was performed. It showed weak correlations among these variables (r_s = −0.054 to 0.373), indicating no evidence of multicollinearity. Multiple logistic regression using the Backward Likelihood Ratio (Backward: LR) identified years of experience, knowledge level, and attitude level as significant factors associated with good practice. Table 4 presents the results of the multiple logistic regression analysis. Respondents with 21–30 years of experience were more likely to demonstrate good practice than those with 11–20 years (AOR=2.860, 95% CI: 1.235-6.626, p=0.014). Good knowledge (AOR=1.684, 95% CI: 1.065–2.662, p=0.026) and positive attitudes (AOR=1.627, 95% CI: 1.023–2.589, p=0.040) were also significantly associated with good practice. Gender was excluded from the final model.

Table 4 Multiple logistic regression analysis for factors associated with good practice towards SF medical products (n=357)

Variable	Full Model AOR (95% CI)	p-value	Final Model AOR (95% CI)	p-value
Gender (Ref: Male)				
Female	1.429 (0.912-2.239)	0.119		
Years of Experience (Ref: 11-20 years)				
1-10 years	1.231 (0.745-2.034)	0.417	1.337 (0.819-2.184)	0.246
21-30 years	2.439 (1.028-5.787)	0.043*	2.860 (1.236-6.626)	0.014*
Knowledge level (Ref: Poor knowledge)				
Good knowledge	1.740 (1.096-2.763)	0.019*	1.684 (1.065-2.662)	0.026*

Variable	Full Model AOR (95% CI)	p-value	Final Model AOR (95% CI)	p-value
Attitude Level (Ref: Negative attitude)				
Positive Attitude	1.611 (1.010-2.568)	0.045*	1.627 (1.023-2.589)	0.040*

Nagelkerke R Square =0.074; Hosmer and Lemeshow test chi-square = 4.358 (df = 7, p-value = 0.738); Omnibus test chi-square 20.418 (df = 4, p-value <0.001)
**Variables that show significant association (P<0.05),*
AOR (Adjusted odds ratio),

DISCUSSIONS

This study found that 54.1% of the respondents demonstrated good practice toward SF medical products. Although this proportion was higher than those reported in Bahir Dar City (46.3%) and Gondar City (35.29%), Ethiopia (13, 22), nearly half of nurses may still not consistently engage in optimal practices. Respondents in the present study reported relatively good preventive practices, such as checking packaging, labeling, and product appearance before use and educating patients on SF medical products. These practices likely reflect nurses' routine responsibilities in medical product management, particularly in Bhutan where nurses often assume additional responsibilities in facilities with limited pharmacy personnel. Similar preventive practices have been reported in India (20), Indonesia (27), Egypt (28), and Sweden (21), suggesting that frontline healthcare professionals generally recognize the importance of preventing SF medical products from reaching patients.

Despite good preventive practices, reporting of suspected SF medical products was limited, with the majority of respondents rarely or never having used the complaint form. Similar underreporting was reported in Jordan, Egypt and Saudi Arabia (12, 28, 29). Furthermore, 71.7% of respondents in the present study had never received training on SF medical products, a finding comparable to Ethiopia (13). In Bhutan, these findings may reflect limited familiarity with reporting procedures rather than the inability to recognize suspected SF medical products. These highlight the need to strengthen reporting mechanisms, increase training, and improve awareness of reporting procedures to enhance surveillance and control of SF medical products.

Knowledge on SF medical products was moderate (50.4%), lower than that reported in Nigeria (70%) (30) but higher than findings from Ethiopia (18.24%) (13). While knowledge of definitions, impacts, sources, and professional responsibilities was generally good, awareness of reporting systems and procedures was limited. This may reflect the fact that nurses have fewer opportunities to participate in pharmacovigilance activities or receive regulatory training. Similar gaps have been reported in Indonesia, India and Ethiopia (20, 22, 27), highlighting the importance of integrating pharmacovigilance and reporting procedures into nursing education and continuing professional development programs.

Slightly more than half of respondents (54.3%) demonstrated positive attitudes toward SF medical products, comparable to studies in Ethiopia (Gondar City – 50%, Bahir Dar City - 54.9%) but lower than in Nepal - 85.3% (13, 22, 31). Most recognized SF medical products as an important public health concern and supported stronger regulatory measures and training initiatives. However, uncertainty regarding stakeholder responsibilities and reporting obligations persisted, which may have contributed to the limited reporting practices observed. Clarifying the roles of healthcare professionals and regulatory authorities, together with regular awareness programmes, could foster a stronger culture of shared responsibility for medicine safety in Bhutan.

The analytical findings supported that respondents with greater experience, good knowledge, and positive attitudes were more likely to demonstrate good practices. Comparable findings regarding years of experience were reported in studies conducted in India, Ethiopia and Nigeria (13, 20, 22, 32). More

experienced nurses may have greater exposure to medical product management and institutional reporting processes, enabling them to identify and respond to suspected SF medical products. Likewise, nurses with better knowledge and positive attitudes are more likely to adopt appropriate preventive and reporting practices. These findings further highlight the importance of strengthening pre-service education, continuing professional development and pharmacovigilance training to enhance capacity to detect, report and prevent SF medical products.

CONCLUSION

This study assessed the knowledge, attitudes, and practices toward SF medical products among 357 nursing professionals in Bhutan. It aimed to identify gaps in their preparedness to detect, report, and prevent SF medical products.

Although respondents demonstrated moderate knowledge, attitudes, and practices toward SF medical products, important gaps remained in regulatory knowledge, reporting systems, and reporting practices. These findings highlight the need for strengthened training, increased awareness, and integration of pharmacovigilance and SF medical product-related content into nursing education and continuing professional development to improve detection, reporting, and surveillance in Bhutan.

RECOMMENDATIONS

The findings identified gaps in reporting practices, training, and awareness of the reporting system for SF medical products. Strengthening training and awareness programmes could improve healthcare professionals' knowledge, vigilance, and reporting practices. As many respondents had never used the reporting form, the reporting system could be simplified and made more accessible through enhanced dissemination of reporting procedures and digital reporting platforms. Additionally, monitoring and post-market surveillance activities could be reinforced through stronger regulatory implementation, stakeholder collaboration and timely dissemination of safety information. Future studies could include other healthcare professionals and use qualitative or longitudinal designs to explore reporting barriers and evaluate intervention effectiveness.

ETHICAL DECLARATION

Ethical approval was obtained from MUCIRB (Protocol No. MU-CIRB 2026/058.0902) and REBH, Bhutan (Approval No. PO/RL/2026.28.NNW) on 17 March 2026. Permission and clearance from the respective Heads/Chief Medical Officers/In-charges were sought prior to the dissemination of the survey questionnaire link. Consent to participate in the survey was obtained from participants prior to participation.

LIMITATIONS

This study was based on self-administered questionnaires and may be subject to recall and social desirability biases. Voluntary participation may have introduced voluntary response bias, as participants may have differed from non-participants in their knowledge or experience. Low internal consistency of the knowledge scale may have reduced measurement precision. As a cross-sectional study, causal relationships cannot be inferred, and the findings may not be generalizable beyond nursing professionals in Bhutan.

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Track II

Environmental, Occupational Health, Injury and Disaster Resilience

AMBIENT $PM_{2.5}$ AND AGE-APPROPRIATE EARLY CHILDHOOD DEVELOPMENT IN THAILAND: A NATIONWIDE SPATIALLY AGGREGATED ECOLOGICAL PANEL STUDY, 2022–2025

Yu Myat Nandar[1], Pallop Siewchaisakul[1], Warangkana Naksen[1]*

[1]Faculty of Public Health, Chiang Mai University, Chiang Mai, Thailand

***Corresponding author**: Warangkana Naksen, Faculty of Public Health, Chiang Mai University, Chiang Mai, Thailand, Email: warangkana.n@cmu.ac.th*

ABSTRACT

Introduction: Early childhood is critical to foster physical, cognitive, and socio-emotional growth. Fine particulate matter ($PM_{2.5}$) negatively influences development through inflammatory responses, oxidative stress, and neurotoxicity. Although $PM_{2.5}$ is a significant public health issue in Thailand, little is known regarding its impact on children's development.

Objectives: To examine the association between $PM_{2.5}$ exposure and age-appropriate early childhood development and to assess whether these associations differ by exposure timing and developmental age.

Methodology: A longitudinal panel study of annual province-level observations was conducted across 76 provinces in Thailand (excluding Bangkok) from 2022 to 2025. Annual mean $PM_{2.5}$ concentrations were derived from MERRA-2 reanalysis and calibrated against ground-based measurements using a mixed-effects model (performance: R^2=0.66; RMSE=3.78 μg/m³). Developmental outcomes, the proportion of children achieving age-appropriate development at the first assessment at 9, 18, 30, 42, and 60 months, were obtained from the Department of Health. Associations between current-year, one-year lagged, and three-year average prior $PM_{2.5}$ exposure and developmental attainment were estimated using negative binomial mixed-effects models with province-level random intercepts, year fixed effects, antenatal coverage, temperature, and the log number of eligible children as an offset.

Results: Mean annual $PM_{2.5}$ concentrations increased from 22.2 μg/m³ in 2022 to 24.2 μg/m³ in 2025. A 10 μg/m³ increase in $PM_{2.5}$ was significantly associated with lower developmental attainment rates for current-year exposure (IRR=0.939, p=0.031), one-year lagged exposure (IRR=0.940, p=0.028), and three-year average prior exposure (IRR=0.944, p=0.039). The greatest reduction in developmental attainment rate was at 18 months (IRR=0.926, p=0.007), followed by 9 months (IRR=0.932, p=0.014) and 30 months (IRR=0.937, p=0.020).

Conclusion: Higher $PM_{2.5}$ exposure was associated with lower developmental attainment rates in Thai children, particularly during infancy and toddlerhood. Reducing $PM_{2.5}$ exposure may support early childhood development. Residual confounding from unmeasured province-level factors cannot be excluded; longer-term studies with broader covariate adjustment are warranted.

Keywords:
PM2.5; Early Childhood Development; Developmental Attainment; Thailand

INTRODUCTION

Early childhood development encompasses physical, cognitive, language, and socio-emotional capacities acquired during the first five years of life. This period is characterized by rapid brain development (1). Synaptogenesis peaks from late gestation to age two, followed by myelination and synaptic pruning that support neurodevelopment (2). Disruption during these sensitive windows can produce long-term deficits in cognition, emotional regulation, and educational attainment (3, 4).

Ambient fine particulate matter ($PM_{2.5}$) is a major environmental threat to child neuro-development. Proposed mechanisms include neuroinflammation, oxidative stress, mitochondrial dysfunction, and altered neuronal signaling following particle translocation through olfactory and systemic pathways (5, 6). $PM_{2.5}$ carries toxic components including polycyclic aromatic hydrocarbons (PAHs), heavy metals, and endocrine disruptors that can impair neurodevelopment (7, 8).

Epidemiological studies consistently report associations between early-life $PM_{2.5}$ exposure and impaired neurodevelopment. Studies in China reported associations between early postnatal $PM_{2.5}$ exposure and delayed gross motor, fine motor, and problem-solving development at 12 and 24 months (9, 10), while a systematic review linked early-life exposure to $PM_{2.5}$, NO_2, and PAHs with poor cognition, attention, and executive function (11).

Thailand presents a compelling context for investigating these relationships. Nationally, the February–April haze season accounts for 46% of the annual $PM_{2.5}$-related health burden in Mainland Thailand (66% in northern Thailand), while $PM_{2.5}$ concentrations increased by approximately 0.1 μg/m³ annually from 2002 to 2021 (12). In northern Thailand, annual mean $PM_{2.5}$ concentrations ranged from 10.8 to 25.7 μg/m³ during 2016–2018, with the 24-hour standard exceeded on 70 days during January–March (13). These recurrent pollution episodes may pose important risks to child health and neurodevelopment.

Thailand's national developmental surveillance system, the Developmental Surveillance and Promotion Manual (DSPM), assesses children at 9, 18, 30, 42, and 60 months at Health Promoting Hospitals (14, 15). The system facilitates early identification of developmental problems and timely intervention. However, according to the report of the Ministry of Public Health, approximately 27–30% of young children exhibit developmental delay (DD), with considerable provincial variation (16). Despite the coexistence of elevated $PM_{2.5}$ exposure and a high burden of developmental delay, population-based studies in Thailand are limited, and national evidence remains lacking.

Routine developmental screening provides an opportunity to examine $PM_{2.5}$–development associations using ecologically valid, policy-relevant outcomes at the provincial level. This study aimed to estimate the association between ambient $PM_{2.5}$ exposure and age-appropriate developmental achievement, assess robustness using current-year, lagged, and cumulative exposure models, and evaluate heterogeneity across developmental ages from 9 to 60 months.

METHODOLOGY

Study Design

This study employed a nationwide province-level longitudinal panel design examining the association between ambient $PM_{2.5}$ and age-appropriate early childhood development across 76 Thai provinces (excluding Bangkok) from 2022 to 2025. The unit of analysis was the province-year observation. The panel was unbalanced in 2022, with 54 provinces providing data; full provincial coverage was achieved from 2023 to 2025. Province-year observations with missing exposure or outcome data were excluded from regression analyses using complete-case analysis.

Outcome Measure

The primary outcome was the number of children achieving age-appropriate developmental status at first assessment at 9, 18, 30, 42, and 60 months, obtained from the Department of Health (DOH) provincial dashboard. The proportion achieving age-appropriate development was used for descriptive summaries, while the number achieving development was modeled as the regression outcome, with the log of the total number assessed included as an offset. A composite outcome across all age groups was used for the primary analysis, with age-stratified analyses conducted across developmental stages.

$PM_{2.5}$ Exposure Assessment and Calibration

MERRA-2 was selected for its spatially continuous and temporally consistent aerosol

estimates, particularly in areas with limited ground-monitoring coverage. Compared with MODIS and VIIRS satellite AOD products, MERRA-2 had approximately 3 and 7 times more matchups, respectively, and showed better overall accuracy in Southeast Asia (17). In Thailand, MERRA-2-derived $PM_{2.5}$ was validated against 51 monitoring stations, showing strong agreement with daily mean $PM_{2.5}$ (r=0.98; RMSE=3.14 μg/m³) after bias correction (18). These characteristics supported its use for consistent province-level exposure estimation across the study period.

Given known systematic biases relative to ground-level measurements, calibration was performed using Pollution Control Department (PCD) ground-based observations over 2019–2025 via a linear mixed-effects model:

$$PM_{pt}^{PCD} = \beta_0 + \beta_1 PM_{pt}^{MERRA2} + \beta_2 \left(PM_{pt}^{MERRA2}\right)^2 + \beta_3 t + u_p + \epsilon_{pt}$$

PM_{pt}^{PCD} denote observed ground-level concentrations for province *p* in year *t*, PM_{pt}^{MERRA2} denote the raw MERRA-2 $PM_{2.5}$ estimate. A quadratic term was included to address non-linear bias at higher pollution levels, improving model fit over a linear specification (AIC: 2290.7 vs. 2335.2). The term u_p captured spatial heterogeneity; the random intercept model outperformed a fixed-effects alternative (AIC: 2232.0 vs. 2290.7), supported by an ICC of 0.413. The model was estimated using restricted maximum-likelihood (REML), with calibrated values applied to the full MERRA-2 dataset. Model performance indicated good agreement with observed data (r=0.81, R^2=0.66, RMSE=3.78 μg/m³).

For regression analyses, $PM_{2.5}$ was scaled per 10 μg/m³. Three exposure specifications were evaluated: contemporaneous (year *t*), one-year lagged (*t–1*), and three-year average prior exposure (*t–1 to t–3*). These windows were selected to represent recent, delayed, and sustained exposure, respectively, consistent with evidence that early postnatal periods are vulnerable to $PM_{2.5}$-related neurodevelopmental effects (11, 19, 20).

Covariates

Two time-varying covariates were included. ANC coverage — the proportion of pregnant women completing ≥5 antenatal visits — was obtained from the DOH provincial dashboard as a proxy for prenatal care access. Annual mean temperature from NASA POWER was matched to each $PM_{2.5}$ exposure period to account for meteorological confounding.

Statistical Analysis

The primary analysis used negative binomial mixed-effects models (NB2, log link) with province random intercepts and year fixed effects:

$$log\ log\ \{E(u_p)\} = log\ log\ (N_{pt}) + \beta_0 + \beta_1 PM_{pt} + \beta_2 Temp_{pt} + \beta_3 ANC_{pt} + \sum_t \gamma_t Year_t + u_p$$

where Y_{pt} is the number of children with age-appropriate development in province p and year t, N_{pt} is the number of eligible children included as an offset, PM_{pt} is $PM_{2.5}$ scaled per 10 μg/m³, $Temp_{pt}$ is annual mean temperature, ANC_{pt} denotes ANC coverage, γ_t captures year fixed effects, and u_p is the province-level random intercept. $PM_{2.5}$ and temperature were matched in exposure timing across three exposure windows: current-year, one-year lagged, and prior 3-year mean. Model diagnostics were performed using DHARMa to assess dispersion, zero inflation, and outliers. All analyses were conducted in R.

RESULTS

Sample Characteristics and Descriptive Statistics

The analytical dataset comprised 277 province-year observations after excluding three observations with missing $PM_{2.5}$ data (1.06%). Descriptive statistics are presented in Table 1.

Table 1 Annual descriptive statistics of $PM_{2.5}$ exposure and developmental attainment across 76 Thai provinces, 2022–2025.

Year	province n	Annual $PM_{2.5}$ (μg/m³)	Overall developmental attainment (%)	9-month (%)	18-month (%)	30-month (%)	42-month (%)	60-month (%)
2022	54	22.18 ± 4.71	69.36 ± 19.92	73.03 ± 30.25	64.62 ± 34.01	71.03 ± 30.93	62.85 ± 35.46	71.30 ± 32.75
2023	76	23.48 ± 4.60	76.75 ± 5.00	77.91 ± 5.58	74.13 ± 5.71	75.44 ± 5.77	75.60 ± 5.45	80.13 ± 4.87
2024	76	24.70 ± 4.50	78.29 ± 4.16	79.47 ± 5.03	75.24 ± 4.72	76.62 ± 4.64	77.36 ± 4.63	81.98 ± 4.07
2025	76	24.22 ± 4.59	80.17 ± 4.53	81.32 ± 5.43	77.03 ± 5.08	78.58 ± 4.86	79.35 ± 4.80	83.75 ± 4.21

Note: Values are mean ± SD, where the mean represents the average across provinces and the SD indicates between-province variation. Provinces (n)=number of provinces contributing data in each year. Overall and age-specific (%) values are percentages of assessed children meeting age-appropriate developmental criteria.

Mean annual $PM_{2.5}$ increased from 22.18 ± 4.71 μg/m³ in 2022 to 24.22 ± 4.59 μg/m³ in 2025, remaining above the WHO annual guideline of 5 μg/m³. Overall developmental attainment percent increased from 69.36 ± 19.92% to 80.17 ± 4.53%. Age-specific attainment also generally increased over time, ranging from 77.03% at 18 months to 83.75% at 60 months in 2025.

Primary Analysis: $PM_{2.5}$ and Overall Developmental Attainment

Results from negative binomial mixed-effects models across all three exposure specifications, adjusting for temperature, ANC coverage, and year, with province random intercepts, were presented in Table 2.

A 10 μg/m³ increase in current-year $PM_{2.5}$ was significantly associated with a 6.1% lower developmental attainment rate (IRR=0.939, p=0.031). Similar inverse associations were observed for one-year lagged $PM_{2.5}$ (IRR=0.940, p=0.028) and prior 3-year mean exposure (IRR=0.944, p=0.039), corresponding to approximately 6.0% and 5.6% lower developmental attainment rates, respectively. Model diagnostics indicated no evidence of overdispersion (dispersion ratios = 1.18–1.27, all p > 0.20), zero inflation (all p > 0.19), or outliers (all p ≥ 0.30).

Table 2 Association between $PM_{2.5}$ exposure and overall age-appropriate early childhood development: negative binomial mixed-effects models, 76 Thai provinces, 2022–2025.

Exposure specification	IRR	95% CI	p-value	N
Current-year $PM_{2.5}$	0.939	0.887–0.994	0.031*	277
One-year lagged $PM_{2.5}$	0.940	0.890–0.993	0.028*	277
Three-year average prior $PM_{2.5}$	0.944	0.893–0.997	0.039*	277

*Note: IRR represents the relative change in the developmental attainment rate per 10 μg/m³ increase in $PM_{2.5}$; an IRR below 1 indicates an inverse association, meaning that higher $PM_{2.5}$ was associated with lower developmental attainment. All models included a province-level random intercept and year fixed effects and adjusted for ANC coverage and annual mean temperature. The log of the number of eligible children was included as an offset. $PM_{2.5}$ was scaled per 10 μg/m³. N=province-year observations. *p<0.05.*

Age-Stratified Analysis

Age-stratified associations for current-year $PM_{2.5}$ were presented in Table 3. Significant inverse associations were observed at 9, 18, and 30 months. A 10 μg/m³ increase in $PM_{2.5}$ was associated with a 6.8% lower developmental attainment rate at 9 months (IRR=0.932, p=0.014), 7.4% lower at 18 months (IRR=0.926, p=0.007), and 6.3% lower at 30 months (IRR=0.937, p=0.020). The strongest association was observed at 18 months.

Associations at 42 months (5.9% lower; IRR=0.941, 95% CI: 0.881–1.005; p=0.069) and 60 months (4.2% lower; IRR=0.958, 95% CI: 0.896–1.024; p=0.206) were also inverse but were weaker and not significant.

Table 3 Age-stratified association between current-year $PM_{2.5}$ and age-appropriate development

Age group	IRR	95% CI	p-value
9 months	0.932	0.881–0.986	0.014*
18 months	0.926	0.876–0.979	0.007*
30 months	0.937	0.887–0.990	0.020*
42 months	0.941	0.881–1.005	0.069
60 months	0.958	0.896–1.024	0.206

*Note: IRR per 10 μg/m³ increase in current-year $PM_{2.5}$. *p<0.05.*

DISCUSSION

This study provides novel evidence that higher ambient $PM_{2.5}$ is associated with lower rates of children reaching age-appropriate developmental milestones across provinces in Thailand. Across all three exposure definitions, a 10 μg/m³ increase in $PM_{2.5}$ was associated with approximately 5.6–6.1% lower developmental attainment rates. Age-specific results revealed the strongest and most consistent associations in infancy and early toddlerhood (9–30 months).

The similarity of effect estimates across concurrent and lagged exposure windows might suggest that the observed association reflects cumulative sustained exposure rather than a transient response to acute pollution. This is biologically plausible as neurodevelopmental trajectories in early childhood are shaped by prolonged environmental influences, and the window from conception through the first three years encompasses particularly sensitive periods for synaptic pruning, myelination, and cortical development (1, 2). In vitro studies demonstrate that $PM_{2.5}$ induces oxidative stress and mitochondrial damage, leading to cell injury, altered synaptic plasticity, and potential disruption of developing neural circuits (21).

The age-stratified findings are consistent with the biological primacy of early developmental windows. The largest point estimates at 9 and 18 months correspond to a period of intensive brain growth and the emergence of language, social cognition, and motor milestones in which domains are particularly sensitive to environmental neurotoxicants (5). Prior cohort studies support this pattern: $PM_{2.5}$ exposure was negatively associated with motor, problem-solving, and social scores at 12 months in Shanghai (9), and a 5 μg/m³ increase in early postnatal $PM_{2.5}$ was associated with higher risk of motor and problem-solving delays in Shenzhen (10). The weaker associations at 42 and 60 months may reflect developmental catch-up and the growing influence of social and educational factors that attenuate the detectable impact of early pollution exposure. Although comparisons across studies are limited due to differences in design, exposure measurement, and outcomes, these findings are further supported by a multi-country study across 12 low- and middle-income countries linking higher $PM_{2.5}$ to increased cognitive delay risk in preschool children (20).

CONCLUSION

Higher $PM_{2.5}$ levels were associated with lower rates of children reaching age-appropriate developmental milestones among children in Thailand. Associations were consistent across contemporaneous and lagged exposure specifications and were most pronounced during infancy and early toddlerhood. Although the ecological study design and residual confounding cannot be ruled out, the consistent

findings support the importance of reducing ambient $PM_{2.5}$ exposure as part of policies promoting early childhood health and development.

RECOMMENDATIONS

Future studies should use longer follow-up periods and individual-level data to better assess $PM_{2.5}$–development associations. Particular attention to exposure timing (prenatal, perinatal, early postnatal windows) would strengthen mechanistic inference. Finer spatial analyses at district or community level, and assessment of $PM_{2.5}$ components related to biomass burning, may further clarify underlying mechanisms. From a policy perspective, integrating air quality information into developmental surveillance systems could support targeted monitoring and early intervention in high-exposure areas.

ETHICAL DECLARATION

This study used publicly available, aggregated provincial-level data without individual identifiers. The study was reviewed and approved by the Institutional Review Board of the Faculty of Public Health, Chiang Mai University (IRB No. ET036/2025).

LIMITATIONS AND STRENGTHS

Several limitations should be acknowledged. First, ecological design limits individual-level inference. Models adjusted for annual mean temperature and antenatal coverage and included year fixed effects and province-level random intercepts; however, key time-varying factors such as income, urbanization, maternal education, and early childhood services could not be fully adjusted for, and residual confounding may persist. In addition, developmental outcomes were based on the DSPM pass/fail screening tool rather than continuous scores or clinical diagnoses. Variations in DSPM coverage and implementation may have introduced measurement error or selection bias (15). Finally, the use of annual province-level $PM_{2.5}$ averages may underestimate the concentrations to which children are exposed, particularly in high-pollution areas such as Chiang Mai and other northern provinces and areas around Bangkok. This may have attenuated the observed associations.

Despite these limitations, this study has several strengths. It is the first nationwide study to examine $PM_{2.5}$ and early childhood development in Thailand using routinely collected administrative data with broad provincial coverage over four years. The DSPM, developed for the Thai healthcare context, is suitable for population-level developmental surveillance due to its high sensitivity and moderate specificity. Calibration of MERRA-2 estimates against ground-based monitoring improved exposure validity. Consistent associations across exposure windows, adjustment for temperature and temporal trends, and province-level random intercepts strengthen the robustness of the results.

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ATTITUDE TOWARDS ROAD CROSSINGS, PEERS' INFLUENCE, AND PERCEIVED SEVERITY OF UNSAFE PEDESTRIAN BEHAVIOR AMONG SECONDARY SCHOOL STUDENTS

Janista Jue-chan[1,*], Warinrumpai Kungsadarn[1], Phurita Surakulkawin[1], Manassanan khamkhong[1], Nethijchakan Mathaphun[1], Thanaporn Janesupasaeree[1], Chotika Thavornkasem[1], and Chayawat Siripantasak[1]

[1] Srinakharinwirot University Prasarnmit Demonstration School (secondary), 176 Soi Sukhumvit 23, Khlong Toei Nuea, Watthana, Bangkok 10110

***Corresponding author**: Janista Jue-chan, Srinakharinwirot University Demonstration School Prasarnmit (Secondary), Bangkok, Thailand, Email: jpblue423@gmail.com*

ABSTRACT

Introduction: Inappropriate pedestrian behavior among secondary school students is an important public health issue, as it may lead to an increased rate of road traffic accidents at the population level. Studying factors related to unsafe pedestrian behavior may therefore contribute to appropriate strategies for preventing risky behaviors.

Objectives: This cross-sectional study aimed to: 1) describe attitudes toward road crossing, peer influence, perceived severity, and unsafe pedestrian behavior, 2) examine the relationships between attitudes toward road crossing, peer influence, and perceived severity with unsafe pedestrian behavior, and 3) analyze their influences on unsafe pedestrian behavior.

Methodology: The sample consisted of 109 students aged 13–18 years enrolled in secondary schools in Thailand. Data was collected in early April 2026. The minimum required sample size was 82, calculated using the Soper (f^2 = 0.22, α = .05, power = .95, three predictors). Research instruments included measures of attitudes toward road crossing, peer influence, perceived severity, and unsafe pedestrian behavior, with omega coefficients ranging from .46 to .86 and evidence of construct validity. Data were analyzed using descriptive statistics, Pearson's correlation, and multiple regression analysis. Statistical significance was set at .05

Results: 1) Means of attitudes toward road crossing, peer influence, perceived severity, and unsafe pedestrian behavior were 3.12, 2.88, 3.81, and 1.95, respectively. 2) Attitudes toward road crossing were significantly negatively correlated with unsafe pedestrian behavior, while peer influence was significantly positively correlated with unsafe pedestrian behavior, perceived severity was negatively correlated with unsafe behavior but not statistically significant. 3) Attitudes toward road crossing, peer influence, and perceived severity together explained 43% of the variance in unsafe pedestrian behavior, with statistical significance. Attitudes toward road crossing had a significant negative influence on unsafe pedestrian behavior, while peer influence had a significant positive influence. Perceived severity had a negative but insignificant influence.

Conclusion: Attitudes toward road crossing and peer influence were significant predictors of unsafe pedestrian behavior among secondary school students. Therefore, schools and relevant organizations should promote road safety education and develop school-based activities, particularly group-based, to increase positive attitudes toward road crossing and encourage positive peer influence. From a public health perspective, promoting safe pedestrian behavior may help prevent road traffic injuries and reduce injury-related morbidity among adolescents. Furthermore, since perceived severity did not significantly influence unsafe pedestrian behavior, future studies may use qualitative research methods to gain a deeper understanding of the factors underlying adolescents' pedestrian behavior.

Keywords:
Attitudes Toward Road Crossing; Peer Influence; Perceived Severity; Unsafe Pedestrian Behavior

INTRODUCTION

Road traffic accidents are a major public health problem in Thailand. They have significant impacts on people's lives, health, and property, particularly among children and adolescents. Unsafe pedestrian behaviors, such as crossing roads at undesignated locations, failing to use pedestrian crossings, and using phones while crossing the street, all increase the risk of road traffic accidents. Secondary school students are in adolescence, a developmental stage characterized by physical, emotional, and social changes that may contribute to risky behaviors and a lack of caution when using roads. As adolescents' pedestrian behaviors are influenced by multiple factors, understanding these factors may help understand the causes of unsafe pedestrian behaviors and contribute to the development of effective strategies for preventing road traffic accidents (1, 2).

Previous studies have reported road safety concerns and pedestrian injuries in Thailand. In 2016, 28,537 road accident cases were reported in Bangkok, accounting for approximately 10% of all road accidents in Thailand (3). Their study examined pedestrian crash zones around primary and secondary schools in Bangkok and found that pedestrian crashes were concentrated in several school areas, particularly in areas with high traffic volume and around major intersections. In addition, an analysis of pedestrian road traffic injury cases in Thailand from 2012 to 2021 identified 1,820 cases, of which 1,728 had complete data for analysis (4). Among these cases, 60.76% involved fatal injuries and 39.24% involved non-fatal injuries. These findings show that pedestrian-related road accidents are an important safety concern in Thailand and support the need to investigate unsafe pedestrian behavior among secondary school students.

Pedestrian behavior refers to the responses or actions of individuals who travel on foot. Pedestrians are road users who neither drive nor ride in vehicles but instead move using their own physical effort or with the assistance of mobility devices, such as wheelchairs, bicycles, or other mobility aids (5, 6). Safe pedestrian behavior is essential for preventing road traffic injuries and promoting road safety, particularly among adolescents who frequently walk to and from school or other destinations. However, unsafe pedestrian behaviors remain common and substantially increase the risk of road traffic accidents. Therefore, promoting safe pedestrian behavior among adolescents should be regarded as an important public health and road safety priority.

To promote safe pedestrian behavior effectively, it is important to understand the factors that influence adolescents' unsafe pedestrian behavior. One factor that may influence unsafe pedestrian behavior is attitudes toward road crossing. This refers to an individual's evaluation, beliefs, and positive or negative feelings regarding crossing behavior, which in turn influence their intention and decision-making when crossing the road (7). Another factor that may influence unsafe pedestrian behavior is peer influence, which refers to the process by which individuals are affected by their friends or peer groups, leading to changes in their thoughts, attitudes, or behaviors in order to conform to their social group. Such influence may occur either directly or indirectly and can have both positive and negative effects (8). Peer influence also affects adolescents' behaviors through imitation, social learning, and the desire for peer acceptance, including risk-taking behaviors (9).

In addition, perceived severity, or an individual's belief regarding the seriousness of the consequences that may result from a disease, event, or behavior (10), may also influence unsafe pedestrian behavior. Individuals evaluate the extent to which the outcomes of engaging in risky behaviors are considered severe (11, 12). Although it is an important factor influencing health-related behaviors, perceived severity alone may not be sufficient to produce behavioral change without a cue to action that motivates individuals to act (11).

Previous studies have identified attitudes toward road crossing, peer influence, and

perceived severity of road traffic accidents as important factors associated with adolescents' unsafe pedestrian behavior (13-15). However, research examining these factors among secondary school students remains limited, particularly within the context of Thai schools and their social environments. This lack of evidence represents an important gap in the literature, highlighting the need for further research to better understand the factors influencing unsafe pedestrian behavior among secondary school students.

Therefore, this study aims to (A) describe attitudes toward road crossing, peer influence, perceived severity behavior, and unsafe pedestrian behavior; (B) examine the relationships between attitudes toward road crossing, peer influence, and perceived severity behavior with unsafe pedestrian behavior; and (C) analyze their influences on unsafe pedestrian behavior among secondary school students. The findings are expected to provide valuable information for planning road safety promotion programs, preventing risky pedestrian behaviors, and developing effective public health interventions to reduce the burden of road traffic injuries among young people.

Conceptual framework

According to the relationships between unsafe pedestrian behavior with attitudes toward road crossing, peer influence, and perceived severity, the conceptual framework could be illustrated in Figure 1.

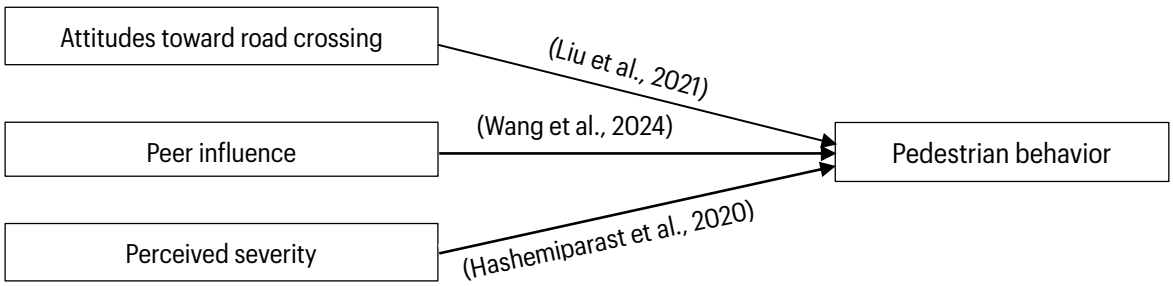

Figure 1 Conceptual framework

METHODOLOGY

This study employed a cross-sectional study design. Methodology could be described as follows.

Study design and study population

The population included secondary school students aged 13–18 years living in Bangkok, Thailand. The sample consisted of 109 secondary school students selected through purposive sampling. Purposive sampling was used because the study specifically targeted secondary school students who met the required criteria and fit the study objectives. The inclusion criteria were students aged 13–18 years who were currently studying at either the lower or upper secondary school level, residing in Bangkok, and willing to participate in the study by completing the research questionnaires. Students who did not meet the inclusion criteria or submitted incomplete questionnaires were excluded from the analysis. Recruitment was conducted through social media platforms by distributing an invitation to participate in the study along with a link to the online questionnaire. Participants were provided with information about the study and were asked to provide informed consent before completing the questionnaire.

The sample size exceeded the minimum requirement for multiple regression analysis based on Soper's approach (16). The effect size (Cohen's f^2) was derived by converting the correlation coefficient (r) reported in a previous (17) using the formula $f^2 = R^2/(1 - R^2)$, with Cohen's f^2 equal to 0.22. With a significance level of .05, statistical power of .95, and a total of three predictor variables, the required minimum sample size was calculated to be 82 participants.

Data collection

The research instruments consisted of four 5-point Likert scale questionnaires adapted from previous studies and their definitions in this research were as follows: (A) The *Attitude Towards Road Crossings* (18), which measures individuals' evaluations of the appropriateness of road-crossing behaviors in various situations, total score is 35; (B) *The Peer Influence Scale* (19), which measures the extent of peer pressure, persuasion, and conformity to peers' behaviors in individuals' decision-making and behavioral expressions across different situations, total score is 35; (C) The *Perceived Severity Scale* (15), which measures individuals' awareness of the severity of consequences when traffic accidents occur, total score is 15; and (D) The *Pedestrian Behavior Scale* (20), which measures risky pedestrian behaviors, such as inattentiveness while crossing roads or neglecting traffic signs and symbols on sidewalks. Higher scores indicate more frequent engagement in unsafe pedestrian behaviors; the total score is 50.

The omega coefficients for the four scales were .46, .79, .86, and .84, respectively. In addition, the results of construct validity testing indicated that all scales demonstrated acceptable construct validity ($X^2/df < 2$, $p > .05$, $RMSEA < .05$, $SRMR < .05$).

Data Analysis

Data were analyzed using R version 4.5.1 and RStudio. The analyses were conducted as follows: (A) descriptive statistics, including means and standard deviations, were used to describe attitudes towards road crossing, peer influence, perceived severity, and unsafe pedestrian behavior; (B) Pearson's correlation analysis was employed to examine the relationships among attitudes towards road crossing, peer influence, perceived severity, and unsafe pedestrian behavior; and (C) multiple linear regression analysis was conducted to investigate the influence of attitudes towards road crossing, peer influence, and perceived severity on unsafe pedestrian behavior.

RESULTS

Characteristics of respondents were shown in Table 1.

Table 1 Characteristics of respondents (*n* = 109)

Characteristics	Study participants (*n* = 109)	
	N	***%***
Gender		
Male	33	30.3
Female	76	69.7
Education level		
Junior high school	2	1.8
Senior high school	107	98.2
History of sidewalk-related accidents		
Yes (Ever experienced)	61	56.0
No (Never experienced)	48	44.0

According to Table 1, most of the research sample were female (69.7%), were enrolled in senior high school education (98.2%), and reported prior experience of sidewalk-related accidents (56.0%).

Descriptive statistics and Pearson's correlation coefficients among the study variables were shown in Table 2.

Table 2 Descriptive statistics and correlation analysis among related variables (* $p < .05$)

Variables	*M*	*SD*	Min	Max	1	2	3	4
1. Attitudes toward road crossing	3.12	0.47	1.86	4.00	1.000			
2. Peers influence	2.88	0.68	1.00	5.00	-.331* (p <.001)	1.000		
3. Perceived severity	3.81	1.03	1.00	5.00	-.084 (p = .385)	.282* (p = .003)	1.000	
4. Unsafe Pedestrian behavior**	1.95	0.71	1.00	4.20	-.553* (p <.001)	.482* (p <.001)	-.007 (p = .939)	1.000

Table 2 presents the descriptive statistics of the study variables. The mean score for attitudes toward road crossing was 3.12 (*SD* = 0.47), peer influence was 2.88 (*SD* = 0.68), perceived severity was 3.81 (*SD* = 1.03), and unsafe pedestrian behavior was 1.95 (*SD* = 0.71).

Regarding the relationships between variables and unsafe pedestrian behavior, attitude toward road crossing was found to have a statistically significant negative correlation with unsafe pedestrian behavior at the .05 level (r = −.553, p < .001). Similarly, peer influence demonstrated a statistically significant positive correlation with unsafe pedestrian behavior (r = .482, p < .001). In contrast, perceived severity showed a negative correlation with unsafe pedestrian behavior that did not reach statistical significance (r = −.007, p = .939).

Regression assumptions were shown in Table 3.

Table 3 Regression assumptions (* $p < .05$)

Assumption	Test	Result	Met/Not Met
Normality	Shapiro-Wilk	W = 0.991 p =.663	Met
Linearity	Havvey-Collier, Rainbow	HC (104) = 2.313, p = .023* $Rain$ (55,50) = 0.996, p = .508	Not Met Met
Homoscedasticit	Breusch-Pagan, Goldfeld-Quandt	BP (3) = 18.984, p < .001* GQ (51,50) = 0.604, p = .962	Not Met Met
No Autocorrelation	Durbin-Watson	DW = 2.144, p = .779	Met
No Multicollinearity	*VIF* values	Ranged from 1.086 to 1.212	Met

Overall, most assumptions for multiple regression analysis were supported. However, the Harvey–Collier and Breusch–Pagan tests indicated potential violations of linearity and homoscedasticity. Therefore, the results should be interpreted with some caution, although the data were considered suitable for multiple linear regression analysis.

The results of the multiple linear regression analysis are shown in Table 3 and Figure 1.

Table 4 Multiple linear regression for unsafe pedestrian behavior (* $p < .05$)

Variables	*B*	*Beta*	*SE*	*p*
Intercept	3.27*	-	0.52	< .001
Attitudes toward road crossing	-0.66*	-0.44	0.12	< .001
Peers influence	0.39*	0.38	0.08	< .001
Perceived severity	-0.10	-0.15	0.05	0.052

$R^2 = .43$, $R^2_{adj} = .41$, $F(3,105) = 26.05$, $p < .001$

From Table 3 and Figure 2, attitude toward road crossing, peer influence, and perceived severity jointly explained 43% of the variance in unsafe pedestrian behavior, and the overall model was statistically significant at the .05 level ($R^2 = .43$, $p < .001$). With respect to individual predictors, attitude toward road crossing exerted a statistically significant negative influence on unsafe pedestrian behavior (*Beta* = −0.44, $p < .001$), indicating that more positive attitudes toward road crossing were associated with poorer pedestrian behavior. Peer influence demonstrated a statistically significant positive effect on unsafe pedestrian behavior (*Beta* = 0.38, $p < .001$), suggesting that greater peer influence was associated with increased unsafe pedestrian behavior. Perceived severity, however, showed a negative influence on unsafe pedestrian behavior that did not attain statistical significance at the .05 level (*Beta* = −0.15, $p = .052$).

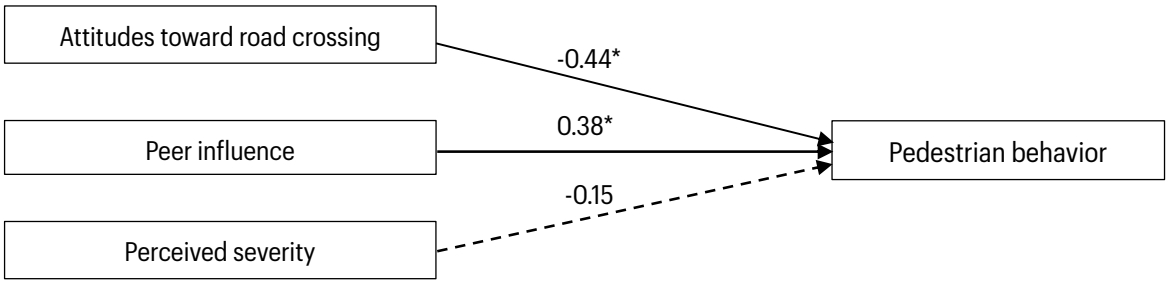

Figure 2 Standardized regression coefficients of factors affecting Pedestrian behavior (*p<.05)

The resulting regression equation was as follows

$\widehat{Pedestrian\ behavior}$ = 3.27 - 0.66* Attitudes toward road crossing + 0.39* Peer influence - 0.10*Perceived severity

DISCUSSION

Given that pedestrian behavior in this study reflected risky pedestrian behaviors, the negative influence of attitude toward road crossing on unsafe pedestrian behavior may be because students have positive attitudes toward road crossings. This may lead to safer crossing behaviors, which are components of unsafe pedestrian behavior (21). This is consistent with findings indicating that attitudes toward road crossing may influence intentions to cross the road and subsequent crossing behavior (7). Therefore, students who view safe road crossing positively are more likely to intend to cross safely, reducing risky pedestrian behaviors.

Peer influence has a statistically significant positive effect on unsafe behaviors. This may be because when students are with their

peers, peer influence may stimulate riskier behaviors, resulting in unsafe pedestrian actions. This is consistent with findings indicating that adolescents may face greater traffic risk when accompanied by peers than when alone (22). While having friends present may promote safety in some situations, it may encourage riskier behavior in others (14). Therefore, peer influence poses a significant risk to road safety among adolescents. In addition, it has been found that adolescents are more susceptible to peer influence than other age groups (23).

Perceived severity had an insignificant effect on unsafe pedestrian behavior. This finding may reflect the presence of conflicting influences on adolescents' unsafe pedestrian behavior. Although previous studies have shown that greater risk perception encourages safer pedestrian behavior and greater risk avoidance (24), students' habitual behaviors or daily time pressure, such as rushing to school or responding immediately to mobile phone notifications, may override their perception of risk and lead them to continue engaging in unsafe pedestrian behaviors. This explanation is consistent with findings that rushing or time pressure may increase unsafe road crossing behavior and traffic rule violations (25). Furthermore, research has shown that pedestrians under time pressure tend to cross the street more quickly and adjust their walking speed to compensate for crossing-related risks (26).

CONCLUSION

This study investigated the influences of attitudes toward road crossing, peer influence, and perceived severity on unsafe pedestrian behavior among secondary school students in Thailand. The sample included 109 students aged 13–18 years.

The findings revealed that attitudes toward road crossing were significantly negatively associated with unsafe pedestrian behavior, whereas peer influence was significantly positively associated with unsafe pedestrian behavior. In contrast, perceived severity was negatively associated with unsafe pedestrian behavior but was nonsignificant. Multiple linear regression analysis indicated that attitudes toward road crossing, peer influence, and perceived severity jointly explained 43% of the variance in unsafe pedestrian behavior.

These findings suggest that positive attitudes toward safe road crossing may encourage safer crossing decisions and reduce risky pedestrian behaviors, while peer influence may contribute to risky pedestrian behaviors among adolescents. Although perceived severity did not significantly influence unsafe pedestrian behavior, habitual behaviors and daily time pressure may affect students' decisions despite their awareness of potential risks. Therefore, school-based road safety programs should focus on developing positive attitudes toward safe road crossing and promoting positive peer influence through group-based activities and peer-led approaches to encourage safer pedestrian behavior among secondary school students.

RECOMMENDATION

Implications of the Study

1. The research findings showed that attitudes toward road crossing were significantly negatively associated with unsafe pedestrian behavior. Therefore, educational institutions or relevant agencies should consider organizing activities or training programs to promote positive attitudes toward safe road crossing among secondary school students (27).

2. The research findings clearly indicated that peer influence had a statistically significant positive effect on inappropriate pedestrian behavior. Furthermore, these findings demonstrate that road-crossing decisions of adolescents were influenced by both unsafe and cautious comments from their peers (28). Educational institutions should develop group-based road safety interventions, such as infographic or short video competitions, to promote positive peer influence and encourage safe pedestrian behavior, thereby contributing to public health.

Recommendations for Future Research

1. Since attitudes toward road crossing and peer influence were identified as significant predictors of unsafe pedestrian behavior, future research should develop and evaluate school-based interventions targeting these factors using research and development (R&D) or randomized controlled trial (RCT) designs.

2. As perceived severity had an insignificant effect on unsafe pedestrian behavior, future research should employ qualitative methods to explore adolescents' perceptions of road traffic risks and identify factors that may explain the limited influence of perceived severity on unsafe pedestrian behavior

ETHICAL DECLARATION

This study did not obtain formal approval from an institutional ethics review board. However, informed consent was obtained directly from each adolescent participant prior to completing the questionnaire, and participation was entirely voluntary. Students who did not provide consent were not included in the study, and their responses were excluded from data collection and analysis. All data were collected anonymously through self-administered Google Forms, and no personally identifiable information was gathered from participants.

LIMITATIONS

Although the sample size was determined according to Soper's recommendations, this study had a relatively small sample size, and the number of senior secondary school students was higher than that of junior secondary school students. In addition, purposive sampling may have caused selection bias because participants were not randomly selected. Therefore, the findings may not fully represent all secondary school students in Bangkok. Future studies should include a larger and more balanced sample and use probability sampling to improve the generalizability of the findings.

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DETERMINANTS OF HEAT ADAPTATION AMONG MYANMAR MIGRANT AGRICULTURAL WORKERS IN MAE SOT DISTRICT, TAK PROVINCE, THAILAND: A CROSS-SECTIONAL STUDY

Nyein Thwe Ko[1], Ho Ngoc Ninh[2], Piyapong Janmaimool[1], Cheerawit Rattanapan[1], Kinga Biro[1*]

[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand
[2]Faculty of Tourism and Foreign Languages, Vietnam National University of Agriculture, Hanoi City, 12406, Vietnam.
*[*]**Corresponding author**: Kinga Biro, ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand, Email:* kinga.bir@mahidol.ac.th

ABSTRACT

Introduction: Climate change is increasing occupational heat exposure among agricultural workers, particularly in Southeast Asia. Myanmar migrant agricultural workers in Mae Sot, Thailand, are especially vulnerable due to prolonged outdoor work, limited occupational protection, and socioeconomic constraints. Heat exposure can adversely affect workers' health, occupational safety, and productivity. To cope with heat-related challenges, workers may adopt various adaptation practices; however, evidence on heat adaptation among Myanmar migrant agricultural workers in Thailand remains limited.

Objective: To identify determinants of heat adaptation among Myanmar migrant agricultural workers in Mae Sot, Thailand.

Methodology: A cross-sectional study was conducted among 220 Myanmar migrant agricultural workers aged 18 years and above who had worked in Mae Sot, Tak Province, Thailand, for at least six months. Data were collected through face-to-face interviews using a structured questionnaire developed from validated instruments assessing perceived heat exposure and adaptation practices. Heat adaptation was measured using five adaptation practices (taking frequent rest breaks, increasing water intake, avoiding work during the hottest periods, using protective clothing, and adjusting work pace). Participants were classified as having high heat adaptation (>3 points) or low heat adaptation (≤3 points). Descriptive statistics, binary logistic regression and multivariable logistic regression analyses were performed using IBM SPSS.

Results: Heat adaptation was significantly associated with workday loss, chilli farm work, cassava farm work, and changes in planting schedules. Workers who did not experience workday loss were more likely to report high heat adaptation (AOR = 2.390, 95% CI: 1.183–4.832). Workers engaged in chilli farm work (AOR = 2.943, 95% CI: 1.464–5.917) and cassava farm work (AOR = 2.462, 95% CI: 1.198–5.058) had higher odds of reporting high heat adaptation. In addition, workers employed on farms that had adjusted planting schedules were more likely to demonstrate high heat adaptation (AOR = 2.004, 95% CI: 1.020–3.938).

Conclusion: Heat adaptation among Myanmar migrant agricultural workers was associated with reduced workday loss and climate-responsive agricultural practices. The findings highlight the importance of strengthening occupational heat protection measures and promoting adaptive farming strategies to enhance workers' resilience to increasing heat exposure. Policymakers, employers, and agricultural stakeholders should support workplace heat protection programs, access to drinking water and rest opportunities, and climate-responsive agricultural practices to improve the adaptive capacity of migrant agricultural workers in a warming climate.

Keywords:
Heat Adaptation; Occupational Heat Exposure; Agricultural Workers; Migrant Agricultural Workers; Climate Change.

INTRODUCTION

Climate change is a major global challenge affecting human health, livelihood, and sustainable development. Rising greenhouse gas concentrations have increased global temperatures, resulting in more frequent, intense, and prolonged heat events worldwide (1). According to the Intergovernmental Panel on Climate Change (IPCC), extreme heat events are projected to become more frequent and severe, posing substantial risks to populations living and working in hot environments (2).

Southeast Asia is among the regions most vulnerable to climate change because of its tropical climate, dense population, and dependence on climate-sensitive sectors (3,4). Increasing temperatures and extreme heat events are placing growing pressure on agricultural production, food security, and labor productivity (5,6). Prolonged heat exposure reduces work capacity, impairs productivity, and threatens occupational safety among outdoor workers (7,8).

Thailand has experienced rising temperatures and increasingly frequent heat events in recent decades (8,9). As a tropical country with a large agricultural workforce, Thailand faces considerable challenges related to occupational heat exposure. Agricultural workers are particularly vulnerable because they perform physically demanding tasks outdoors under direct sunlight and high ambient temperatures, increasing the risk of heat-related health problems, injuries, and productivity loss (10,11).

Myanmar migrant agricultural workers represent a substantial proportion of the agricultural workforce in border provinces, such as Tak Province (12,13). They often perform labor-intensive outdoor work while facing socioeconomic constraints, language barriers, limited access to occupational health information, and inadequate workplace protection. Temporary employment, dependence on employers, and concerns about job security may further restrict their ability to adopt heat adaptation measures, increasing their vulnerability to climate-related heat exposure (14).

Adaptation is widely recognized as a key strategy for reducing vulnerability and enhancing resilience to climate-related hazards (15). Heat adaptation refers to behavioral, occupational, and environmental adjustments that enable individuals to cope with heat exposure and minimize its adverse effects. Among outdoor workers, adaptation measures may include increasing water consumption, seeking shade, taking rest breaks, modifying work schedules and reducing working hours during periods of extreme heat, and working in environments where climate-responsive agricultural practices have been implemented (16,17).

Despite growing attention to occupational heat exposure, evidence on heat adaptation among migrant agricultural workers remains limited. This study is guided by IPCC Adaptation Farmwork, which defines adaptation as the process of adjustment to actual or expected climate adaptation as the process of adjustment to actual or expected climate and its effects, aimed at moderating harm or exploiting beneficial opportunities (18). The framework conceptualizes adaptive capacity as the ability of individuals and systems to adjust to climate variability and extremes, shaped by available resources, institutional support, and socio-economic conditions. In the context of migrant agricultural workers, heat adaptation practices such as increasing water intake, taking rest breaks, and adjusting work represent behavioral and occupational adjustments that enhance adaptive capacity. However, migrant workers face unique constraints, including language barriers, limited access to health information, socioeconomic vulnerability, and dependence on employers that may reduce their ability to adopt effective adaptation measures (19). Guided by the IPCC adaptation framework, this study examines how socio-demographic characteristics, occupational conditions, workplace support, and farm-level climate adaptations influence heat adaptation among Myanmar migrant agricultural workers in Thailand

Therefore, this study aimed to identify factors associated with heat adaptation among

Myanmar migrant agricultural workers in Mae Sot District, Tak Province, Thailand.

METHODOLOGY

A cross-sectional study was conducted among Myanmar migrant agricultural workers in Mae Sot District, Tak Province, Thailand. The required sample size was calculated using Cochran's formula, resulting in a target sample size of 384 participants. This paper presents preliminary findings based on the first 220 participants because data collection was still ongoing. Participants were recruited using a multistage sampling method. In the first stage, sub-districts and villages in Mae Sot District with high concentrations of Myanmar migrant agricultural workers were purposively selected. In the second stage, agricultural farms within the selected areas were identified. In the third stage, eligible Myanmar migrant agricultural workers were selected from these farms using simple random sampling. Data were collected through face-to-face interviews between 5 May and 22 May 2026 using a structured questionnaire adapted from standardized and validated instruments related to occupational heat exposure and heat adaptation.

The questionnaire consisted of five sections: sociodemographic characteristics, perceived heat exposure, occupational factors, agricultural adaptation measures, and heat adaptation practices. Perceived heat exposure was assessed using a self-reported 5-point Likert scale ranging from 1 (very low) to 5 very high, reflecting participants' perceptions of heat exposure experienced during agricultural work. For analysis, responses were categorized into low and high perceived heat exposure. Content validity was evaluated by three experts using the Items-Objective Congruence (IOC) method. A pilot study was conducted among 35 Myanmar migrant agricultural workers to assess the reliability of the questionnaire, which demonstrated acceptable internal consistency (Cronbach's alpha = 0.717).

Heat adaptation was assessed using five adaptation practices: taking frequent rest breaks, increasing water intake, avoiding work during the hottest period of the day, using protective clothing, and adjusting work pace. Responses were coded as Yes (1) and No(0) and summed to generate a total adaptation score ranging from 0 to 5. As no established cut-off value was available for this instrument, the median score of 3 was used as the cut-off point. Participants with scores >3 were classified as having high heat adaptation, while those with scores ≤3 were classified as having low heat adaptation. Working day loss referred to the number of workdays lost because of heat exposure during the one month preceding the interview. Variables such as changes in planting schedules and adjusted farming practices referred to farm-level adaptation measures implemented by farm owners.

Data were analyzed using IBM SPSS Statistics version 31. Descriptive statistics were used to summarize participants' characteristics. Bivariate logistic regression analysis was performed to examine the association between each independent variable and heat adaptation by estimating crude odds ratios (CORs) and 95% confidence intervals (CIs). Independent variables were selected for multivariable logistic regression based on the study conceptual framework, previous literature, and bivariate analysis ($p < 0.25$). Prior to model fitting, multicollinearity among the independent variables was assessed using the Variance Inflation Factor (VIF) and tolerance statistics. Variables with VIF values <5 and tolerance values >0.20 were considered to indicate the absence of significant multicollinearity. A backward likelihood ratio (Backward LR) procedure was then applied to develop the final multivariable logistic regression model. Adjusted odds ratios (AORs) with 95% confidence intervals were reported. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 presents the socio-demographic and occupational characteristics of the 220 Myanmar migrant agricultural workers included in this preliminary analysis. The mean age of the

participants was 40.31 ± 12.92 years (range: 18–72 years). Most participants were female (64.1%), married (89.1%), and had completed primary school education (53.6%). Approximately 60.5% had a work permit, whereas 39.5% were undocumented migrants. The participants had a mean agricultural work experience of 7.57 ± 5.18 years and had lived in Thailand for an average of 8.67 ± 5.84 years. The mean household size was 3.88 ± 1.65 members, and the average monthly income was 3,890.37 ± 1,383.48 THB. Participants reported losing an average of 12.36 ± 16.10 working days due to heat during the one month preceding the interview. Most participants received daily wages (81.4%), while 10.0% and 8.6% were paid weekly and monthly, respectively. Overall, 136 participants (61.8%) were classified as having high heat adaptation, whereas 84 (38.2%) were classified as having low heat adaptation.

Table 1 Socio-demographic, occupational, and adaptation-related characteristics of participants (n=220)

Variables	n (%) Mean ± SD
Age (years)	40.31 ± 12.92
Min-18 -Max-72	
Sex	
Male	79 (35.9)
Female	141 (64.1)
Marital status	
Single	24 (10.9)
Married	196 (89.1)
Education	
No education	36 (16.4)
Primary school	118 (53.6)
Middle school	41 (18.6)
High school	24 (10.9)
University level or above	1 (0.5)
Migration status	
Undocumented	87(39.5)
Work permit	133(60.5)
Working experiences (years)	7.57 ± 5.18
Min – 1 Max- 30	
Length of stay in Thailand	8.67 ± 5.84
Min – 1 Max- 30	
Household members	3.88 ± 1.65
Min-1 Max-10	
Income	3890.37 ± 1383.482
Min-1000 Max-15000	
Loss of working days	12.36 ± 16.10
Min-0 Max 88	
Payment Method	
Daily	179(81.4)
Monthly	19 (8.6)
Weekly	22(10.0)

Table 2 presents the bivariate analysis of factors associated with heat adaptation among Myanmar migrant agricultural workers. Age, sex, marital status, perceived heat exposure, workday loss, reduction of workdays or working hours, and shade provision were not significantly associated

with heat adaptation (p >0.05).

Several occupational and workplace-related factors were significantly associated with heat adaptation. Workers employed on chilli farms were more likely to report high heat adaptation compared with those not employed on chilli farms (COR=5.514, 95% CI: 3 .019-10.070, P <0.001). Similarly, workers employed on maize farms (COR=1.777, 95% CI: 1.003-3.145, p=0.049) were more likely to demonstrate high heat adaptation. Workers employed on cassava farms were more likely to report high heat adaptation (COR=5.195, 95% CI: 2.806-9.617, p<0.001).

In addition, workers employed on farms that had changed planting schedules were significantly more likely to report high heat adaptation than those working on farms without such changes (COR= 2.652, 95% CI: 1.484-4.739, P<0.001). Adjustment of farming practices was also significantly associated with heat adaptation (COR=2.134, 95% CI: 1.216-3.742, P= 0.008). Furthermore, access to irrigation water (COR= 4.034, 95% CI: 2.203- 7.385, p < 0.001) and employer support (COR= 4.009, 95% CI: 1.916-8.391, p< 0.001) were significantly associated with high heat adaptation.

Table 2 Bivariate analysis of factors associated with heat adaptation

Variables	Number	Heat adaptation		COR	95% CI		P value
		Low (0)	High (1)		Lower	Upper	
Age							
Younger workers	106	38 (35.8)	68 (64.2)	1.211	0.702	2.089	0.492
Older workers	114	46 (40.4)	68 (59.6)	1			
Sex							
Male	79	24 (30.4)	55 (69.6)	1.698	0.946	3.045	0.076
Female	141	60 (42.6)	81 (57.4)	1			
Marital Status							
Single	24	7 (29.2)	17 (70.8)	1.571	0.623	3.966	0.339
Married	196	77 (39.3)	119 (60.7)	1			
Perceived severe Heat							
Low perceive heat	53	25 (47.2)	28 (52.8)	1			
High perceived heat	167	59 (35.3)	108 (64.7)	1.634	0.874	3.056	0.124
Working day loss							
Yes (1)	106	47 (44.3)	59 (55.7)	1			
No (0)	114	37 (32.5)	77 (67.5)	1.658	0.958	2.868	0.071
Worked on chilli farms							
Yes (1)	112	22 (19.6)	90 (80.4)	5.514	3.019	10.070	<0.001***
No (0)	108	62 (57.4)	46 (42.6)	1			
Worked on maize farms							
Yes (1)	146	49 (33.6)	97 (66.4)	1.777	1.003	3.145	0.049*
No (0)	74	35(47.3)	39 (52.7)	1			
Worked on cassava farms							
Yes (1)	101	19 (18.8)	82 (81.2)	5.195	2.806	9.617	<0.001***
No (0)	119	65 (54.6)	54 (45.4)	1			
Reduce workdays/ hours							
Yes (1)	145	49 (33.8)	96 (66.2)	1.714	0.970	3.029	0.064
No (0)	75	35 (46.7)	40 (53.3)	1			
Shade provided							
Yes	146	51 (34.9)	95 (65.1)	1.499	0.847	2.653	0.164
No	74	33 (44.6)	41 (55.4)	1			

Variables	Number	Heat adaptation		COR	95% CI		P value
		Low (0)	High (1)		Lower	Upper	
Change in planting Time							
Yes	94	24 (25.5)	70 (74.5)	2.652	1.484	4.739	<0.001***
No	126	60 (47.6)	66 (52.4)	1			
Adjusted farming practices							
Yes (1)	101	29 (28.7)	72 (71.3)	2.134	1.216	3.742	0.008
No (0)	119	55 (46.2)	64 (53.8)	1			
Irrigation water							
Yes(1)	153	43 (28.1)	110 (71.9)	4.034	2.203	7.385	<0.001***
No (0)	67	41 (61.2)	26 (38.8)	1			
Employer support							
Received (0)	182	59 (32.4)	123 (67.6)	4.0091	1.916	8.391	<0.001***
None (1)	38	25 (65.8)	13 (34.2)	1			

Prior to the multivariable logistic regression analysis, multicollinearity among the independent variables was assessed using the variance Inflation Factors (VIF) and tolerance statistics. No evidence of significant multicollinearity was observed. All tolerance values were greater than 0.20, and VIF values ranged from 1.096 to 1.388, indicating that multicollinearity was not a concern.

Table (3) Variables with a p-value < 0.25 in the bivariate analysis were included in the initial multivariable logistic regression model. A backward likelihood ratio (Backward LR) selection procedure was applied to obtain the final model. The final model identified four factors significantly associated with heat adaptation.

Workers who did not experience workday loss were more likely to report high heat adaptation than those who experienced workday loss (AOR= 2.390, 95% CI: 1.183-4.832, p=0.015). Workers engaged in chilli farm work had higher odds of reporting high heat adaptation compared with those not engaged in chilli farm work (AOR = 2.943, 95% CI: 1.464-5.917, p= 0.002). Similarly, workers engaged in cassava farm work were more likely to report high heat adaptation (AOR= 2.462, 95% CI: 1.198-5.058, p=0.014). In addition, workers employed on farms that had adjusted planting schedules were more likely to demonstrate high heat adaptation than those working on farms that had not implemented such changes (AOR = 2.004, 95% CI: 1.020-3.938, p=0.044).

Table 3 Multivariable logistic regression analysis identified four significant determinants of heat adaptation.

Independent variables	Full model		Final model	
	AOR (95% CI)	P value	AOR (95% CI)	P value
Working days lost (*ref:* Yes)				
No	2.382 (1.146-4.952)	0.020*	2.390 (1.183-4.832)	0.015*
Worked on chilli farms (*ref:* No)				
Yes	2.589 (1.207-5.556)	0.015*	2.943 (1.464-5.917)	0.002**
Worked on cassava farms (*ref*: No)				
Yes	2.564 (1.214-5.412)	0.014*	2.462 (1.198-5.058)	0.014*
Reduce workdays (*ref*: No)				
Yes	1.841 (0.840-4.034)	0.127	2.003 (0.974-4.118)	0.059
Changing Planting time (*ref*: No)				
Yes	1.940 (0.912-4.126)	0.085	2.004 (1.020-3.938)	0.044*
Irrigation water (*ref:* No)				
Yes	1.666 (0.648-4.283)	0.290	2.026 (0.988-4.152)	0.054

DISCUSSION

This study examined factors associated with heat adaptation among Myanmar migrant agricultural workers in Mae Sot District, Tak Province, Thailand. The findings indicated that 61.8% of participants demonstrated high heat adaptation. Multivariable logistic regression analysis identified workday loss, chilli farm work, cassava farm work, and changes in planting schedules as significant factors associated with heat adaptation.

Workers who did not experience workday loss demonstrated greater heat adaptation capacity than those who reported workday loss, suggesting that heat adaptation may reflect workers' capacity to continue occupational activities despite exposure to high temperatures. Adaptive practices such as increasing water intake, taking rest breaks, and adjusting work pace may help reduce heat-related discomfort and maintain work performance. This finding is supported by Hansson et al. (2024), who reported that a rest-shade-hydration intervention among agricultural workers improved workers' health and productivity under hot environmental conditions. The authors also found that increasing heat exposure was associated with reduced productivity, highlighting the importance of effective adaptation measures in minimizing heat-related work disruptions. Therefore, heat adaptation may play an important role in supporting work continuity and reducing the adverse occupational impacts of rising temperatures among migrant agricultural workers (18).

Workers engaged in chilli and cassava farm work were more likely to report high heat adaptation. One possible explanation is that chilli and cassava cultivation are commonly conducted in open fields with limited tree cover or natural shade, resulting in prolonged exposure to direct sunlight and high temperatures. In addition, these crops are seasonal and require labor-intensive outdoor work throughout different stages of cultivation. Greater exposure to heat may increase workers' awareness of heat-related risks and encourage the adoption of adaptive behaviors such as increasing water consumption, use of protective clothing, and adjustment of work pace (17). These findings suggest that crop-specific working conditions may influence workers' heat adaptation practices.

The positive association between changes in planting schedules and heat adaptation highlights the importance of farm-level adaptation measures in responding to climate-related challenges. This finding is consistent with previous research showing that agricultural households modify planting calendars in response to climate variability and environmental stressors (19). Although migrant agricultural workers may not directly participate in decisions regarding agricultural planning, such measures may reduce occupational heat exposure and support worker well-being. Strengthening farm-level adaptation strategies may therefore contribute to enhancing climate resilience among agricultural workers.

Although employer support was not retained in the final multivariable model, its significant association with heat adaptation in the bivariate analysis. This finding highlights the potential importance of employers in supporting heat adaptation among Myanmar migrant agricultural workers. Given the language barriers, socioeconomic constraints, and dependence on employers commonly experienced by migrant workers, employer-provided measures such as access to drinking water, shaded rest areas, flexible work schedules, and heat-safety information may facilitate the adoption of heat adaptation practices.

CONCLUSION

In this study, 61.8% of Myanmar migrant agricultural workers demonstrated high heat adaptation. Workday loss, chilli farm work, cassava farm work, and changes in planting schedules were identified as significant factors associated with heat adaptation. The findings suggest that heat adaptation is influenced not only by individual experiences but also by workplace and agricultural environmental conditions. As climate change continues to

increase heat exposure among outdoor workers, strengthening workplace adaptation measures and promoting supportive working environments may enhance workers' resilience and adaptive capacity. These findings provide evidence to inform occupational health policies and climate adaptation strategies for Myanmar migrant agricultural workers in Thailand.

RECOMMENDATION

Workplace heat adaptation measures should be strengthened to enhance the adaptive capacity of Myanmar migrant agricultural workers. Employers and relevant stakeholders should promote access to drinking water, shaded rest areas, and flexible work arrangements during periods of extreme heat. Heat adaptation training and educational materials should also be provided in the Myanmar language to improve workers' understanding of heat-related risks and appropriate adaptation practices. In addition, climate-responsive agricultural practices and occupational heat protection programs should be encouraged to reduce heat-related risks among migrant agricultural workers. Future studies should explore heat adaptation strategies in different agricultural settings and evaluate interventions that effectively support workers' resilience under changing climatic conditions.

ETHICAL DECLARATION

This study was approved by the Institutional Review Board (IRB) of Mahidol University (Approval no. 2026/161.2403). Verbal informed consent was obtained from all participants prior to data collection. Research assistants explained the study objectives, procedures, potential risks, and benefits before obtaining consent and conducting the interviews. Participation was voluntary, and the confidentiality and anonymity of participants were maintained throughout the study.

LIMITATIONS

This study has several limitations. First, the cross-sectional design does not allow causal relationships between the identified factors and heat adaptation to be established. Second, the use of self-reported data may be subject to recall bias and social desirability bias. Third, the study achieved a sample of 220 participants instead of the target 384, which may reduce statistical power and limit the precision of effect estimates. This shortfall was primarily due to time constraints and challenges in accessing undocumented migrant workers during the data collection period. Finally, the study was conducted among Myanmar migrant agricultural workers in Mae Sot District, Tak Province, Thailand, and the findings may not be generalizable to migrant workers in other regions or occupational settings. Therefore, the results should be interpreted with caution.

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FACTORS ASSOCIATED WITH EARTHQUAKE PREPAREDNESS BEHAVIORS AND RESILIENCE IN EARTHQUAKE-PRONE AREAS: A SYSTEMATIC REVIEW BASED ON THE DISASTER LITERACY MODEL

Wisutthiphat Singklang[1,2], Suphamas Partiprajak[3]*, Suphanna Krongthaeo[3]

[1]Graduate student, Master of Nursing Science Program in Community Health Nurse Practitioner, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand
[2]Department of Public Health Nursing, Faculty of Nursing, Mahidol University, Nakhon Pathom 73170, Thailand
[3]Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand
***Corresponding Author**: Suphamas Partiprajak, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand, Email: Suphamas.par@mahidol.ac.th*

ABSTRACT

Introduction: Earthquakes are a major global hazard because they can cause substantial structural damage, economic losses, and fatalities, particularly in earthquake-prone areas. A key disaster risk reduction (DRR) concept that substantially reduces earthquake impacts and promotes personal and community resilience is preparedness. Although earthquake risk exposure is high, individual and household preparedness remains suboptimal because of complex factors. While numerous factors have been identified, existing evidence remains fragmented, hindering effective policy-making. Building on prior work, this study integrates the Disaster Literacy Model to synthesize factors associated with earthquake preparedness behaviors and resilience.

Objectives: This systematic review aimed to investigate factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas, based on the Disaster Literacy Model.

Methodology: In this systematic review, the researcher searched CINAHL, PubMed, Embase, Scopus, and ProQuest for original studies published in English between January 2015 and September 16, 2025. Studies were included based on eligibility criteria. Data were independently screened and extracted by two reviewers, and the methodological quality was rigorously appraised using the JBI Critical Appraisal Tool for Analytical Cross-Sectional Studies. The study is registered with PROSPERO.

Results: Of 3,347 records identified, 15 studies published between 2017 and 2025 were included. All studies employed a cross-sectional design. The Disaster Literacy Model served as the primary framework for synthesizing the independent variables. Predisposing factors, including income, education, age, and social support; situational internal factors, particularly self-efficacy; and disaster literacy were identified as factors associated with preparedness behaviors or resilience. Gender was categorized under socio-economic, cultural, and environmental factors, whereas past disaster experience and risk perception were identified as exogenous factors. Overall, these factors were associated with preparedness behaviors and resilience, although the direction and strength of the associations varied across populations and settings.

Conclusion: Identifying these factors gives researchers and policymakers plausible target constructs for designing future interventions. However, experimental evaluations are necessary to confirm their effectiveness in enhancing preparedness and resilience.

Keywords:
Earthquake; Preparedness Behaviors; Earthquake-Prone Areas; Disaster Literacy Model; Systematic Review.

INTRODUCTION

Earthquakes are natural disasters with the potential to cause catastrophic effects on humanity. They can cause a large number of fatalities, considerable damage to residential buildings and infrastructure, economic losses, and widespread injuries among populations in earthquake-prone areas. Billions of dollars are lost due to earthquakes (1), especially in seismically active regions that host hundreds of millions of people worldwide.

The Disaster Management Cycle, which spans from pre-disaster to post-disaster, provides a comprehensive framework for risk management. It comprises four primary stages: 1) Prevention and Mitigation, 2) Preparedness, 3) Response and Relief, and 4) Recovery. To reduce risks, ensure efficient response capabilities, and enable recovery aligned with the "Build Back Better" principle, these phases must be carried out in concert as a continuous, closed-loop process. This idea seeks to return the economy, housing, infrastructure, and mental and physical health to a better and more resilient state than before (2). Preparedness is a key tactic in disaster risk reduction (DRR) and greatly increases personal resilience (3). This multifaceted preparedness includes acquiring emergency survival gear, basic first-aid training, physical and mental preparedness, home structural safety assessments, and family evacuation plans. These preparedness behaviors can help reduce the impacts of earthquakes (4). Furthermore, communities actively engaged in disaster risk reduction through life-saving preparations, structural damage mitigation, and the development of early warning systems experience substantially lower losses and demonstrate a more efficient recovery process (5).

While global emphasis on earthquake preparedness remains high, empirical evidence indicates that actual preparedness is suboptimal (6-7). Individual and household preparedness is driven by a complex interplay of personal, social, cultural, socio-economic, and environmental factors (8-9). Despite the large number of people living in earthquake-prone areas, most implement only rudimentary preparedness measures. This discrepancy has led scholars from a variety of fields to examine factors associated with preparedness behaviors in earthquake-prone areas. Many variables have been identified through empirical research over the past few decades, but this body of evidence remains fragmented, posing a significant obstacle to the development of effective interventions and policies. Davarani et al. (10) synthesized these factors using Social Cognitive Theory in a systematic review. Acknowledging the importance of this problem, this study integrates the Disaster Literacy Model (8-9) to provide a broader framework for synthesizing the evidence. This model emphasizes a person's ability to access, understand, appraise, and apply information, supporting informed decision-making before and after an earthquake.

Therefore, this systematic review aimed to investigate factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas. The knowledge gained from this research will not only systematize currently fragmented variables but also empower relevant agencies to design policies and measures tailored to each specific area. Ultimately, this will lead to the development of earthquake-resilient societies and ensure sustainable safety for the future.

METHODOLOGY

This study is designed as a systematic review, conducted in accordance with the JBI methodology for systematic review of etiology and risk. The results are reported with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (11). The protocol for this study has been registered with the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD420251245671.

Inclusion and Exclusion Criteria

Studies were selected according to a clearly defined set of criteria illustrated in Table 1.

Table 1 Inclusion and exclusion criteria for the studies

Category	Inclusion criteria	Exclusion criteria
Population	Individuals aged 18 years or older, or households residing in earthquake-prone areas.	Studies focusing on specific populations, such as medical professionals, emergency responders, students, groups with specific medical conditions, and people with disabilities.
Exposure of interest	Any factors associated with earthquake preparedness behaviors or resilience.	
Outcomes	The primary outcomes of interest are disaster or earthquake preparedness behaviors and disaster or earthquake resilience.	Research primarily focused on other disasters, such as floods, fires, or tsunamis, where earthquake-related data could not be isolated or were not specifically addressed.
Design	-	Studies for which the full text was unavailable, non-primary research, or specific study designs, including systematic reviews, qualitative studies, case reports, conference abstracts, editorial opinions, and research with incomplete or insufficient data
Setting	Studies conducted in earthquake-prone areas.	-
Publication	Studies published between 2015 and 2025 were included to ensure that the findings were contemporary and relevant to the current population context.	-
Language	Articles published in the English language only.	-

Information Sources

To identify studies that focused on the factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas, and were published between 2015 and September 16, 2025, a systematic review search was conducted. Five electronic databases were searched, including CINAHL, PubMed, Embase, Scopus, and ProQuest.

Search Strategy

Using the PEO framework as a guide, the search strategy was created by combining keywords and Medical Subject Headings (MeSH) from PubMed. Key terms such as " Disaster-prone population," "earthquake-prone area," "factors affecting preparedness," "disaster literacy," "earthquake literacy," "preparedness behavior," and "resilience" were used. These terms were combined using Boolean operators (OR, AND) to refine the search. To ensure the studies identified aligned with the main study objectives, the search was limited to titles and abstracts. Only studies written in English were considered for this study.

Selection Process

All studies identified through the electronic database search were imported into EndNote version 21 for management. Duplicates were identified and removed before proceeding to the next phase. Two independent reviewers conducted the screening process in two phases. Disagreements between the two reviewers were resolved through discussion and consensus with a third reviewer. Titles and abstracts were reviewed in the first phase to assess eligibility against the study's objectives; papers that weren't relevant at this stage were removed. The full texts of potentially relevant studies were retrieved and evaluated according to predefined inclusion and exclusion criteria. The same two reviewers performed this phase independently.

Data Collection Process

A standardized data extraction form created in Microsoft Excel was used to extract data from the selected studies. The extraction process was carried out independently by two reviewers for each study to ensure accuracy, transparency, and completeness, thereby reducing errors and the risk of bias in data extraction. Any disagreements that arose during the process were resolved through discussion between the two reviewers and subsequently verified by a third reviewer.

The following important details were recorded using the standard form: 1) Author(s); 2) Year of publication; 3) Study country; 4) Study design; 5) Sample or target population; 6) Sample size; 7) Mean age or age range; and 8) Key outcomes.

Study Risk of Bias Assessment

The risk of bias in the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tool for Analytical Cross-Sectional Studies (12). Two reviewers carried out the appraisal independently. If any disagreements arose in the quality assessment, they were resolved through internal discussion to reach a final consensus.

Synthesis Methods

To synthesize the data, studies with similar characteristics were grouped according to the framework. The Disaster Literacy Model of Brown et al. served as the primary framework for synthesizing the independent variables. To enhance coverage, the Integrated Disaster Literacy Model (IDLM) of Çalışkan et al. was utilized as a supplement to incorporate key concepts not mapped in the primary model. Additionally, relevant exogenous factors outside the Disaster Literacy Model were integrated to provide more comprehensive coverage. Guided by this model structure, the factors associated with earthquake preparedness behaviors and resilience were categorized into four analytical domains: 1) Bivariate analysis of earthquake preparedness behaviors, 2) Multivariable analysis of earthquake preparedness behaviors, 3) Bivariate analysis of resilience, and 4) Multivariable analysis of resilience.

Statistical Analysis

The researchers used descriptive statistics, such as frequencies and percentages, to analyze the general characteristics of the studies. Additionally, content summarization and categorization were used to synthesize factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas.

RESULTS

Study Selection

A total of 3,347 records were identified from five databases, including CINAHL, PubMed, Embase, Scopus, and ProQuest. The reference management program EndNote Version 21 was used to import all of the identified studies. Duplicate records were removed before proceeding to the next phase, resulting in the removal of 579 records. The screening process was applied to these remaining 2,768 records. 2,707 records were removed after the titles and abstracts were screened. As a result, 61 records were retrieved for eligibility assessment. However, nine of these records could not be

retrieved because their full texts were unavailable. As a result, the eligibility of 52 full-text studies was assessed. 37 full-text studies were removed. In the last phase, for a variety of reasons, such as ineligible outcome variables (30 studies), ineligible population (4 studies), ineligible disaster setting (3 studies). Finally, 15 studies remained for this systematic review. To ensure transparency and reproducibility of the research process, the PRISMA flow diagram (Figure 1) outlines the specific steps of the study selection process.

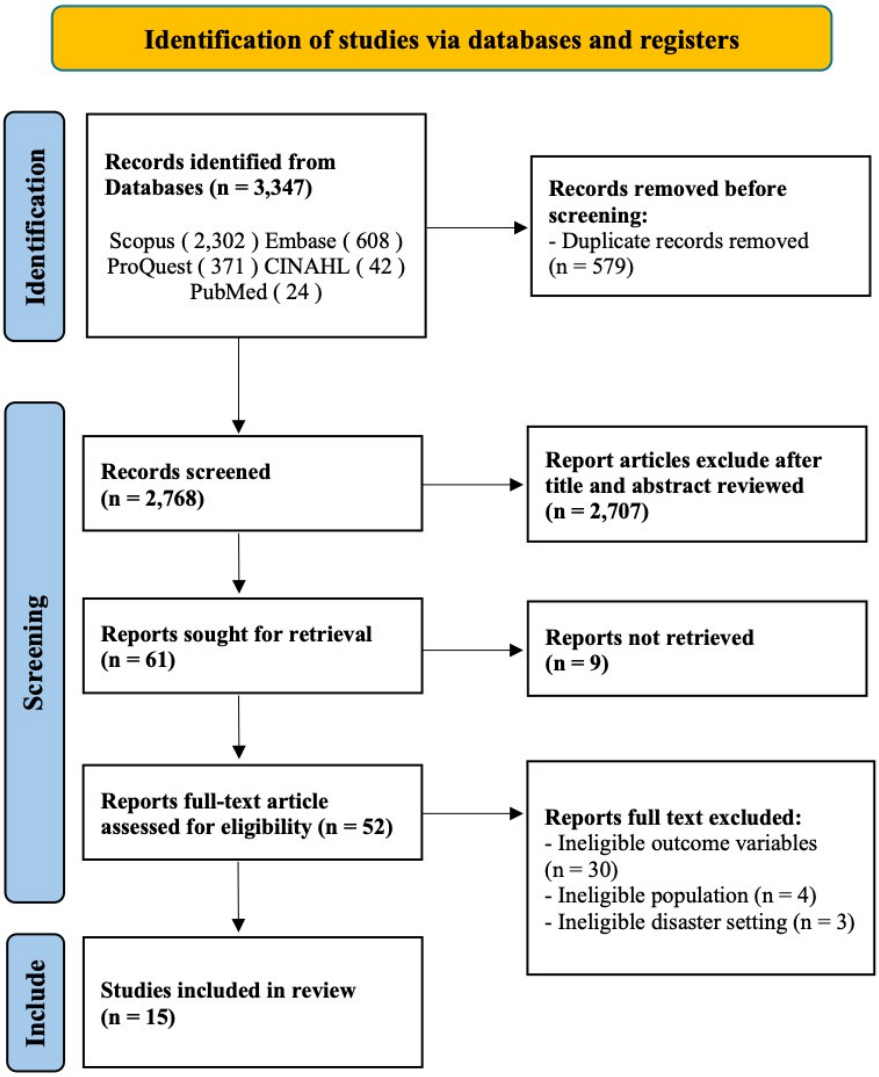

Figure 1 PRISMA flow diagram of the search and selection process

Study Characteristics

For this study, 15 included studies published between 2017 and 2025 were selected. The sample sizes of the included studies ranged from 286 to 9,966 participants. Most studies were conducted among adults. Geographically, most studies (n = 11) were conducted in Asia. Of those, three studies were conducted in mainland China and three studies in Taiwan, followed by one each in Israel, Iran, Nepal, Pakistan, and Japan. Four studies were conducted in Türkiye.

Regarding study design, all 15 included studies were cross-sectional studies. In terms of the target population, the majority of studies (12 studies) concentrated on households or the general population. The remaining targeted groups (3 studies) comprised the elderly or older survivors of disasters (2 studies) and general patients and their relatives (1 study). Table 2 provides illustrations of the details.

Table 2 General characteristics of the included studies

Author, (Year)	Country	Sample/ Target group	Sample size (n)	Mean age/age range	Key outcomes	
					Bivariate findings	Multivariable findings
Yin et al. (2025) (13)	China	Residents	9,966	0.66*	Social support and self-efficacy show positive associations with household disaster preparedness (r = 0.161, p < .01; r = 0.149, p < .01).	Social support (B = 0.024, p < .001), gender (B = .166, p < .05), income (B = .179, p < .05), education level (B = .600, p < .001) and self-efficacy (B = .025, p < .001) showed positive associations with preparedness.
Rostami-Moez et al. (2020) (14)	Iran	Households	884	38.24 years	Earthquake preparedness among participants was related to gender (p < .001) and prior experience with a destructive earthquake (p < .001). Furthermore, preparedness levels differed significantly between individuals with primary education and those with either academic education or a diploma degree (p < .001).	Self-efficacy (B = .253, p < .001) was associated with earthquake preparedness.
Torpus et al. (2024) (15)	Türkiye	Individuals aged 18–52 years	401	20.40 years	There was a positive association between age and disaster resilience (r = 0.186, p < .05). Additionally, a moderate positive association between disaster resilience and the disaster literacy scale preparedness sub-dimension (r = 0.444, p < .001).	The effect of disaster literacy and individual disaster resilience was statistically significant (β = .444, p < .001)
Gün et al. (2022) (16)	Türkiye	People living in the center of Elazığ	388	32.93 years	There was a weak positive association between preparedness and risk perception (r = 0.141, p < .01).	-

Author, (Year)	Country	Sample/ Target group	Sample size (n)	Mean age/age range	Key outcomes	
					Bivariate findings	Multivariable findings
Liao et al. (2025) (17)	Taiwan	Older adults	398	73.15 years	-	Education level (β = .179, p < .01), monthly income (β = −.140, p < .05), disaster experience (β = .106, p < .05), and risk perception (β = −.210, p < .001) are associations with preparedness behaviors.
Ao et al. (2022) (4)	China	Rural residents	674	unclear	-	There is a difference in disaster preparedness behaviors based on gender (p < .05). Age is negatively associated with disaster preparedness behaviors (p < .05). Education level is positively associated with disaster preparedness behaviors (p < .05).
Kirschenbaum et al. (2017) (18)	Israel	Israeli adults	947	50 years	Actual preparedness associated with education (r = .079, p < .05) and past experience (r = .081, p < .05).	Experience of earthquakes (B = .902, p < .01) and level of education (B = .564, p < .05) were associated with earthquake preparedness.
Kiani et al. (2022) (19)	Pakistan	Household	400	urban, peri-urban, and rural (37, 39, and 35)	Pearson's correlation analysis showed a relationship between risk perception and household preparedness in urban, peri-urban, and rural areas. The findings indicate a positive association between risk perception and preparedness.	Risk perception showed an association preparedness across all three study areas. The overall correlation coefficient (R) is 0.515, indicating a moderate association. The strongest association was found in the peri-urban region (R = 0.594), followed by urban (R = 0.456) and rural areas (R = 0.530) (p < .001).

Author, (Year)	Country	Sample/ Target group	Sample size (n)	Mean age/age range	Key outcomes	
					Bivariate findings	Multivariable findings
Ashida et al. (2024) (20)	Japan	Japanese in Kinki region	401	52.1 years	The Pearson correlation coefficient showed a positive association between risk perception and preparedness behaviors (r = .117, p < .05), as well as between past disaster experience and preparedness behaviors (r = .162, p < .01).	Risk perception and past disaster experience each positively associated with preparedness behaviors (B = .122, p < .01; B = .128, p < .01).
Ao et al. (2021) (21)	China	Rural residents	476	18 - 70 years	-	Age (B = .397, p < .001), education (B = .647, p < .001), and risk perception (B = .332, p < .05) were positively associated with earthquake preparedness. In contrast, experience of earthquake intensity was negatively associated with disaster preparedness (B = -.747, p < .001).
Bian et al. (2022) (22)	Taiwan	TSGS dataset	1933	47.92 years	-	Age (β = −.01, p < .001), education level (β = .23, p < .001), and risk perception (β = .15, p < .001) were associations with disaster preparedness behaviors.
Kılınç et al. (2025) (23)	Türkiye	Outpatients and relatives	414	27.65 years	A significant association was found between disaster literacy and disaster preparedness (r = 0.242, p < .001)	Gender (β = .119, p < .05) and disaster literacy (β = .171, p < .05) positively associated with disaster preparedness.
Tang et al. (2018) (24)	Taiwan	Tainan residents	286	38.1 years (Range 20–79)	Self-efficacy associated with disaster preparedness behaviors (r = 0.468, p < .01).	-

Author, (Year)	Country	Sample/ Target group	Sample size (n)	Mean age/age range	Key outcomes	
					Bivariate findings	Multivariable findings
Gülsoy et al. (2025) (25)	Türkiye	Adult individuals	3861	Unclear	Disaster literacy and disaster preparedness are moderate associated ($r = 0.40$, $p < .001$).	-
Timalsina et al. (2021) (26)	Nepal	Older disaster survivors	324	74.08 years	Gender ($r_{pb} = 0.33$, $p < .001$) and personal income ($r_{pb} = 0.31$, $p < .001$) had a moderate positive association with resilience. In contrast, social support ($r = -0.24$, $p < .001$), and age ($r = -0.22$, $p < .001$) showed a weak negative association with resilience.	Income ($B = .19$, $p < .001$), and social support ($B = .22$, $p < .001$) showed positive associations with resilience. In contrast, age was negatively associated with resilience ($B = -.14$, $p < .05$).

*** Age** (0 = 19–35 years, 1 = 36–59 years, 2 = greater than or equal to 60 years)
Unclear (The description of the Mean age or age range is unclear.

Risk of Bias Assessment

The risk of bias in the 15 included studies was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies (12). Overall, four studies met all eight criteria (14,19-20,24). A thorough description of the study subjects and setting (Q2), the identification of confounding factors (Q5), and the appropriate use of statistical analysis (Q8) were consistent strengths across all studies.

However, we identified several limitations and risks of bias. Specifically, most included studies (10 of 15) did not clearly describe the sample inclusion criteria (Q1). One study (16) described the exposure measurement method unclearly (Q3), while three studies (16-17,26) did not describe detailed procedures for sample measurement (Q4). Two studies (15,25) did not describe strategies to deal with confounding factors (Q6), whereas one study (16) described these strategies unclearly. Additionally, seven studies (4,13,16,18,21-23) did not clearly describe how they validated the instruments used to measure outcomes (Q7). Given these reporting and methodological limitations across multiple studies, the findings should be interpreted with consideration of the risk of bias in specific appraisal domains. The detailed results of this appraisal are illustrated in Table 3.

Table 3 Risk of bias assessment of the included studies

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Kirschenbaum et al. (18)	U	Y	Y	Y	Y	Y	U	Y
Tang et al. (24)	Y	Y	Y	Y	Y	Y	Y	Y
Rostami-Moez et al. (14)	Y	Y	Y	Y	Y	Y	Y	Y
Ao et al. (21)	U	Y	Y	Y	Y	Y	U	Y
Timalsina et al. (26)	U	Y	Y	U	Y	Y	Y	Y
Ao et al. (4)	U	Y	Y	Y	Y	Y	U	Y
Bian et al. (22)	U	Y	Y	Y	Y	Y	U	Y
Gün et al. (16)	Y	Y	U	U	Y	U	U	Y
Kiani et al. (19)	Y	Y	Y	Y	Y	Y	Y	Y
Ashida et al. (20)	Y	Y	Y	Y	Y	Y	Y	Y
Torpus et al. (15)	U	Y	Y	Y	Y	N	Y	Y
Gülsoy et al. (25)	U	Y	Y	Y	Y	N	Y	Y
Kılınç et al. (23)	U	Y	Y	Y	Y	Y	U	Y
Liao et al. (17)	U	Y	Y	U	Y	Y	Y	Y
Yin et al. (13)	U	Y	Y	Y	Y	Y	U	Y

Y: yes; N: no; U: unclear; N/A: not applicable
Q1. Were the criteria for inclusion in the sample clearly defined?
Q2. Were the study subjects and the setting described in detail?
Q3. Was the exposure measured in a valid and reliable way?
Q4. Were objective, standard criteria used for measurement of the condition?
Q5. Were confounding factors identified?
Q6. Were strategies to deal with confounding factors stated?
Q7. Were the outcomes measured in a valid and reliable way?
Q8. Was an appropriate statistical analysis used?

Factors Associated with Earthquake Preparedness Behaviors and Resilience

Based on the analysis of the 15 included studies, factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas were identified.

Guided by the integrated framework, these synthesized variables were organized into four analytical domains, as presented in Table 4. Detailed statistical estimates are provided in Table 2.

Table 4 Classification of variables based on the framework

Framework	Variable Domain	Independent Variables	Dependent Variables
Disaster Literacy Model (6)	- Predisposing factors	- Income - Social support - Education - Age	1. Earthquake Preparedness Behaviors 2. Resilience
	- Disaster literacy	- Disaster literacy	
	- Situational internal factor	- Self-efficacy	
Integrated Disaster Literacy Model (IDLM) (7)	- Socio-economic, cultural, and environmental factors	- Gender	
External Integration	- Exogenous factors	- Past disaster experience - Risk perception	

Bivariate Analysis of Earthquake Preparedness Behaviors

In the bivariate analysis, predisposing factors and situational internal factors were positively associated with preparedness behaviors. Specifically, social support (13), education level (14,18), self-efficacy (13,24), and disaster literacy (23,25) were significantly associated with preparedness behaviors. Exogenous factors, particularly risk perception (16,19-20) and past disaster experience (14,18,20), were also significantly associated with preparedness behaviors, although the direction of the association varied across studies. Gender (14) was also significantly associated with preparedness behaviors.

Multivariable Analysis of Earthquake Preparedness Behaviors

In the multivariable analysis, educational level was significantly positively associated with preparedness behaviors across both general and rural contexts (4,13,17-18,21-22). Similarly, gender (4,13,23), self-efficacy (13-14), disaster literacy (23), social support (13), and past disaster experience (17-18,20) remained significantly positively associated with preparedness across the included populations. In contrast, the intensity of earthquake experience was significantly negatively associated with preparedness among adult rural residents affected by the 2008 Wenchuan earthquake (21).

However, context-specific associations were also observed. For instance, while higher monthly income was positively associated with preparedness in general households across China and Taiwan (13,22), Liao et al. (17) observed a contrasting negative association when focusing specifically on older adults in Taiwan. Age showed context-dependent effects across studies conducted in rural Sichuan. In one study focusing on five rural counties (21), age showed a significant positive association with preparedness. In contrast, another study conducted in the same region across nine severely affected villages (4) showed that age was negatively associated with specific preparedness behaviors, such as purchasing insurance, stockpiling supplies, participating in drills, and acquiring disaster knowledge.

Additionally, risk perception is positively associated with disaster preparedness in the general population (19-20,22), but negatively associated among older adults (17).

Bivariate Analysis of Resilience

Bivariate analyses showed that disaster literacy had a significant positive association with individual resilience (15). Among older adults who had survived disasters, gender and income showed moderate positive associations with resilience (26). In contrast, age and social support showed weak negative associations with resilience among older disaster survivors (26). However, age has a significant positive association with resilience among individuals aged 18-52 years in Türkiye (15).

Multivariable Analysis of Resilience

In multivariable analysis, disaster literacy is significantly associated with resilience in adults (15). Among older adults with disaster survivors, income and social support were significantly positively associated with resilience. Conversely, age showed a significant negative association with resilience (26).

DISCUSSION

The findings of this systematic review provide an empirical understanding of the factors associated with earthquake preparedness behaviors and resilience among residents in earthquake-prone areas. The synthesis was guided primarily by the Disaster Literacy Model of Brown et al., supplemented by the Integrated Disaster Literacy Model (IDLM) and relevant exogenous factors, to organize the identified variables within a framework-driven perspective.

Associations between age, income, and preparedness varied across studies. Age showed positive, negative, or weak associations across studies (4,15,21,26). These differences may reflect variation in age distributions, population characteristics, and study settings. For instance, some studies investigated rural residents, while others included nationally representative populations. Similarly, income showed different associations in China and Taiwan (13,17,22), which may reflect differences in socioeconomic conditions, income measurement, and household characteristics. These findings indicate that demographic characteristics may have context-dependent associations with preparedness.

Education showed a relatively consistent positive association with disaster preparedness in studies conducted in China, Iran, Taiwan, and Israel (4,13-14,17-18,21-22). This pattern was evident among households, rural residents, older adults, and general adult populations, indicating that the association was observed across diverse population groups and settings. However, differences in educational levels among study populations may contribute to variation in this association.

Evidence on social support and gender was comparatively limited because relatively few included studies examined these factors. Social support showed positive associations with preparedness or resilience in the available studies (13,26). Gender was associated with preparedness in several studies (4,13-14,23); however, variations in population characteristics affect the direct comparison of study results.

Studies in Türkiye have consistently shown an association between disaster literacy and preparedness (23,25). These investigations encompassed diverse populations, such as adults, patients, and their relatives. These consistent findings may reflect similarities in geographical and sociocultural contexts. However, variations in population characteristics and measurement instruments should be considered when interpreting these results.

Self-efficacy has been consistently associated with increased disaster preparedness in studies conducted in China, Iran, and Taiwan (13-14,24,). Although the studies differed in population characteristics and instruments, they reported similar trends, supporting an association between self-efficacy and disaster preparedness.

Past disaster experience was positively associated with preparedness across studies conducted in Iran, Israel, Japan, and Taiwan

(14,17-18,20). This pattern may be related to greater familiarity with disaster risks and preparedness activities among individuals with previous disaster experience. However, Ao et al. (21) reported a different association when they examined earthquake intensity experience. This difference may reflect how disaster experience was defined and measured, because experience of a destructive earthquake and experience of earthquake intensity may capture different aspects of disaster exposure.

Risk perception was positively associated with preparedness across studies conducted in Türkiye (16), Pakistan (19), Japan (20), and Taiwan (22). In contrast, Liao et al. (17) identified a negative association among older adults in Taiwan. These discrepancies may be attributable to population characteristics, particularly age, as well as variations in disaster context. Consequently, the direction of the association between risk perception and preparedness may differ across populations and settings.

Ultimately, these findings provide a comprehensive understanding of earthquake preparedness behaviors and resilience. However, several factors-such as age, education, income, past disaster experience, risk perception, and disaster literacy-were derived from studies with potential risk of bias. Results from studies with unclear outcome measurement or inadequate adjustment for confounding should be interpreted cautiously, because risk of bias in specific appraisal domains may affect the certainty and interpretation of the findings.

CONCLUSION

This systematic review identified factors associated with earthquake preparedness behaviors and resilience, including income, education, age, gender, social support, self-efficacy, disaster literacy, past experience, and risk perception. However, these associations varied across different populations and geographical contexts. These findings support the development of context-specific interventions for earthquake preparedness behaviors and resilience. Future research should operationalize these factors into theoretically grounded intervention components and evaluate their effectiveness through well-designed experimental studies.

DECLARATION

The authors used Gemini to translate and Grammarly to polish the language and enhance the manuscript's overall readability. The authors subsequently reviewed and verified the content and revised the manuscript to ensure accuracy and compliance with academic standards. The authors explicitly state that all core research ideas, data synthesis, and conclusions are their original work.

LIMITATIONS

Several limitations should be considered when interpreting these findings. First, all included studies were cross-sectional, which restricts the ability to establish temporality or causality; longitudinal evidence was not available. Second, the search was restricted to English-language publications, and reference or citation tracking was not performed. This may have introduced language bias and increased the risk of missing relevant studies. Third, the use of a framework-guided synthesis and substantial heterogeneity in definitions and measurement instruments may have reduced comparability across studies. Fourth, the synthesis focused primarily on statistical significance, and publication bias and selective reporting could not be formally assessed; therefore, the possibility of such bias cannot be excluded. Fifth, most studies relied on self-reported measures, which are susceptible to social desirability bias, and some studies provided limited information on confounder adjustment, eligibility criteria, or instrument validity. Additionally, evidence on disaster resilience was limited, as only two included studies addressed this outcome. Only 15 of 3,347 identified records met the eligibility criteria, resulting in a relatively small evidence base. This may reflect the specificity of the eligibility criteria and could limit the comprehensiveness and generalizability of the

findings across diverse populations and geographical settings.

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FACTORS ASSOCIATED WITH HEAT-INDUCED PRODUCTIVITY LOSS AMONG MYANMAR MIGRANT FARM WORKERS IN MAE SOT, THAILAND

Khaing Thin Hlaing [1], Orapin Laosee [1] *, Cheerawit Rattanapan[1], Piyapong Janmaimool[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Nakhon Pathom, 73170, Thailand
**Corresponding Author: Orapin Laosee, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand, E-mail: orapin.lao@mahidol.ac.th*

ABSTRACT

Introduction: Heat-induced productivity loss occurs through presenteeism, characterized by reduced work-related productivity while remaining at work, and absenteeism resulting from heat-related health problems and absence from work. Myanmar migrant farm workers are highly vulnerable due to prolonged exposure to sunlight and limited access to healthcare, but evidence on their specific productivity losses remains limited.

Objectives: To assess the heat-induced productivity loss (presenteeism and absenteeism) and its associated factors among Myanmar migrant farm workers in Mae Sot, Thailand.

Methodology: A cross-sectional study was conducted among 250 Myanmar migrant farm workers aged 18–60 years who had lived in Mae Sot for at least six months. Data collection was conducted from May 01 to May 20, 2026. Participants were selected through multistage cluster sampling and interviewed using a structured questionnaire adapted from previous studies. Heat-induced productivity loss was measured using two different indicators: presenteeism (perceived work impairment) and absenteeism (missed working days). Data were analyzed using descriptive statistics, chi-square tests, and Multiple logistic regression using IBM SPSS Statistics version 31.

Results: Of the 250 Myanmar migrant farm workers surveyed, 50.4% reported high presenteeism. Younger age (<40years), male sex, lower income (≤170 THB per day), and frequent heat-related symptoms were significantly associated with high presenteeism. Use of heat-relief measures outside working hours was significantly associated with lower odds of high presenteeism. Heat-related absenteeism was reported by 64.0% of participants. Absenteeism was significantly associated with being female, undocumented worker, and frequent heat-related symptoms. In addition, absenteeism was significantly associated with higher income (>170 THB per day), although this association was not statistically significant.

Conclusion: High levels of presenteeism and absenteeism were observed among Myanmar migrant farm workers. Strengthening occupational heat prevention strategies and promoting effective heat-relief practices may reduce productivity loss and improve worker health under heat exposure.

Keywords:
Productivity Loss, Heat Stress, Presenteeism, Absenteeism, Myanmar Migrant Farm Workers

INTRODUCTION

Climate change has led to a significant increase in global average temperatures which have risen by about 1.1°C since pre-industrial times (1). Southeast Asia is a region particularly vulnerable to extreme heat due to a combination of physical and human pressures, including high population density, low adaptive capability, and a hot, humid climate (2). While global warming affects all populations, the impact is disproportionately felt by those in developing countries and tropical regions where heat stress is already a significant issue (3). Heat stress occurs when heat exceeds the body's ability to regulate temperature (4). The physiological response, known as heat strain, is characterized by increased body temperature, heart rate, and sweating (5) and may progress into heat-related illnesses, ranging from dizziness and fatigue to severe conditions like heat stroke (6).

Certain populations, including farmworkers, migrants, pregnant women, and children, are extremely vulnerable to heat stress (6). Occupational heat exposure is a major hazard for outdoor workers, especially those in labor-intensive sectors such as agriculture and construction (7). Globally, more than 2.4 billion workers are exposed to workplace heat stress, resulting in an estimated 22.85 million occupational injuries and 18,970 fatalities annually (3). Beyond direct health impacts, heat exposure significantly compromises work productivity. Physiological heat strain reduces a worker's physical capacity, often forcing them to slow down or take unscheduled breaks as a natural defense mechanism to reduce internal heat production (7). By 2030, 2.2% of total working hours worldwide could be lost to high temperatures (8). Heat-related productivity may also be influenced by workers' opportunities to recover from heat exposure outside working hours (9). Access to cooling, hydration, and adequate rest may help reduce residual heat strain and support recovery between work periods (3).

Thailand is experiencing rising temperatures, with daily maximums frequently exceeding 40°C, a trend expected to worsen due to climate change (10). In Thailand, predictive models under future climate change scenarios estimate that heat stress will reduce general work performance by 4%-10% annually, and up to 50% during peak summer months (2). Agriculture is a cornerstone of the Thai economy, employing approximately 30% of the national workforce and relying heavily on migrant laborers, primarily from Myanmar (11).

Tak Province, located on the border with Myanmar, hosts one of the largest migrant populations in the country, with Mae Sot district serving as a key economic and migrant worker hub (12). As of 2024, it is estimated that 42% of the population in Mae Sot are non-Thai residents, predominantly from Myanmar. The majority of Myanmar migrant workers are employed in agricultural sectors (13), and they are often in irregular situations and earn below the minimum wage (14). A 2021 ILO survey found that over half of migrant farm workers experienced dizziness and headaches from prolonged exposure to sunlight and high temperatures (15). Despite growing evidence on the health impacts of occupational heat exposure, research focusing specifically on heat-induced productivity loss among Myanmar migrant agricultural workers remains limited. This gap is particularly important in border areas such as Mae Sot, where migrant workers often experience precarious employment conditions, prolonged heat exposure, and limited workplace protections. Empirical evidence is needed to better understand how occupational heat stress affects presenteeism, absenteeism, and heat-related health outcomes in this vulnerable population.

This study aims to provide essential empirical evidence on heat-induced productivity losses among Myanmar migrant farm workers, addressing a key gap in regional occupational health literature (16). By focusing on worker perceptions, the findings will support the design of practical, worker-centered interventions, such as optimized work-rest cycles and hydration strategies, to mitigate heat strain. Ultimately, this research will guide employers and policymakers in establishing necessary protective regulations that safeguard both worker well-being and economic productivity in the face of rising global temperatures.

METHODOLOGY

Study Design and Study Population

It was a cross-sectional design conducted in Mae Sot District, Tak Province, Thailand. The required sample size was calculated using Cochran's formula, resulting in a target sample size of 384 participants. Adding 10% for non-response resulted in a target sample of 422. Participants were recruited using a multistage sampling method. Firstly, sub-districts and villages in Mae Sot District with high concentrations of Myanmar migrant agricultural workers were purposively selected. Secondly, agricultural farms within the selected areas were identified. Finally, eligible Myanmar migrant agricultural workers aged 18–60 years who had resided in Mae Sot for ≥6 months were selected

from these farms using simple random sampling. At the time of this preliminary analysis, 250 workers had been recruited.

Data Collection Procedures

After getting MUCIRB approval, community leaders in Mae Sot were informed about the study. Informed consent was obtained from participants. Face-to-face interviews were conducted in Myanmar using structured questionnaires via KoboToolbox from May 1 to 20, 2026.

Research Instruments

The questionnaires were adapted from previous studies (9, 17) and modified for Myanmar migrant farm workers in Mae Sot. Content validity was assessed by three experts using the Item-Objective Congruence (IOC) method, with all items showing IOC values >0.5. A pilot test with 30 workers showed acceptable internal consistency (Cronbach's α = 0.68–0.74). The questionnaire captured four sections: 1) Socio-demographic, 2) Occupational, 3) Heat-related characteristics, and 4) Heat-induced productivity loss.

Working hours per day and direct sunlight exposure were categorized as ≤8 and >8 hours/day based on the observed distribution and to distinguish exposure within a standard 8-hour workday from exposure exceeding 8 hours. Heat-related symptoms were classified as frequent or less frequent using the median. Heat-related symptoms were assessed using Likert-scale items and categorized as frequent or less frequent based on the mean score. Presenteeism (perceived work impairment) was assessed in 5 areas: motivation, speed, physical strength, concentration and quality reduction on daily tasks on hot days. It was dichotomized into high and low presenteeism using the mean score (mean = 16.57 ± 8.541) as the cutoff. Absenteeism was measured as the percentage of scheduled workdays missed or left early due to heat-related conditions during the previous three months and dichotomized as 0% (no absenteeism) versus >0% (any absenteeism).

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics version 31. Descriptive analyses were employed to describe the characteristics of respondents. Chi-square tests were used to identify associations between independent variables and dependent variables. Variables with $p < 0.25$ in the bivariate analysis were entered into a multiple logistic regression model. A forced-entry procedure was used to identify independent predictors of high presenteeism and absenteeism. Multicollinearity was assessed using VIF < 10. Adjusted odds ratios (aOR) and 95% CIs were reported, with $p < 0.05$ considered significant.

RESULTS

General characteristics of respondents

Table 1 presents the characteristics of the respondents (n=250). Age was equally distributed, with 125 (50%) of < 40 years and 125 (50%) of 40 years and above. The majority of the respondents were female (62%), married (78%), and had not attended school or had completed only primary education (64.4%). Nearly half of the respondents were undocumented workers (44.4%). The majority were non-smokers (80.8%), non-alcohol drinkers (89.6%), and earned <170THB per day (80%).

Regarding the occupational and heat-related characteristics, the majority of the respondents worked for more than 8 hours per day (89.2%) and were directly exposed to sunlight for more than 8 hours (88%). Regarding heat relief measures during working hours, 40% reported a low frequency of use, while 60.0% reported a high frequency. Similarly, 55.2% reported a low frequency of heat relief measures outside working hours, compared with 44.8% who reported a high frequency. For heat-related symptoms, of respondents had a low frequency, while 44% reported a high frequency

Table 1 Characteristics of respondents (n= 250)

Categories	Number	Percent
Age (Years)		
Min – 18, Max- 60, Median 39.5, IQR - 20		
Sex		
Male	95	38.0
Female	155	62.0
Marital Status		
Single/Divorced/ Widow/ Separated	55	22.0
Married	195	78.0
Education Level		
Did not attend school through primary school	161	64.4
Middle school and higher	89	35.6
Documentation status		
Undocumented	111	44.4
Documented (Temporary/ Long-term visa/ Work permit)	139	55.6
Income per day		
≤170 THB per day	200	80.0
>170 THB per day	50	20.0
Min – 100, Max- 500, Median 39.5, IQR - 10		
Alcohol Status		
Non-drinker	224	89.6
Drinker	26	10.4
Working hours per day		
≤ 8 hours per day	27	10.8
> 8 hours per day	223	89.2
Min – 7, Max- 9, Median- 9, IQR - 0		
Hours of direct exposure to sunlight		
≤ 8 hours per day	30	12.0
> 8 hours per day	220	88.0
Min – 3, Max- 9, Median -9, IQR - 0		
Heat relief measures during working hours		
Low frequency	150	60.0
High frequency	100	40.0
Min – 2, Max- 12, Median -9, IQR - 3		
Heat relief measures outside of working hours		
Low frequency	138	55.2
High frequency	112	44.8
Min – 2, Max- 12, Median -9, IQR - 3		
Heat-related symptoms		
Low frequency	140	56.0
High frequency	110	44.0
Min – 5, Max- 38, Mean ±SD (19.87 ±5.599)		

*IQR= Interquartile Range, SD= Standard Deviation

Of 250 Myanmar migrant farm workers surveyed, 50.4% were classified as having high presenteeism, while 49.6% had low presenteeism. Regarding absenteeism, 64% reported absenteeism and 36 % reported no absenteeism (Table 2)

Table 2 Prevalence of heat-induced productivity loss among Myanmar migrant farm workers (n=250)

Outcome	Category	n (%)	Total
Presenteeism	High	126 (50.4)	250 (100.0)
	Low	124 (49.6)	
Absenteeism	Yes	160 (64.0)	250 (100.0)
	No	90 (36.0)	

Table 3 shows the association between independent variables and dependent variables (presenteeism and absenteeism) using the chi-square test. In terms of presenteeism, age was significantly associated with high presenteeism, as 57.6% of respondents aged <40 years reported high presenteeism compared with those aged ≥40 years. High presenteeism was also more common among male respondents (60.0%) and among those earning ≤170 THB per day (56.0%). In addition, respondents who worked more than 8 hours per day (52.9%) and those who were exposed to direct sunlight for more than 8 hours per day showed a prevalence of high presenteeism (53.6%). High presenteeism was also more prevalent among respondents who reported a low frequency of heat relief measures outside working hours (54.0%) and among those who had a high frequency of heat-related symptoms (61.8%).

In terms of absenteeism, sex was significantly associated with a higher proportion of females (69.0%) reporting absenteeism compared to males (55.8%). Documentation status was significantly associated with absenteeism. A higher proportion of undocumented workers reported absenteeism (73.0%) compared with documented workers (56.8%)

Table 3 Association between independent variables and presenteeism and absenteeism using Chi-square tests (n= 250)

Variables	Number	Presenteeism			Absenteeism		
		High n (%)	Low n (%)	P value	Yes n (%)	No n (%)	P value
Age				**0.023**			0.292
<40yrs	125	72 (57.6)	53 (42.4)		84 (67.2)	41 (32.8)	
40yrs and above	125	54 (43.2)	71 (56.8)		76 (60.8)	49 (39.2)	
Sex				**0.017**			**0.034***
Male	95	57 (60.0)	38 (40.0)		53 (55.8)	42 (44.2)	
Female	155	69 (44.5)	86 (55.5)		107 (69.0)	48 (31.0)	
Marital Status				0.107			0.703
Single/Divorced/ Widow/ Separated	55	33 (60.0)	22(40.0)		34(61.8)	21 (38.2)	
Married	195	93 (47.7)	102 (52.3)		126 (64.6)	69 (35.4)	
Education Level				0.059			0.415
Did not attend school to primary school	161	74 (46.0)	87 (54.0)		106 (65.8)	55 (34.2)	
Middle school and higher	89	52 (58.4)	37 (41.6)		54 (60.7)	35 (39.3)	
Documentation status			0.077			**0.008****	
Undocumented	111	49 (44.1)	62 (55.9)		81 (73.0)	30 (27.0)	
Documented	139	77 (55.4)	62 (44.6)		79 (56.8)	60 (43.2)	

Variables	Number	Presenteeism			Absenteeism		
		High n (%)	Low n (%)	P value	Yes n (%)	No n (%)	P value
Income per day				**<0.001**			0.100
≤170 THB per day	200	112(56.0)	88 (44.0)		123 (61.5)	77 (38.5)	
>170 THB per day	50	14 (28.0)	36 (72.0)		37 (74.0)	13 (26.0)	
Alcohol Status				0.432			0.060
Non-drinker	224	111 (49.6)	113 (50.4)		139 (62.1)	85 (37.9)	
Drinker	26	15 (57.7)	11 (42.3)		21 (80.8)	5 (19.2)	
Working hours per day				**0.022**			0.760
≤ 8 hours per day	27	8 (29.6)	19(70.4)		18 (66.7)	9 (33.3)	
> 8 hours per day	223	118 (52.9)	105 (47.1)		142 (63.7)	81 (36.3)	
Hours of direct exposure to sunlight				**0.006**			0.465
≤ 8 hours per day	30	8 (26.7)	22 (73.3)		21 (70.0)	9 (30.0)	
> 8 hours per day	220	118 (53.6)	102 (46.4)		139 (63.2)	81 (36.8)	
Heat relief measures during working hours				0.163			0.591
Low frequency	150	81 (54.0)	69 (46.0)		98 (65.3)	52 (34.7)	
High frequency	100	45(45.0)	55 (55.0)		62 (62.0)	38 (38.0)	
Heat relief measures outside of working hours				0.004			0.159
Low frequency	138	81 (58.7)	57 (41.3)		83 (60.1)	55 (39.9)	
High frequency	112	45 (40.2)	67 (59.8)		77 (68.8)	35 (31.3)	
Heat-related symptoms				**0.001**			0.080
Low frequency	140	58 (41.4)	82 (58.6)		83 (59.3)	57 (40.7)	
High frequency	110	68 (61.8)	42 (38.2)		77 (70.0)	33 (30.0)	

Table 4 presents the results of binary and multiple logistic regression analyses assessing the predictors of high presenteeism. In multiple logistic regression, five significant predictors were identified. Age was significantly associated with high presenteeism. Participants aged <40 years had significantly higher odds of high presenteeism compared to those aged 40 years and above (aOR = 1.8, 95% CI: 1.027-3.140). Males had significantly higher odds of high presenteeism than females (aOR = 1.87, 95% CI: 1.041-3.360). Respondents with a daily income of ≤170 THB and those who experienced a high frequency of heat-related symptoms had significantly higher odds of high presenteeism (aOR = 2.74, 95% CI: 1.266-5.905 and aOR = 2.09, 95% CI: 1.188-3.659, respectively). Conversely, respondents who reported a high frequency of heat-relief measures outside of working hours had significantly lower odds of high presenteeism (aOR = 0.55, 95% CI: 0.302-0.995).

Table 4 Binary and multiple logistic regression analyses of predictors of high presenteeism

Predictor Variable	cOR (95%CI)	P value	aOR (95%CI)	P value
Age (ref:40yrs and above)				
<40yrs	1.79 (1.082-2.948)	**0.023**	1.80 (1.027-3.140)	**0.04**
Sex (ref: Female)				
Male	1.87 (1.113-3.140)	**0.018**	1.87 (1.041-3.360)	**0.04**
Marital Status (ref: Single/Divorced/ Widow/ Separated)				
Married	1.65 (0.895-3.023)	0.109	0.53 (0.266-1.057)	0.07
Education Level (ref: Did not attend school to primary school)				
Middle school and higher	1.65 (0.979-2.788)	0.06	1.50 (0.817-2.735)	0.19

Predictor Variable	cOR (95%CI)	P value	aOR (95%CI)	P value
Documentation status (ref: Documented (Temporary/ Long-term visa/ Work permit)				
Undocumented	0.64 (0.385-1.051)	0.078	0.81 (0.458-1.441)	0.48
Income per day (ref: >170 THB per day)				
≤170 THB per day	3.27 (1.662-6.444)	**<0.001**	2.74 (1.266-5.905)	**0.01**
Alcohol Status (ref: Non-drinker)				
Drinker	1.39 (0.611-3.155)	0.434	_____	____
Working hours per day (ref: ≤ 8 hours per day)				
> 8 hours per day	2.67 (1.122-6.351)	**0.026**	0.31 (0.025-3.938)	0.37
Hours of direct exposure to sunlight (ref:≤ 8 hours per day)				
> 8 hours per day	3.18 (1.358-7.454)	**0.008**	3.78 (0.314-45.448)	0.30
Heat relief measures during working hours (ref: Low frequency)				
High frequency	0.70 (0.419-1.159)	0.164	0.64 (0.350-1.173)	0.15
Heat relief measures outside of working hours (ref: Low frequency)				
High frequency	0.47 (0.285-0.785)	**0.004**	0.55 (0.302-0.995)	**0.049**
Heat-related symptoms (ref: Low frequency)				
High frequency	2.29 (1.373-3.815)	**0.001**	2.09 (1.188-3.659)	**0.011**

Table 5 presents the results of binary and multiple logistic regression analyses assessing the independent predictors of absenteeism. In the multiple logistic regression analysis, four significant predictors were identified. Females had significantly higher odds of absenteeism than males (aOR = 2.63, 95% CI: 1.416-4.891). Undocumented workers and alcohol drinkers had significantly higher odds of absenteeism (aOR= 1.8, 95% CI: 1.0220-3.167 and aOR= 5.07, 95% CI: 1.665-15.455, respectively). Respondents who experienced a high frequency of heat-related symptoms had significantly higher odds of absenteeism (aOR= 2.19, 95% CI: 1.223-3.914).

Table 5 Binary and multiple logistic regression analyses of predictors of absenteeism

Predictor Variable	cOR (95%CI)	P value	aOR (95%CI)	P value
Age (ref:40yrs and above)				
<40yrs	1.32 (0.787-2.217)	0.292	_____	____
Sex (ref: Male)				
Female	1.77 (1.041-2.998)	**0.035**	2.63 (1.416-4.891)	**0.002**
Marital Status (ref: Single/Divorced/ Widow/ Separated)				
Married	1.13 (0.608-2.093)	0.703	_____	____
Education Level (ref: Did not attend school to primary school)				
Middle school and higher	0.80 (0.469-1.368)	0.416	_____	____
Documentation status (ref: Documented (Temporary/ Long-term visa/ Work permit)				
Undocumented	2.05 (1.199-3.508)	**0.009**	1.80 (1.020-3.167)	**0.042**
Income per day (ref: ≤170 THB per day)				
>170 THB per day	1.78 (0.891-3.563)	0.102	2.09 (0.986-4.411)	0.054
Alcohol Status (ref: Non-drinker)				
Drinker	2.57 (0.934-7.065)	0.068	5.07 (1.665-15.455)	**0.004**
Working hours per day (ref:≤ 8 hours per day)				
> 8 hours per day	0.88 (0.376-2.041)	0.76	_____	____
Hours of direct exposure to sunlight (ref:≤ 8 hours per day)				
> 8 hours per day	0.74 (0.321-1.682)	0.47	_____	____
Heat relief measures during working hours (ref: Low frequency)				
High frequency	0.87 (0.514-1.473)	0.604	_____	____
Heat relief measures outside of working hours (ref: Low frequency)				
High frequency	1.46 (0.862-2.465)	0.159	1.07 (0.606-1.885)	0.817

Predictor Variable	cOR (95%CI)	P value	aOR (95%CI)	P value
Heat-related symptoms (ref: Low frequency)				
High frequency	1.60 (0.944-2.720)	0.081	2.19 (1.223-3.914)	**0.008**

DISCUSSION

This study identified a high burden of heat-induced productivity loss among Myanmar migrant farm workers in Mae Sot. Heat-related symptoms were independently associated with both presenteeism and absenteeism, consistent with previous studies reporting that heat-related symptoms negatively affect work-related activities and increase absenteeism (9). Conversely, workers who frequently used heat-relief measures outside of working hours had lower odds of high presenteeism. This suggests that recovery practices, such as hydration and resting in shaded areas after work, may reduce heat strain and help to maintain workers' ability to perform their tasks. Previous studies have similarly indicated that adequate recovery and cooling during and after heat exposure may reduce physiological heat strain, fatigue, and performance impairment among workers in hot environments (3, 18, 19).

Several sociodemographic factors such as younger age, male sex, and individuals and lower income were independently associated with high presenteeism. Similar findings have been reported that male and low-income workers were more vulnerable to productivity loss (20). These findings demonstrate that socioeconomic vulnerability contributes to presenteeism among migrant workers and emphasize the need for workplace protection, heat-related health education, and supportive employment policies.

Regarding absenteeism, undocumented status was independently associated with higher odds of absenteeism; this may reflect greater employment insecurity, limited access to occupational health protection, and barriers to healthcare and workplace resources. Alcohol consumption was also associated with absenteeism. Although the finding is consistent with the previous study (20), it should be interpreted with caution due to the small subgroup size, which indicates limited precision of the estimate. Overall, these findings highlight the need for heat prevention strategies, workplace protections, health education, and supportive employment policies to mitigate productivity loss among migrant farm workers.

CONCLUSION

Overall, 50.4% of the participants reported presenteeism while 64% reported absenteeism. Heat-related symptoms were significantly associated with both presenteeism and absenteeism. Male workers reported significantly higher presenteeism, while female workers reported higher absenteeism. Similarly, workers with lower income (≤170 THB/day) also reported higher presenteeism, while the higher-income workers reported higher absenteeism, although this association was not statistically significant. Frequent use of heat-relief measures outside working hours was associated with lower odds of presenteeism.

RECOMMENDATIONS

These findings highlight the need for coordinated actions from policymakers, implementing partners, and researchers to reduce the impact of occupational heat exposure on the health and productivity of Myanmar migrant farm workers. Firstly, relevant government agencies should strengthen occupational heat protection policies for agricultural workers, including guidelines on

work-rest schedules, access to drinking water, shaded rest areas, and heat-health education. Special attention should be given to undocumented migrant workers who may have limited access to occupational health protections. Secondly, employers, local health authorities, and non-governmental organizations should promote workplace heat mitigation measures and awareness programs on heat-related illness prevention.

Moreover, future studies should use longitudinal designs and objective measures of heat exposure and productivity to reduce reporting bias. Research involving migrant workers in different occupations and settings is also recommended to improve generalizability.

ETHICAL DECLARATION

The study was approved by the Mahidol University-Central Institutional Review Board (MU-CIRB), Office of the President, Mahidol University, on April 21, 2026. The COA number was MU-CIRB 2026/172.2104. Written informed consent was obtained from all participants. Participation was voluntary, with confidentiality maintained and no data shared with local authorities. Participants could decline any question, and three-digit identification codes were used without recording names to protect privacy.

LIMITATIONS

Heat-induced productivity loss (presenteeism and absenteeism) and other variables such as working hours, sunlight exposure hours, use of heat relief measures and heat-related symptoms were based on self-reported responses, which may be subject to recall bias. Participants may have under- or overreported symptoms and behaviors, although short recall periods and experienced interviewers may have reduced reporting bias. As the study included only Myanmar migrant outdoor workers in Mae Sot, the findings may not be generalizable to other migrant populations or settings.

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POST-DISASTER RESILIENCE AND FACTORS ASSOCIATED WITH RESILIENCE AMONG VOLUNTEERS RESPONDING TO THE 2025 SAGAING-MANDALAY EARTHQUAKE IN MYANMAR

Thwet Su Su Htwe[1*], Htet Zaw Shein[1], Wandee Sirichokchatchawan[1,2]

[1] College of Public Health Sciences, Chulalongkorn University, 10330, Thailand.

[2] Excellent Center for Health and Social Sciences and Addiction Research, Bangkok, Thailand.

** **Corresponding Author:** Thwet Su Su Htwe, College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, Email:6874012153@student.chula.ac.th*

ABSTRACT

Introduction: Volunteers play an important role in disaster response and recovery but may face substantial stress and operational challenges. Resilience is important for adapting and coping with these challenges.

Objectives: To assess post-disaster resilience and identify factors associated with resilience among volunteers involved in the response to the 2025 Sagaing-Mandalay earthquake in Myanmar.

Methodology: A cross-sectional study was conducted between May and June 2026 among 259 volunteers involved in earthquake response and recovery activities. Data were collected using a self-administered online questionnaire. Post-disaster resilience was measured using the Brief Resilient Coping Scale (BRCS) and categorized as low or moderate/high resilience. Bivariate analyses were conducted using Chi-square or Fisher's exact tests. Variables meeting the exploratory screening criterion of $p < 0.10$ were subsequently examined using univariable binary logistic regression. Crude odds ratios (CORs) with 95% confidence intervals (CIs) were reported.

Results: Overall, 77.2% of participants demonstrated moderate-to-high resilience. Perceived social support and perceived organisational support were significantly associated with resilience in the bivariate analysis ($p < 0.001$). In univariable logistic regression, volunteers reporting high perceived organisational support had higher odds of moderate-to-high resilience than those reporting low organisational support (COR = 4.163, 95% CI: 1.080-16.052, $p = 0.038$).

Conclusion: Most volunteers demonstrated moderate-to-high resilience following the 2025 Sagaing-Mandalay earthquake. High perceived organisational support was associated with resilience in the univariable analysis, although the estimate was unadjusted and should be interpreted cautiously. Further research is needed to confirm this relationship.

Keywords:

Post-Disaster Resilience; Volunteers; Organisational Support; Earthquake; Myanmar

INTRODUCTION

Natural disasters represent a major global public health challenge, causing substantial mortality, morbidity, displacement, and socioeconomic disruption each year. Earthquakes are among the most devastating natural hazards due to their sudden onset and potential to cause widespread destruction of infrastructure, disruption of essential services, and long-term impacts on affected populations. Beyond the immediate physical consequences, disasters often result in significant psychological and social impacts that may persist long after the event, affecting both affected communities and individuals involved in response and recovery activities (1).

Myanmar is one of the most disaster-prone countries in Southeast Asia and is highly vulnerable to multiple natural hazards, including earthquakes, cyclones, floods, and landslides. The country is located along several active tectonic structures, particularly the Sagaing Fault, one of the region's major strike-slip fault systems. Combined with rapid urbanization,

vulnerable infrastructure, limited disaster preparedness capacity, and ongoing humanitarian challenges, these factors increase the population's susceptibility to disaster-related impacts and complicate emergency response efforts (2,3).

On 28 March 2025, Myanmar experienced one of its most destructive earthquakes in recent history. A magnitude 7.7 earthquake struck near Sagaing, followed shortly by a magnitude 6.7 aftershock, causing widespread devastation across Sagaing and Mandalay regions. The disaster resulted in thousands of deaths and injuries, extensive population displacement, and severe damage to homes, health facilities, transportation networks, and other critical infrastructure (2,3). The scale of destruction generated substantial humanitarian needs and placed considerable pressure on emergency response and recovery systems.

Volunteers constitute an essential component of disaster response and recovery efforts. They provide a wide range of services, including emergency relief, logistics support, healthcare assistance, and community outreach. Their contributions are particularly important in resource-limited settings where formal emergency response capacities may be insufficient to meet urgent needs. During the Sagaing-Mandalay earthquake response, volunteers from diverse professional and community backgrounds played a vital role in supporting affected populations. Despite their critical role, volunteers are frequently exposed to stressful and potentially traumatic experiences during disaster operations, including witnessing human suffering, working under resource constraints, and responding to rapidly changing situations (4).

Resilience refers to the ability to adapt positively and recover from adversity, stress, or traumatic experiences. Among disaster responders, resilience is considered an important protective factor that facilitates effective coping and psychological adaptation. Previous studies have shown that higher levels of resilience are associated with better mental health outcomes, reduced psychological distress, and greater capacity to function effectively under challenging circumstances (5,6). Understanding factors that promote resilience among volunteers is therefore essential for strengthening disaster preparedness and response systems.

Social and organizational support have been consistently identified as important determinants of resilience. Social support from family, friends, and significant others can provide emotional, informational, and practical resources that help individuals manage stress and adversity. Similarly, organizational support, including effective leadership, communication, supervision, recognition, and access to resources, may enhance volunteers' confidence and coping abilities during disaster response activities (6,7). However, evidence regarding resilience and its associated factors among disaster volunteers in Myanmar remains limited.

Understanding the resilience of volunteers involved in the 2025 Sagaing-Mandalay earthquake response may provide valuable evidence for strengthening volunteer support systems and improving future disaster preparedness efforts. Therefore, this study aimed to assess post-disaster resilience and identify factors associated with resilience among volunteers involved in the response to the Sagaing-Mandalay earthquake in Myanmar.

METHODOLOGY

Study Design, Settings, and Participants

A cross-sectional study was conducted between May and June 2026 among Sagaing-Mandalay earthquake volunteers in Myanmar. These regions experienced a tremendous impact from the 2025 earthquake, causing substantial damage to critical infrastructure, including health facilities, and creating major operational pressure on emergency response and clinical service delivery during and immediately after the disaster. Eligible participants were volunteer frontline healthcare responders (including paramedics and allied health professionals) who were 18 years and above and participated in response and recovery activities during this

event. This study employed snowball sampling through volunteer networks. The initial sample size was calculated using Cochran's formula for an unknown population proportion, assuming a 95% confidence level (Z = 1.96), a proportion of 0.50, and a 5% margin of error. The calculated minimum sample size was 384 participants. After allowing for an anticipated 20% non-response, the target sample size was increased to 461 participants. At the time of this preliminary analysis, data collection was ongoing and 259 eligible volunteers had completed the survey; these participants were included in the present analysis.

Measurements

The questionnaire consisted of five sections: (1) Sociodemographic characteristics (2) Critical Incident exposure (3) Perceived social and organizational support (4) Lifestyle factors (covering smoking, drinking and drugs) and (5) Post-disaster resilience factors.

Variables were selected a priori based on previous literature and a conceptual framework in which sociodemographic, socioeconomic, occupational, health, and lifestyle characteristics were considered potential covariates; critical incident exposure represented disaster-related exposure; and perceived social and organisational support represented psychosocial and organisational resource factors potentially associated with resilience.

Perceived social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS), a 12-item instrument assessing support from family, friends, and significant others (9). As there are no standard cut-off points for the MSPSS and the scores in this study were not normally distributed, total scores were categorized into low, moderate, and high levels using the median and interquartile range (IQR) for this preliminary analysis.

Perceived organisational support was assessed using three Likert-scale items measuring perceived workplace support during earthquake response, including supervisor support, team support, and organisational concern for staff wellbeing. Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Item scores were summed to generate a total perceived organisational support score ranging from 3 to 15, with higher scores indicating greater perceived organisational support. Total scores were categorized as low (3-9), moderate (10-12), and high (13-15) perceived organisational support based on the observed distribution of scores in the study sample (7).

Resilience, the study outcome, was measured using the Brief Resilient Coping Scale (BRCS), a validated four-item instrument designed to assess adaptive coping and resilience in response to stress (10). The original BRCS classifies scores as low (4-13), medium (14-16), and high (17-20) resilient coping. For this preliminary analysis, the medium and high categories were combined into moderate/high resilient coping (14-20) to reduce sparse categories and provide a more stable binary outcome for exploratory analysis. Thus, resilience was categorized as low (4-13) and moderate/high (14-20).

The study questionnaire was assessed for content validity using the Index of Item-Objective Congruence (IOC) through expert review. Prior to the main data collection, the questionnaire was pretested among 30 participants to assess its reliability and comprehensibility. The overall measurement instrument demonstrated acceptable internal consistency, with a Cronbach's alpha coefficient of 0.753.

Data Collection

Data were collected using a self-administered online questionnaire developed in Google Forms. Recruitment was conducted through the distribution of an advertisement leaflet containing a QR code linking directly to the survey. The leaflet was disseminated via commonly used social media platforms, including Facebook, Messenger, Telegram, and Viber. In addition, focal volunteers assisted in further distributing the survey invitation through

their volunteer networks to facilitate participant recruitment.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0. Descriptive statistics were used to summarize participant characteristics and study variables. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using means and standard deviations or medians and interquartile ranges, as appropriate.

Variables examined in the study were identified a priori based on the conceptual framework and previous literature on resilience among disaster responders. These included sociodemographic and socioeconomic characteristics, occupational characteristics, critical incident exposure, perceived social support, perceived organisational support, health-related characteristics, and lifestyle factors.

Bivariate analyses were conducted using Chi-square tests or Fisher's exact tests, as appropriate, to examine associations between these variables and post-disaster resilience. For the purpose of exploratory screening, variables showing evidence of an association at $p < 0.10$ in the bivariate analysis were subsequently examined using univariable binary logistic regression. The less restrictive screening threshold was used to avoid prematurely excluding potentially relevant variables at this exploratory stage. Crude odds ratios (CORs), 95% confidence intervals (CIs), and p-values were reported. As this was a preliminary exploratory analysis, multivariable logistic regression was not performed; therefore, adjusted odds ratios (AORs) were not estimated. The reported associations are unadjusted and should not be interpreted as independent associations after controlling for potential confounding. Statistical significance was set at $p < 0.05$.

RESULTS

General Characteristics of Participants

A total of 259 volunteers participated in the study as summarized in Table 1 . The median age was 35 years (IQR: 27–45), with 60.2% aged 31 years and above. Most participants were female (61.0%), had attained a bachelor's degree or higher (71.0%), and reported responsibility for household dependents (69.9%). Nearly half were allied health professionals (46.3%). High levels of perceived social support and organizational support were reported by 72.2% and 44.8% of participants, respectively.

Table 1 General characteristics of study participants, 2026 (n = 259)

Characteristics	Frequency (Percentage)
Sociodemographic Characteristics	
Age Group	
30 years and younger	103 (39.8)
31 and above	156 (60.2)
Median (IQR)	35 (27-45)
Min-Max	18-75
Gender	
Male	101 (39)
Female	158 (61)
Highest Education Attainment	
Basic Education	75 (29)
Bachelor's Degree and above	184 (71)
Marital Status	
Single	135 (52.1)
Others	124 (47.9)

Characteristics	Frequency (Percentage)
Monthly Income Level	
500,000 MMK and below	148 (57.1)
More than 500,000 MMK	111 (42.9)
Median (IQR)	500,000 (300,000-1,000,000)
Min-Max	0-18,000,000
Occupation	
Medical Doctors	83 (32)
Midwifery and Nurses	5 (1.9)
Medics and Volunteers	16 (6.2)
Allied Health Professionals	120 (46.3)
Others	35 (13.5)
Ethnicity	
Burma	239 (92.3)
Others	20 (7.7)
Religion	
Buddhism	255 (98.5)
Others	4 (1.5)
Responsibility for Household Dependents	
Yes	181 (69.9)
No	78 (30.1)
Working Experience Levels	
5 years and less	81 (31.3)
6 to 10 years	61 (23.6)
11 years and above	117 (45.2)
Median (IQR)	10 (4-20)
Min-Max	0-45
Critical Incident Exposure Level	
Low	63 (24.3)
Moderate	115 (44.4)
High	81 (31.3)
Median (IQR)	6 (5-8)
Min-Max	1-14
Perceived Social Support Level	
Low	6 (2.3)
Moderate	66 (25.5)
High	187 (72.2)
Median (IQR)	68 (60-72)
Min-Max	20-84
Perceived Organisational Support Level	
Low	11 (4.2)
Moderate	132 (51.0)
High	116 (44.8)
Median (IQR)	11 (10-12)
Min-Max	3-15
Lifestyle Characteristics	
History of non-communicable disease	
Yes	18 (6.9)
No	241 (93.1)

Characteristics	Frequency (Percentage)
Smoking Status	
Never smoked	221 (85.3)
Former smoker	16 (6.2)
Current smoker	22 (8.3)
Alcohol Consumption Status	
Drinker	95 (36.7)
Non-drinker	164 (63.3)
Drug Abuse History	
Yes	4 (1.5)
No	255 (98.5)

Proportion of Post-Disaster Resilience

Overall, 77.2% of participants demonstrated moderate-to-high resilience, whereas 22.8% exhibited low resilience. BRCS responses demonstrated generally high resilience among volunteers (Figure 1). The highest proportions of positive responses were observed for growing positively through difficulties (83.4%), followed by replacing losses encountered in life (73.0%) and controlling reactions to difficult situations (73.0%). Fewer participants reported using creative ways to alter difficult situations (46.7%). In *Table 2*, higher proportions of moderate-to-high resilience were observed among volunteers aged 31 years and above (80.8%) compared with those aged 30 years and younger (71.8%). Similarly, volunteers with monthly incomes above 500,000 MMK showed a higher prevalence of moderate-to-high resilience (82.9%) than those with lower incomes (73.0%). The prevalence of moderate-to-high resilience was also greater among participants reporting high perceived social support (83.4%) and high perceived organizational support (87.9%).

Table 2 Bivariate analysis of the factors associated with post-disaster resilience among volunteers of the Sagaing-Mandalay earthquake, Myanmar, 2026 (n = 259)

Characteristics	Post-disaster Resilience		Pearson Chi-square		Binary Logistic Regression		
	Low	Moderate/ High	X^2	*p*-value	COR[b]	(95% CI[c]) LL-UL	*p*-value
Age Group							
30 years and younger	29 (28.2)	74 (71.8)	2.809	0.094*	Ref		0.095
31 and above	30 (19.2)	126 (80.8)			1.646	0.916-2.956	
Gender							
Male	20 (19.8)	81 (80.2)	0.835	0.361			
Female	39 (24.7)	119 (75.3)					
Highest Education Attainment							
Basic Education	14 (18.7)	61 (81.3)	1.015	0.333			
Bachelor's degree and above	45 (24.5)	139 (75.5)					
Marital Status							
Single	35 (25.9)	100 (74.1)	1.587	0.208			
Others	24 (19.4)	100 (80.6)					
Monthly Income Level							
500,000 MMK and below	40 (27)	108 (73)	3.541	0.06*	Ref		0.062
More than 500,000 MMK	19 (17.1)	92 (82.9)			1.793	0.972-3.310	
Occupation							
Medical Doctors	20 (24.1)	63 (75.9)	6.047[a]	0.175			
Midwifery and Nurses	1 (20)	4 (80)					

Characteristics	Post-disaster Resilience		Pearson Chi-square		Binary Logistic Regression		
	Low	Moderate/ High	X^2	*p*-value	COR[b]	(95% CI[c]) LL-UL	*p*-value
Medics and Volunteers	0	16 (100)					
Allied Health Professionals	30 (25)	90 (75)					
Others	8 (22.9)	27 (77.1)					
Ethnicity							
Burma	54 (22.6)	185 (77.4)	0.061	0.805			
Others	5 (25)	15 (75)					
Religion							
Buddhism	58 (22.7)	197 (77.3)	0.011	1.0			
Others	1 (25)	3 (75)					
Responsibility for Household Dependents							
Yes	40 (22.1)	141 (77.9)	0.158	0.691			
No	19 (24.4)	59 (75.6)					
Working Experience Levels							
5 years and less	15 (18.5)	66 (81.5)	2.427	0.297			
6 to 10 years	18 (29.5)	43 (70.5)					
11 years and above	26 (22.2)	91 (77.8)					
Critical Incident Exposure Level							
Low	12 (19)	51 (81)	0.957	0.620			
Moderate	26 (22.6)	89 (77.4)					
High	21 (25.9)	60 (74.1)					
Perceived Social Support Level							
Low	1 (16.7)	5 (83.3)	16.549	<0.001***	Ref		
Moderate	27 (40.9)	39 (59.1)			0.289	0.032-2.613	0.269
High	31 (16.6)	156 (83.4)			1.006	0.114-8.915	0.995
Perceived Organisational Support Level							
Low	4 (36.4)	7 (63.6)	13.865	<0.001***	Ref		
Moderate	41 (31.1)	91 (68.9)			1.268	0.352-4.573	0.716
High	14 (12.1)	102 (87.9)			4.163	1.080-16.052	0.038**
History of non-communicable disease							
Yes	6 (33.3)	12 (66.7)	1.225	0.268			
No	53 (22)	188 (78)					
Smoking Status							
Never smoked	48 (21.7)	173 (78.3)	1.208	0.547			
Former smoker	4 (25)	12 (75)					
Current smoker	7 (31.8)	15 (68.2)					
Alcohol Consumption Status							
Drinker	26 (27.4)	69 (72.6)	1.796	0.18			
Non-drinker	33 (20.1)	131 (79.9)					
Drug Abuse History							
Yes	0	4 (100)	1.199	0.577			
No	59 (23.1)	196 (76.9)					

a Fisher's exact test; b Crude odds ratio; c Confidence interval; * Exploratory screening criterion (p < 0.10); ** p < 0.05; *** p < 0.001.

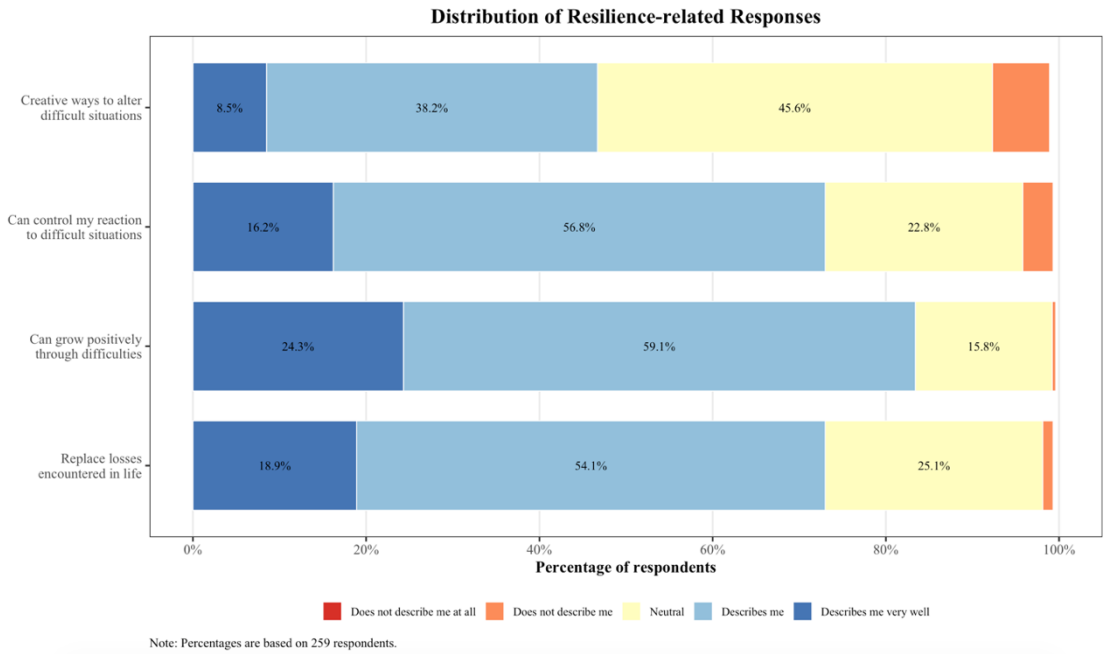

Figure 1 Distribution of responses to the Brief Resilient Coping Scale (BRCS) items among volunteers involved in the Sagaing–Mandalay earthquake response, Myanmar, 2026 (n = 259).

Factors Associated with Post-Disaster Resilience

Table 2 reported that age group (χ^2 = 2.809, p = 0.094) and monthly income (χ^2 = 3.541, p = 0.060) met the exploratory screening criterion (p < 0.10), while perceived social support (χ^2 = 16.549, p < 0.001) and perceived organisational support (χ^2 = 13.865, p < 0.001) were significantly associated with post-disaster resilience.. Moderate-to-high resilience was more prevalent among volunteers aged ≥31 years (80.8%), those with monthly incomes >500,000 MMK (82.9%), those reporting high perceived social support (83.4%), and those reporting high perceived organizational support (87.9%). In univariable logistic regression analysis, high perceived organizational support was significantly associated with moderate-to-high resilience (Figure 2). Volunteers reporting high perceived organizational support had more than four times the odds of moderate-to-high resilience compared with those reporting low organizational support (COR = 4.163, 95% CI: 1.080–16.052, p = 0.038).

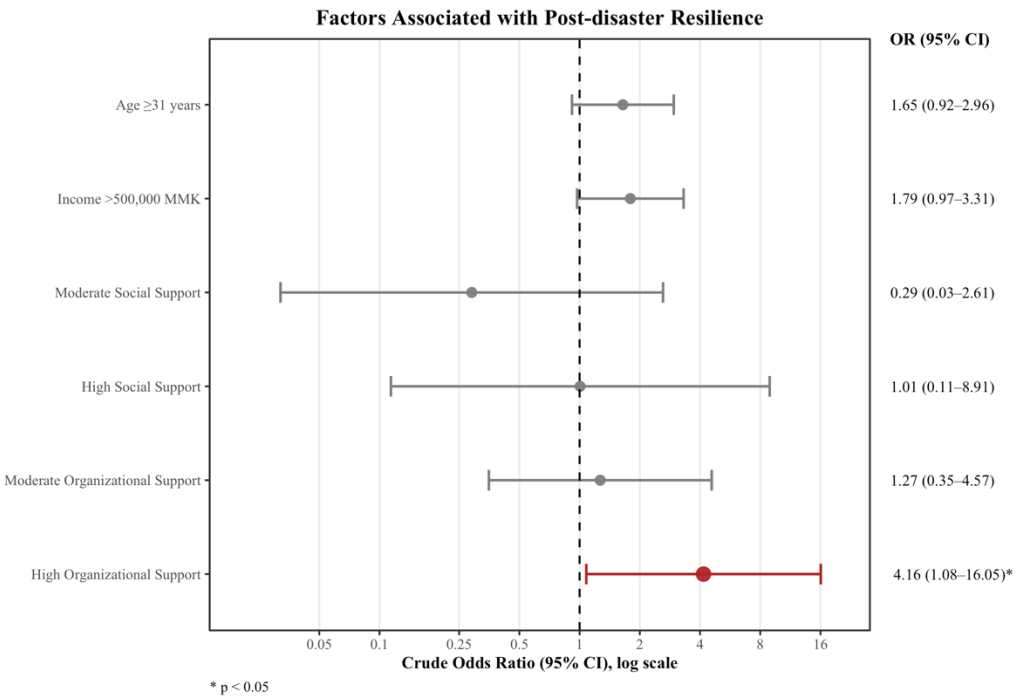

Figure 2 Forest plot showing the crude odds ratios (CORs) and corresponding 95% confidence intervals for factors associated with post-disaster resilience among study participants.

DISCUSSION

This study assessed post-disaster resilience and its associated factors among volunteers involved in the response to the Sagaing-Mandalay earthquake in Myanmar. The findings revealed that more than three-quarters of participants demonstrated moderate-to-high resilience, indicating a generally strong capacity to adapt and cope with challenges encountered during disaster response activities. Responses to the BRCS further suggested that many volunteers perceived themselves as capable of growing positively through difficulties, replacing losses encountered in life, and controlling their reactions in stressful situations.

The high proportion of participants with moderate-to-high resilience_observed in this study may be related to the adaptive capacities developed through volunteer engagement and exposure to challenging environments. Participation in disaster response activities often requires problem-solving, teamwork, flexibility, and commitment to community service, which may be related to resilient coping. Similar findings have been reported among disaster responders and humanitarian volunteers in other settings, where resilience has been associated with positive coping strategies and continued engagement in response activities despite adversity (5,6).

Age group and monthly income_showed evidence of association with resilience at the exploratory screening level ($p < 0.10$). Volunteers aged 31 years and above and those with higher monthly incomes demonstrated greater proportions of moderate-to-high resilience than their counterparts. However, neither association reached statistical significance in the univariable logistic regression analysis. These patterns may reflect differences in life experience and financial resources related to coping with disaster-related stressors, although causal relationships cannot be inferred. Previous studies have similarly reported that older individuals often possess more developed coping mechanisms and psychological resources that facilitate adaptation during crises (11).

Perceived social support was also significantly associated with resilience in the bivariate analysis. Volunteers reporting higher levels of social support demonstrated a greater prevalence of moderate-to-high resilience than

those reporting lower levels of support. This finding is consistent with previous research highlighting the relationship between social support, psychological well-being, and resilience (6,12). Supportive social networks may provide emotional encouragement, practical assistance, and opportunities for sharing experiences that may be relevant to coping with stressful circumstances.

The principal finding of this study was that high perceived organizational support remained significantly associated with moderate-to-high resilience in the univariable logistic regression analysis. Volunteers who reported high organizational support had more than four times the odds of demonstrating moderate-to-high resilience compared with those reporting low organizational support. However, the wide confidence interval indicates limited precision, and the finding should therefore be interpreted cautiously. As the estimate was unadjusted, potential confounding cannot be excluded. This finding suggests a possible relationship between supportive organizational environments and resilience during disaster response operations. Organizational support may contribute to greater resilience through effective communication, leadership, recognition of contributions, provision of resources, and psychosocial support, which have been associated with resilience and coping in previous studies. Such support can foster a sense of value, belonging, and confidence among volunteers, enabling them to cope more effectively with operational challenges and stressful experiences. Similar associations between organizational support and resilience have been reported among healthcare workers and emergency responders during public health emergencies and disasters (5,6).

These findings have important implications for disaster preparedness and volunteer management in Myanmar. Organizations involved in disaster response should consider strengthening volunteer support mechanisms, including training programs, supervision systems, recognition initiatives, and psychosocial support services. Given the observed association between organizational support and resilience, supportive organizational environments may be relevant to volunteer resilience; however, further research is needed to confirm this relationship.

CONCLUSION

In conclusion, most volunteers demonstrated moderate-to-high resilience following the 2025 Sagaing-Mandalay earthquake. Perceived organizational support was significantly associated with resilience in the univariable analysis, although the estimate was unadjusted and should be interpreted cautiously. The findings suggest that organizational support may be an important factor related to resilience among disaster response volunteers; however, further studies using multivariable and longitudinal analyses are needed to confirm this relationship.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University (COA No. 175/69). Informed consent was obtained from all participants prior to participation.

LIMITATIONS

Several limitations should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between resilience and associated factors. Second, the use of self-reported measures may introduce recall and social desirability bias. Third, participants were recruited through snowball sampling and online platforms, which may limit the generalizability of the findings to all disaster volunteers in Myanmar. Fourth, this study presents a preliminary analysis of 259 participants, which was lower than the initially calculated target sample size of 461. The smaller achieved sample may have reduced the statistical power to detect associations, particularly for variables with small subgroup sizes, and may have contributed to less precise effect estimates and wider confidence intervals. Therefore, non-significant findings should be

interpreted cautiously, as the absence of statistical significance does not necessarily indicate the absence of an association. These limitations should be considered when interpreting and generalizing the findings. Fifth, only crude associations were estimated; therefore, potential confounding could not be accounted for. Data collection is ongoing to achieve the target sample size according to the timeline approved by the ethics committee. Nevertheless, this study provides valuable preliminary evidence on resilience among volunteers involved in one of the most significant recent disasters in Myanmar and highlights the observed relationship between organizational support and resilience.

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PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISORDERS AND ASSOCIATED FACTORS AMONG MALE MACHINERY WORKERS IN MANDALAY, MYANMAR: A PRELIMINARY STUDY

Thin Zar Htet[1], Kraiwuth Kallawicha[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

**Corresponding Author: Kraiwuth Kallawicha, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330. Email: Kraiwuth.K@chula.ac.th*

ABSTRACT

Introduction: Work-related musculoskeletal disorders (MSDs) are one of the most common occupational health problems worldwide, especially among industrial workers who are exposed to repetitive movements, awkward postures, heavy lifting, and prolonged working hours. In developing countries, limited occupational safety measures and poor ergonomic practices further increase the risk of MSDs. Machinery workers in Mandalay, Myanmar, are vulnerable to these conditions due to physically demanding work environments and limited workplace health protection.

Objective: This preliminary study aimed to identify the prevalence of short-term self-reported work-related musculoskeletal disorders and examine the association between socio-demographic characteristics, health-related factors, work-related factors, and the presence of MSDs among machinery workers in Mandalay, Myanmar.

Methodology: A quantitative cross-sectional study was conducted among 100 male machinery workers from selected machinery workshops in Mandalay. Participants were recruited by convenience sampling after permission was obtained from relevant workshop authorities. The sample size was determined using a preliminary sample. MSD symptoms were measured using the Nordic Musculoskeletal Questionnaire, focusing on self-reported symptoms in different body regions during the past 7 days. Descriptive statistics were used to summarize the data, while the Chi-square test and Fisher's exact test were applied to determine the association between independent variables and the presence of short-term MSDs.

Results: Among the participants, 79.0% reported having musculoskeletal disorders during the past 7 days in at least 1 body part. The highest prevalence was reported in the shoulders (30.0%), followed by the upper back, lower back, and knees, each reported by 25.0% of participants. Significant associations were found between monthly income, working experience, working hours, working posture, and the presence of MSDs ($p < 0.05$).

Conclusion: The prevalence of self-reported short-term MSDs among machinery workers in Mandalay was high. Several socio-demographic and work-related factors were associated with the occurrence of MSDs, particularly long working hours and poor working posture. Workplace ergonomic interventions, occupational health education, and proper working schedules are recommended to reduce the burden of MSDs among machinery workers.

Keywords:

Work-Related Musculoskeletal Disorders; Male Machinery Workers; Occupational Health; Working Postures, Mandalay

INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are among the most common occupational health problems worldwide and are an important cause of pain, disability, reduced work ability, and impaired quality of life among workers. WMSDs affect muscles, joints, tendons, ligaments, nerves, and other structures of the musculoskeletal system and may develop or worsen as a result of occupational exposures such as repetitive movements, forceful exertions, awkward or sustained postures, manual handling, and prolonged physical strain (1). According to the World Health Organization, approximately 1.71 billion people worldwide live with musculoskeletal conditions, which account for approximately 17% of all years lived with disability globally (2). In addition to their effects on workers' health, musculoskeletal problems can contribute to absenteeism, reduced productivity, healthcare costs, and decreased work performance (3).

Workers in industrial and manufacturing settings are particularly affected because they are frequently exposed to repetitive tasks, prolonged working postures, manual material handling, high physical workloads, and poorly designed workstations (3). A systematic review and meta-analysis among automobile manufacturing workers reported a substantial burden of WMSDs and identified occupational characteristics and longer job tenure as important contributing factors (4). Similarly, research among electronics manufacturing workers found that awkward posture, repetitive work, lifting or carrying loads, prolonged sitting, and longer job tenure were associated with musculoskeletal symptoms in different body regions (5). A recent systematic review and meta-analysis among garment workers also demonstrated a high burden of musculoskeletal disorders, emphasizing repetitive physical tasks, prolonged working hours, and workstation-related ergonomic exposures (6). A study among garment factory workers in Myanmar reported a high prevalence of WMSDs and identified physical demand, job stress, and impaired work productivity as important associated factors (7).

However, available research involving Myanmar workers has mainly focused on garment workers and Myanmar migrant workers employed in other occupational settings. Among Myanmar migrant workers in the Thai seafood industry, musculoskeletal disorders were associated with working hours, repetitive hand movements, awkward wrist postures, prolonged standing, and manual handling of heavy loads (8). Mandalay is an important industrial center in Myanmar, with industrial zones containing numerous factories involved in agricultural production, machinery, and heavy-industry-related activities (9). Machinery workers commonly perform activities such as cutting, welding, grinding, drilling, and assembly, which can involve prolonged standing, repetitive upper-limb movements, bending, forceful exertion, and sustained or awkward working postures. Despite these occupational exposures, evidence specifically examining WMSDs among male machinery workers in Mandalay remains limited. Therefore, this preliminary study aimed to determine the 7-day prevalence of self-reported musculoskeletal symptoms and examine their associations with socio-demographic, health-related, and work-related factors among male machinery workers in Mandalay, Myanmar. The findings may provide preliminary occupational health evidence to support future research and the development of appropriate ergonomic preventive interventions for machinery workers.

METHODOLOGY

Study Design and Setting

A quantitative cross-sectional analytical study was conducted to determine the prevalence of work-related musculoskeletal disorders (MSDs) and their associated factors among male machinery workers in Mandalay, Myanmar. The study was carried out in machinery workshops and industrial zones located in Mandalay Region, one of the major industrial areas in Myanmar. These workplaces commonly involve machinery-related activities such as welding, cutting, grinding, and machinery assembly, which expose workers to ergonomic and occupational health risks.

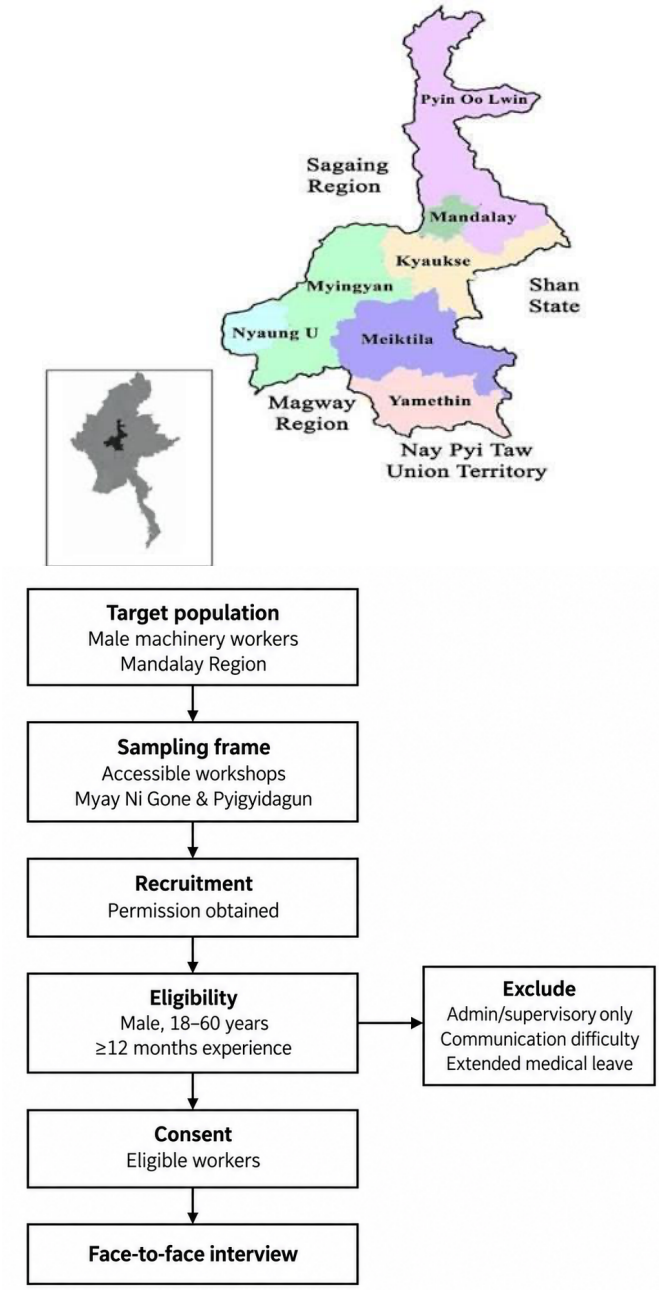

Figure 1 Map of study area and sampling frame

Study Population, Sampling and Sample Size

Eligible participants were male machinery workers aged 18-60 years who had worked continuously for at least 12 months and provided informed consent. Workers with hearing or communication difficulties, those working only in administrative or supervisory positions, and workers on extended medical leave were excluded. Participants were recruited by convenience sampling from selected workshops and industrial zones after workplace permission was obtained.

Data Collection and Measurements

Data were collected through face-to-face interviews using a structured questionnaire entered into Google Forms by trained research assistants. The questionnaire included socio-demographic characteristics, health-related factors, and work-related factors. Musculoskeletal symptoms were assessed using the Standardized

Nordic Musculoskeletal Questionnaire (NMQ), which is designed for epidemiological screening of musculoskeletal symptoms and includes a 7-day recall period (12). Working-posture items were adapted from the Dutch Musculoskeletal Questionnaire (DMQ), an established instrument for assessing musculoskeletal workload and potentially hazardous working conditions (13).

For this preliminary analysis, the outcome was symptom-based rather than a clinical diagnosis. A participant was classified as having 7-day MSD symptoms when he self-reported ache, pain, or discomfort in at least one of nine NMQ body regions (neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, or ankles/feet) during the previous 7 days (12). The 7-day period was selected because it is a standard NMQ recall window that captures recent symptoms and reduces long-recall errors.

The working-posture section contained nine items covering common exposures such as prolonged standing, overhead work, forward bending and other awkward postures. Each item was rated from Never (0) to Always (3), giving a possible total score of 0-27; higher scores indicated greater ergonomic exposure. For this study, total scores were categorized as low risk (0-8), moderate risk (9-17), and high risk (18-27).

Validity and Reliability

Content validity was evaluated by three occupational/public health experts, with an Index of Item-Objective Congruence of 0.93. A pilot study among workers with similar characteristics obtained a Cronbach alpha coefficient of 0.71, indicating acceptable internal consistency for the preliminary questionnaire.

Data Analysis

Data were analyzed using SPSS. Descriptive statistics were presented as frequencies and percentage for categorical variables and median with interquartile range (IQR) for continuous variables. The binary outcome was the presence or absence of 7-day MSD symptoms. Chi-square or Fisher's exact tests were used. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 100 male machinery workers were included. The median age was 32 years (IQR 27-38), and 43.0% were aged 30 years or younger. Most participants worked more than 8 hours per day (79.0%), and 48.0% were classified in the high-risk working-posture category. Table 1 presents participant characteristics.

Table 1. Socio-demographic, health-related and work-related characteristics of participants (n=100)

Variables	Frequency	Percentage (%)
Age group		
≤ 30	43	43.0
31 – 40	42	42.0
> 40	15	15.0
Median (IQR)	32 (38 - 27)	
Min - Max	18 - 60	
Education		
No formal education	8	8.0
Primary school	13	13.0
Middle school	42	42.0
High school	32	32.0
University or college and above	5	5.0
Monthly Income (1 USD = 4,200 MMK)		
< 300,000 MMK	10	10.0
300,000 – 600,000 MMK	39	39.0
600,000 – 900,000 MMK	40	40.0
>900,000 MMK	11	11.0

Variables	Frequency	Percentage (%)
Marital Status		
Single	49	49.0
Married	42	42.0
Divorced	9	9.0
Working Experience		
≤ 5 years	61	61.0
>5 years	39	39.0
Median (IQR)	4.5 (8 – 2)	
Min - Max	1 - 30	
Health-related Factors (n= 100)		
BMI (kg/m2)		
underweight (<18.5)	6	6.0
normal (18.5-24.9)	65	65.0
overweight (25.0-29.9)	29	29.0
Median (IQR)	23.54 (25.71 – 21.50)	
Min - Max	16.19 – 27.99	
Presence of Underlying Diseases		
Yes	24	24.0
No	76	76.0
Presence of Previous Injury		
Yes	11	11.0
No	89	89.0
Currently Diagnosed		
Yes	11	11.0
No	89	89.0
Work-related Factors		
Job Role		
Cutting	24	24.0
Welding	22	22.0
Drilling	23	23.0
Assembly	31	31.0
Working Hours		
≤ 8	21	21.0
>8	79	79.0
Median (IQR)	8 (9 – 8)	
Min - Max	1 - 10	
Break Time		
≤ 30	62	62.0
>30	38	38.0
Median (IQR)	8 (10 – 7)	
Min - Max	20 - 60	
Shift Work		
Yes	16	16.0
No	84	84.0
Working Posture		
Low Risk	35	35.0
Moderate Risk	17	17.0
High Risk	48	48.0
Median (IQR)	9.5 (12 – 7)	
Min – Max	0 – 25	

Prevalence of 7-day Musculoskeletal Symptoms

Among the participants, 79.0% reported having musculoskeletal disorders in at least 1 part of any body region, while 21.0% did not report MSDs, as shown in Table 2.

Table 2 Presence of self-reported MSD symptoms in the past 7 days (n=100)

	Frequency	Percentage (%)
Presence of MSDs		
Yes	79	79.0
No	21	21.0

Association between Socio-demographic Characteristics and Presence of MSDs

Monthly income and working experience were significantly associated with the presence of MSDs. Participants with monthly income between 300,000 and 600,000 MMK reported the highest prevalence of MSDs (87.2%), and the association was statistically significant (p = 0.015). Workers with more than 5 years of working experience also reported a higher prevalence of MSDs (89.7%) compared to those with shorter working experience, and this association was statistically significant (p = 0.029).

Table 3 Association between socio-demographic characteristics and 7-day MSD symptoms (n=100)

	Presence of MSD			
	Yes n (%)	**No** n (%)	**Chi-square (x^2)**	***p*-value**
Age group			3.191	0.222†
≤ 30	31 (72.1%)	12 (27.9%)		
31 – 40	34 (81.0%)	8 (19.0%)		
> 40	14 (93.3%)	1 (6.7%)		
Education			1.625	0.849†
No formal education	7 (45.0%)	1 (55.0%)		
Primary school	10 (36.7%)	3 (63.3%)		
Middle school	31 (40.3%)	11 (59.7%)		
High school	27 (46.7%)	5 (53.3%)		
Monthly income			11.297	0.015†
< 300,000 MMK	4 (40.0%)	6 (60.0%)		
300,000 – 600,000 MMK	34 (87.2%)	5 (12.8%)		
600,000 – 900,000 MMK	33 (82.5%)	7 (17.5%)		
>900,000 MMK	8 (72.7%)	3 (27.3%)		
Marital status			5.354	0.071†
Single	34 (69.4%)	15 (30.6%)		
Married	37 (88.1%)	5 (11.9%)		
Divorced	8 (88.9%)	1 (11.1%)		
Working Experience			4.448	0.029†
≤ 5 years	44 (72.1%)	17 (27.9%)		
>5 years	35 (89.7%)	4 (10.3%)		

*Note: *Statistically significant at p<0.05. †Fisher exact test.*

Association between Health-related Factors and Presence of MSDs

No statistically significant associations were observed between BMI, underlying diseases, previous injury, participant-reported current medical MSD diagnosis, and 7-day symptoms.

Table 4 Association between health-related factors and 7-day MSD symptoms (n=100)

Health-related factors	Presence of MSD Yes n (%)	No n (%)	(x^2)	*p*-value
BMI (kg/m2)			0.591	0.767†
underweight (<18.5)	4 (66.7%)	2 (33.3%)		
normal (18.5-24.9)	52 (80.0%)	13 (57.4%)		
overweight (25.0-29.9)	23 (35.8%)	6 (64.2%)		
Presence of Underlying Diseases			1.375	0.388†
Yes	21 (87.5%)	3 (12.5%)		
No	58 (76.3%)	18 (23.7%)		
Presence of Previous Injury			3.285	0.114†
Yes	11 (100%)	0 (0%)		
No	68 (76.4%)	21 (23.6%)		
Currently Diagnosed			3.285	0.114†
Yes	11 (100%)	0 (0%)		
No	68 (76.4%)	21 (23.6%)		

Note:†Fisher exact test

Association between Work-related Factors and Presence of MSDs

Working hours and working posture were significantly associated with the presence of MSDs. Participants working more than 8 hours per day reported a significantly higher prevalence of MSDs (87.3%) compared to those working less than or equal to 8 hours (47.6%) ($p < 0.001$).

Regarding working posture, workers categorized under high-risk posture reported a higher prevalence of MSDs (85.4%), and the association was statistically significant ($p = 0.015$).

Table 5 Association between work-related factors and 7-day MSD symptoms (n=100)

Work-related Factors	Presence of MSD Yes n (%)	No n (%)	Chi-square (x^2)	*p*-value
Job Role			1.742	0.646†
Cutting	17 (70.8%)	7 (29.2%)		
Welding	19 (86.4%)	3 (13.6%)		
Drilling	18 (78.3%)	5 (21.7%)		
Assembly	25 (80.6%)	6 (19.4%)		
Working Hours			15.779	<0.001*
≤ 8	10 (47.6%)	11 (52.4%)		
>8	69 (87.3%)	10 (12.7%)		
Break Time			2.333	0.127
≤ 30	52 (83.9%)	10 (16.1%)		
>30	27 (71.1%)	11(28.9%)		

Work-related Factors	Presence of MSD Yes n (%)	No n (%)	Chi-square (x^2)	*p*-value
Shift Work			2.498	0.181†
Yes	15 (93.8%)	1 (6.3%)		
No	64 (76.2%)	20 (23.8%)		
Working Posture			8.464	0.015*
Low Risk	29 (82.9%)	6 (17.1%)		
Moderate Risk	9 (52.9%)	8 (47.1%)		
High Risk	41 (85.4%)	7 (14.6%)		

*Note: *Statistically significant at p<0.05. †Fisher's exact test.*

DISCUSSION

The preliminary analysis found a high 7-day prevalence of self-reported musculoskeletal symptoms (79.0%). This result should be interpreted as recent symptom prevalence rather than a medical diagnosis. The NMQ is intended for epidemiological screening, and its 7-day recall period identifies recent aches, pain, or discomfort in predefined body regions (12). The high symptom burden is consistent with evidence from industrial settings where repetitive work, awkward posture, and forceful exertion are common (5,10).

Monthly income was significantly associated with MSDs in this study. Workers with moderate income levels reported a higher prevalence of MSDs. Although the relationship between income and musculoskeletal disorders has been inconsistently reported in previous studies, socioeconomic status may influence occupational exposure, workload distribution, and access to workplace protection measures (7). This finding may reflect differences in job responsibilities and workload among workers with different income levels. Workers earning moderate income may perform more physically demanding tasks with limited workplace support and protection (15).

Longer work experience was also associated with MSDs. Cumulative exposure to repetitive and physically demanding work may increase musculoskeletal strain over time, which is consistent with evidence identifying job tenure and cumulative biomechanical exposure as relevant WMSD risk factors (6,10,16).

Among work-related factors, long working hours showed a strong association with MSDs. Participants who worked more than eight hours per day experienced a significantly higher prevalence of musculoskeletal disorders compared with those who worked fewer hours. This finding is consistent with previous research indicating that extended working hours increase physical fatigue and reduce recovery time for muscles and joints (14,16).

Working posture was another important factor significantly associated with MSDs. Workers who had high-risk postures were more likely to experience musculoskeletal disorders than those with lower-risk postures. This finding is supported by ergonomic research showing that awkward postures, repetitive movements, forceful exertions, and prolonged static positions place excessive stress on the musculoskeletal system. Strained and awkward postures were associated with musculoskeletal symptoms across multiple body regions among manufacturing workers. Poor ergonomic posture may increase muscle fatigue and joint loading, thereby contributing to the development of musculoskeletal disorders (17).

Practical ergonomic interventions should focus on the exposures observed in machinery work. Examples include adjusting working table or machine height to reduce bending and overreaching, positioning frequently used tools within comfortable reach, providing suitable seating or sit-stand options when task-compatible, rotating repetitive tasks, and scheduling short recovery or stretching breaks. Evidence from ergonomic and exercise interventions

indicates that workplace modification combined with active exercise or stretching can reduce musculoskeletal discomfort (18).

CONCLUSION

This study found a high prevalence of self-reported work-related musculoskeletal disorders among industrial workers in Mandalay, Myanmar. Significant associations were observed between MSDs and monthly income, working experience, working hours, and working posture. Long working hours and high-risk working postures were major contributing factors. The findings suggest the need for occupational health interventions focusing on ergonomic improvement, proper working schedules, and health education programs to reduce the burden of MSDs among industrial workers.

RECOMMENDATIONS

Occupational health education and ergonomic training programs should be implemented among industrial workers to improve awareness regarding musculoskeletal health and workplace safety. Employers should provide training in proper working posture and provide adequate rest periods to reduce physical strain. Workplaces should also consider ergonomic modifications and proper scheduling to minimize prolonged working hours.

ETHICAL DECLARATION

The study received approval from the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University, on 7 May 2026 (COA No. 118/69). Data collection began only after approval. Participation was voluntary, informed consent was obtained, and confidentiality and anonymity were maintained.

LIMITATIONS

This study reports a preliminary sample of 100 participants. The convenience sampling method limits generalizability. The cross-sectional design cannot establish causality. Musculoskeletal outcomes were self-reported NMQ symptoms and were not independently verified by clinical examination or medical records, so recall and reporting bias are possible.

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THE ASSOCIATION BETWEEN HEALTHCARE RESOURCES AND ROAD TRAFFIC MORTALITY AND YEAR OF POTENTIAL LIFE LOST IN THAILAND, 2019 TO 2024

***Nunnapat Pungloy*[1*]**
[1]*College of Public Health Sciences, Chulalongkorn University, Sabbasatravicaya Building, Phayathai Road, Bangkok 10330, Thailand*
***Corresponding Author:** Nutta Taneepanichskul,*
College of Public Health Sciences,Chulalongkorn University, Bangkok 10330, Thailand, E-mail: nutta.t@chula.ac.th

ABSTRACT

Introduction: Road traffic injuries remain a leading public health concern in Thailand, which recorded an estimated mortality rate of 25.4 per 100,000 population in 2021, ranking second highest in the WHO South-East Asia Region. Road traffic deaths disproportionately affect younger and working-age populations, generating a substantial burden of premature mortality. Despite persistent geographic disparities in healthcare resource distribution, national evidence examining the association between healthcare resource availability and road traffic mortality and years of potential life lost at the provincial level remains limited.

Objectives: This study aimed to quantify road traffic mortality and years of potential life lost across Thailand's 77 provinces from 2019 to 2024, characterize the provincial distribution of general and emergency healthcare resources, and examine the association between healthcare resource index levels and both road traffic mortality and YPLL rates.

Methodology: This ecological study utilized secondary data from the Division of Strategy and Planning, the Division of Disease Control, and the National Institute for Emergency Medicine, covering January 2019 to December 2024. Road traffic fatalities were identified using ICD-10 codes V01 to V89, with records missing age, sex, province, or ICD-10 information excluded. Mortality rates were calculated per 100,000 population and YPLL was calculated using Thai sex specific life expectancy at birth. Three composite healthcare resource indices were constructed by standardizing resource rates per 10,000 population, comprising a General HCR index from four general resource components, an Emergency HCR index from four emergency-specific components, and a Combined HCR index encompassing all eight components. Provinces were categorized into low, moderate, and high tertile groups. Associations were assessed using the Kruskal-Wallis test with Dunn post hoc comparisons at p less than 0.05.

Results: Among 104,530 road traffic deaths recorded between 2019 and 2024, males accounted for 77.2% of fatalities. The 25 to 44 age group recorded the highest proportion of deaths, followed closely by the 45 to 64 age group. Among deaths with a classifiable road user type, motorcyclists comprised 42.5% of fatalities. The average mortality rate was 26.7 per 100,000 population, declining from 30.2 in 2019 to 24.9 in 2021 before stabilizing at approximately 26 per 100,000 from 2022 to 2024. The cumulative YPLL totaled 3,231,661 years, averaging 31.3 years per death. Geographically, Rayong, Chanthaburi, and Chon Buri recorded the highest mortality and YPLL rates. The Combined HCR index comprised Low (n = 26, median -0.525, IQR -0.642 to -0.392), Moderate (n = 25, median -0.107, IQR -0.151 to 0.047), and High (n = 26, median 0.460, IQR 0.323 to 0.761) groups, with Mae Hong Son, Chanthaburi, and Rayong recording the highest values. The HCR index was significantly associated with both mortality rate (p = 0.008) and YPLL (p = 0.018).

Conclusion: The 25 to 44-year age group accounted for the majority of road traffic deaths in Thailand during 2019 to 2024, with a mean age at death of 42 years and a predominance of male fatalities. Motorcyclists represented the largest share of deaths by road user type. The average road traffic mortality rate was 26.7 per 100,000 population, and an average of 3.2 million years of potential life were lost annually due to premature road traffic death. The HCR index was significantly associated with both road traffic mortality and YPLL rates at the provincial level. Targeted interventions designed specifically

for young motorcyclists should be implemented, alongside efforts to strengthen the equitable distribution of general healthcare resources as part of a comprehensive strategy to reduce road traffic mortality.

Keywords:
Road Traffic Mortality; Years Of Potential Life Lost; Healthcare Resources; Healthcare Resource Index

INTRODUCTION

Road traffic injuries (RTIs) represent one of the most significant preventable public health challenges globally. In 2021, approximately 1.19 million people died from road traffic accidents worldwide, with over 90% of deaths occurring in low- and middle-income countries(1, 2). The WHO South-East Asia (SEA) region accounts for an estimated 28% of global road traffic deaths, with six SEA countries recording death rates above the global average. Thailand ranked second highest in the region at 25.4 per 100,000 population (1). Thailand has a long-standing and well-documented road traffic mortality burden. Between 2011 and 2021, 218,964 road traffic deaths were recorded nationally, with motorcyclists consistently representing the majority of fatalities (3). The WHO Decade of Action for Road Safety 2021–2030 targets a 50% reduction in road traffic deaths by 2030, emphasising five pillars: road safety management, safer roads, safer vehicles, safer road users, and post-crash response (4). Thailand's Road Safety Development Plan 2022–2027 aligns with this framework, targeting a reduction to 12 deaths per 100,000 population by 2027 (5). The speed and quality of post-accident care, including emergency services, treatment before hospital arrival, and available hospital resources, play a critical role in determining whether road traffic injury victims survive. Research conducted in Poland and Iran has found that areas with limited healthcare infrastructure tend to experience greater rates of road traffic fatalities(6, 7). In Thailand, however, the relationship between provincial healthcare resource availability and road traffic outcomes has not been systematically quantified across all 77 provinces. This study addresses this gap with three objectives: first, to quantify road traffic mortality (RTM) rates and YPLL across Thailand from 2019 to 2024; second, to characterise the geographic distribution of healthcare resources (HCR) across all 77 provinces; and third, to assess the association between HCR levels and road traffic outcomes.

METHODOLOGY

Study Design and Setting

This study employed an ecological design using secondary data. The unit of analysis was the province. The study encompassed all 77 provinces of Thailand over the period January 2019 to December 2024.

Data Sources

Mortality data were obtained from two openly accessible national death registration systems, namely the Division of Disease Control and the Division of Strategy and Planning, Ministry of Public Health (MOPH), using the International Classification of Diseases 10 (ICD-10 codes) V01–V89 to identify road traffic deaths. Mid-year population data were obtained from the Division of Strategy and Planning. General Physician, Emergency Physician, nurse, and hospital bed counts were retrieved from MOPH annual reports. Counts of emergency medical technicians (EMT), emergency medical responders (EMR), first responder units (FR), and life support ambulances were obtained from openly accessible the National Institute for Emergency Medicine (NIEM), available only as a single 2026 snapshot. Records with missing age, province, sex, or ICD-10 code were excluded.

Outcome Measures

Road traffic mortality rate was calculated as deaths per 100,000 population using mid-year population as the denominator. Years of potential life lost (YPLL) were calculated as the difference

between sex-specific Thai life expectancy and age at death, which is 71.8 years for males and 79 years for females, and the YPLL rate was expressed per 100,000 population.

Healthcare Resource Index

A composite Healthcare Resource Index (HCR index) was constructed for each province from eight resource components: general physicians, emergency physicians, nurses, hospital beds, EMTs, EMRs, FR units, and life support ambulances. Each component was first expressed as a rate per 10,000 population.

$$\text{HCR component rate} = \frac{Number\ of\ healthcare\ resource}{Average\ mid-year\ population} \times 10{,}000$$

Then standardised using z-score transformation,

$$Z_i = \frac{(X_i - \mu)}{\sigma}$$

The HCR index for each province is calculated as the arithmetic mean of the eight standardized z-scores:

$$\text{HCR index} = \frac{\sum_{j=1}^{n} Z_j}{n}$$

Where

n = The number 8 components, including resources such as general physician, emergency physician, Nurse, EMT, EMR, FR unit, and Life Support Ambulance.

Provinces were grouped into three HCR categories based on tertile rankings, with Low (≤ -0.107), Moderate (-0.107 to 0.460), and High (≥ 0.460).

Statistical Analysis

Descriptive statistics summarised baseline characteristics. The Kruskal–Wallis test compared average annual RTM and YPLL rates across the three HCR tertile categories at the significance level α = 0.05. Where significant overall differences were detected, Dunn's post-hoc test with Bonferroni correction identified pairwise differences. All analyses were performed in R.

RESULTS

A total of 105,549 road traffic deaths were obtained from two national data sources. After cleaning and validation, 1,019 records (0.96%) were excluded due to missing province codes, age, or ICD-10 data inconsistencies. The final analytical dataset comprised 104,530 death records across 77 provinces.

Baseline Characteristics

The median age at death was 42.0 years (interquartile range of 25 to 58 years). Males accounted for 77.2% of deaths (n = 80,664). The 25 to 44-year age group represented the largest share of deaths at 30.7%, followed by the 45 to 64-year age group at 30.1%. The "Other" category comprised 46.5% (n=48,604), followed by motorcyclists comprised 42.5% of all deaths (n = 44,417). These data are shown in Table 1. Within the Other land transport category (V80–V89), most deaths were coded as V89.2 (person injured in an unspecified motor-vehicle accident). The remaining 1.2% comprised codes V81.1, V84.0, V85.0, V87.9, and V89.9, representing railway train occupants, agricultural vehicle occupants, construction vehicle occupants, traffic accidents with unknown victim transport mode, and unspecified vehicle type or traffic status, respectively.

Table 1 Baseline characteristics of road traffic death cases, Thailand, 2019–2024.

Characteristic	N (104,530)	Percent %
Gender		
Male	80,664	77.2
Female	22,592	21.6
Unknown	1,274	1.2
Age, Median age (IQR), years		
42 (25–58)		
0–14 years	4,649	4.4
15–24 years	19,911	19.1
25–44 years	32,050	30.7
45–64 years	31,493	30.1
65+ years	16,427	15.7
Road user type		
Motorcycle	44,417	42.5
Motor vehicle occupant	7,926	7.6
Pedestrian	2,971	2.8
Cyclist	612	0.6
Other	48,604	46.5

Road Traffic Mortality

The national road traffic mortality rate fell from 30.2 per 100,000 population in 2019 to 24.9 per 100,000 in 2021, before stabilising at around 26 per 100,000 between 2022 and 2024, giving a six-year average of 26.7 per 100,000 (Table 2). Considerable variation was observed across provinces, with Rayong recording the highest average rate at 58.2 per 100,000, followed by Chanthaburi at 45.1, Chon Buri at 43.7, Saraburi at 42.1, and Prachinburi at 39.3. In contrast, the lowest rates were observed in Yala at 13.0, Bangkok at 13.6, and Pattani at 13.9 per 100,000 population. (Figure 1)

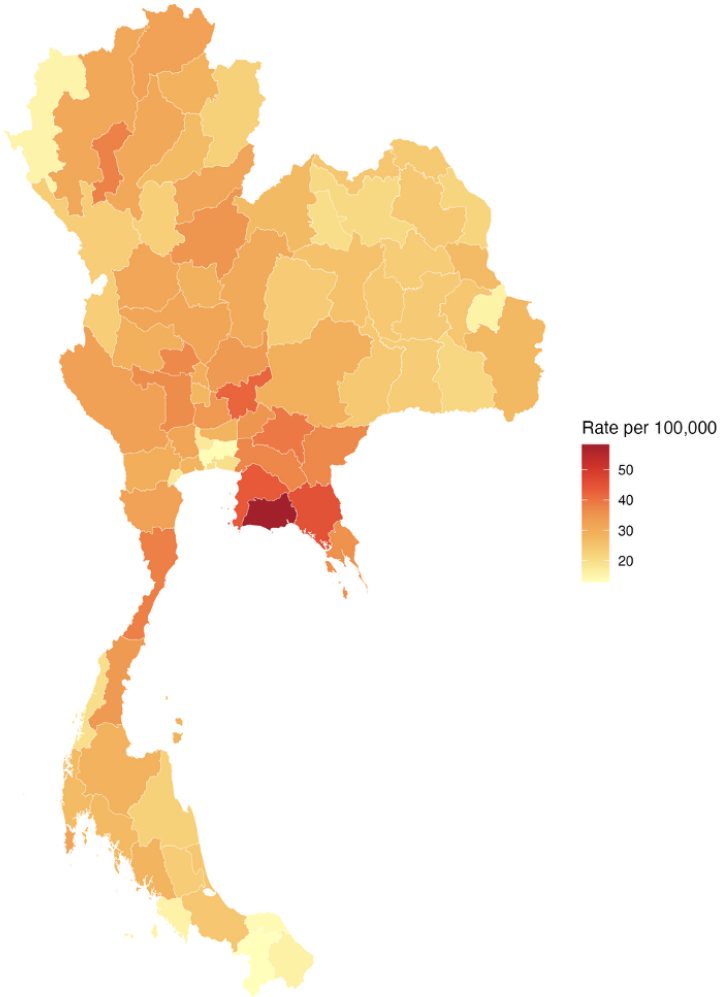

Figure 1 Road traffic mortality rate per 100,000 population by year, Thailand, 2019–2024

Years of Potential Life Lost

Deaths with unknown sex (n = 1,274) were excluded from the years of potential life lost (YPLL) calculations, resulting in a final dataset of 103,256 records. Over the six-year period from 2019 to 2024, cumulative YPLL totalled 3,231,661 years with an average of 31.3 years lost per death. Annual YPLL decreased from 649,378 in 2019 to 471,706 in 2021, before rising to 531,159 in 2022, then declining slightly to 512,354 in 2023 and 519,600 in 2024 (Table 2). The geographic distribution of YPLL across provinces closely reflected the patterns seen in mortality, with Rayong recording the highest YPLL rate at 2,041.3 per 100,000 and Yala recording the lowest at 452.3 per 100,000. (Figure 2)

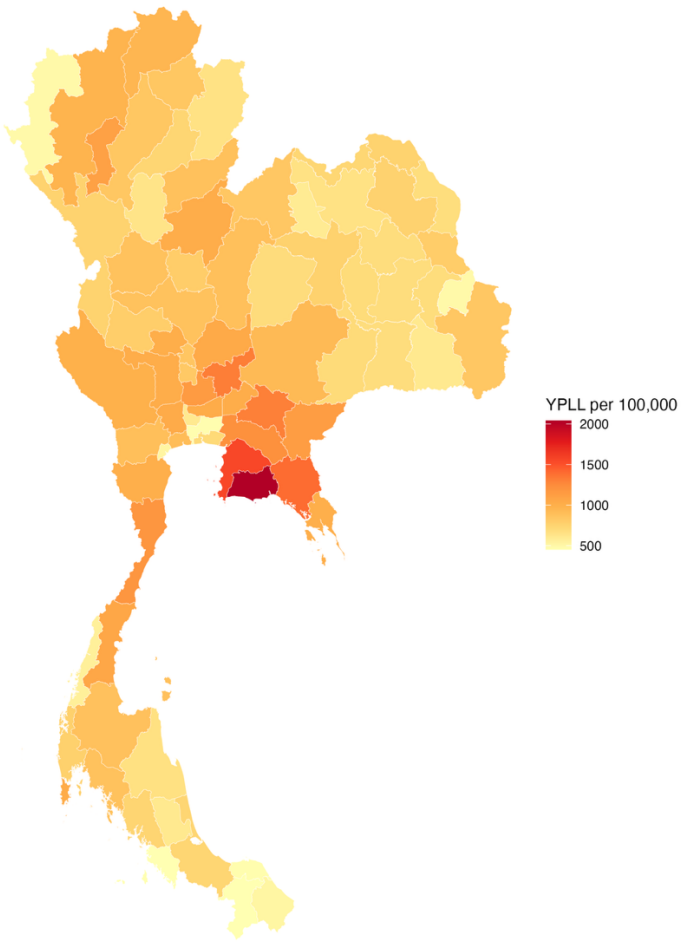

Figure 2 Years of potential life lost rate per 100,000 population by year, Thailand, 2019–2024

Table 2 Mortality rate and Years of potential life lost (YPLL) by year, Thailand, 2019–2024.

Year	Total Deaths	Mortality Rate (per 100,000)	Total YPLL	Avg YPLL/death (years)
2019	19,814	30.2	649,378	32.8
2020	17,181	26.3	547,464	31.9
2021	14,978	24.9	471,706	31.5
2022	17,198	26.4	531,159	30.9
2023	16,879	25.9	512,354	30.4
2024	17,207	26.5	519,600	30.2
Total	104,530	26.7†	3,231,661	31.3

Deaths with unknown sex (n = 1,274) excluded from YPLL calculations. †Six-year average mortality rate.

Healthcare Resource Distribution and Association with Outcomes

Marked variation in the composite HCR index was observed across all 77 provinces. The HCR index had a mean of 0 by construction (SD = 0.540), ranging from -1.017 to 1.607, with a median of -0.107 and an IQR of 0.705. Provinces were stratified into Low (n = 26, median -0.525,

IQR -0.642 to -0.392), Moderate (n = 25, median -0.107, IQR -0.151 to 0.047), and High (n = 26, median 0.460, IQR 0.323 to 0.761). The geographical distribution of the Combined HCR index across Thailand's 77 provinces is mapped in Figure 3. The highest HCR index values were observed in Mae Hong Son, Chanthaburi, Rayong, Ranong, and Saraburi, and the lowest in Nong Bua Lam Phu, Samut Prakan, Kamphaeng Phet, Bueng Kan, and Nakhon Phanom.

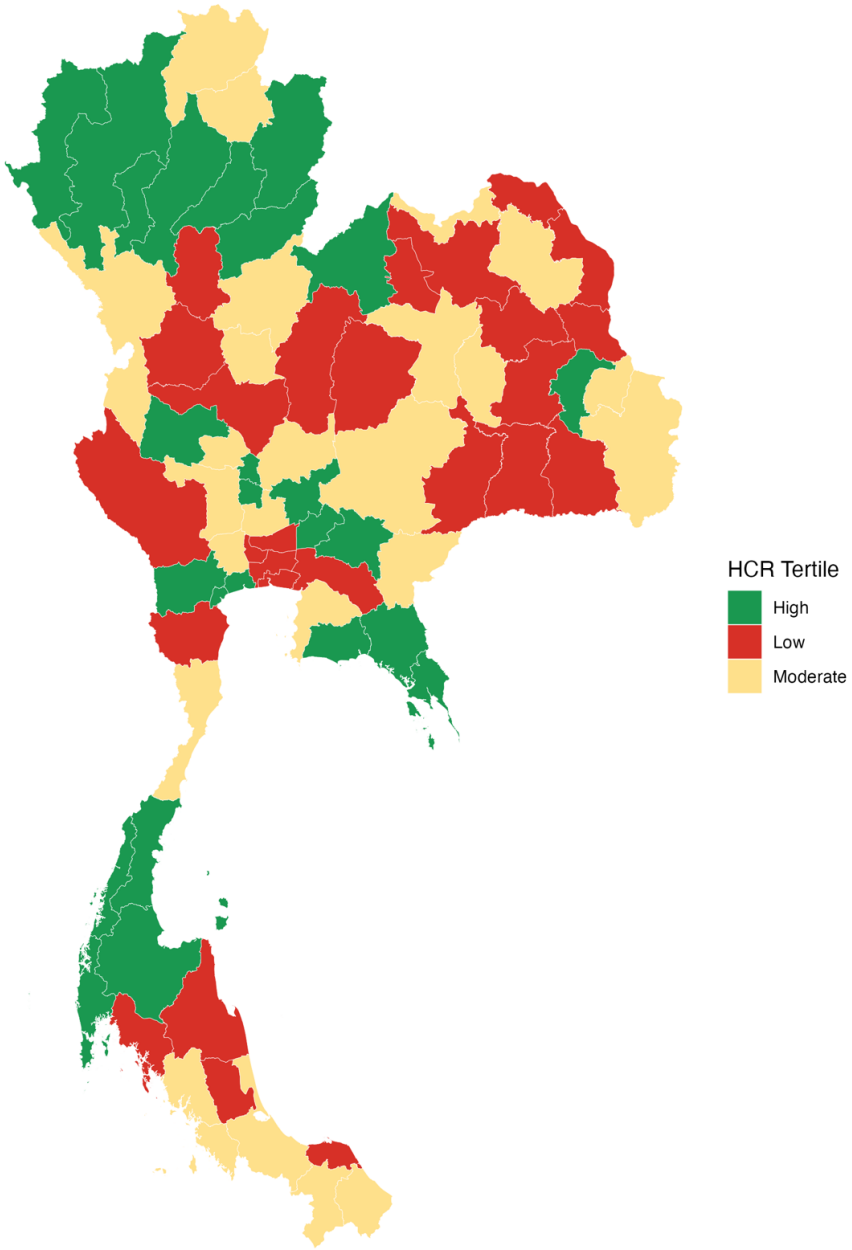

Figure 3 Healthcare Resource (HCR) Index by province, Thailand — tertile map

Kruskal–Wallis testing identified statistically significant differences in RTM rates across HCR tertiles (H = 9.76, df = 2, p = 0.008) and in YPLL rates (H = 8.07, df = 2, p = 0.018), as shown in Table 3. Dunn post-hoc tests confirmed that RTM significantly differed between High and Low HCR provinces (p = 0.008). Furthermore, YPLL was significantly associated with the HCR index, differing between Low and High HCR groups (p = 0.020).

Table 3 Association between HCR index categories and road traffic outcomes, Thailand, 2019–2024.

Outcome (Per 100,000)	Low HCR (n=26)	Moderate HCR (n=25)	High HCR (n=26)	*p*	Dunn post-hoc (p)
RTM Mean (SD)	24.50 (5.71)	28.32 (7.89)	31.00 (8.88)	0.008	Low vs Mod: 0.081 Low vs High: 0.008* Mod vs High: 1.000
RTM Median (IQR)	23.50 (21.42–27.94)	28.50 (24.20–34.14)	29.75 (26.96–34.59)		
YPLL Mean (SD)	748.58 (177.66)	865.35 (257.22)	938.17 (320.52)	0.018	Low vs Mod: 0.119 Low vs High: 0.020* Mod vs High: 1.000
YPLL Median (IQR)	690.28 (642.36–875.03)	838.15 (738.76 – 1,018.69)	880.86 (778.81–1,026.51)		

*Note: Kruskal–Wallis test; Dunn post-hoc with Bonferroni correction. *p < 0.05. Mod = Moderate HCR tertile.*

DISCUSSION

This study documented 104,530 road traffic deaths and 3,231,661 YPLL across Thailand's 77 provinces from 2019 to 2024, situating Thailand among the highest RTI-burden settings in the WHO South-East Asia region (1, 2). The decline in mortality between 2019 and 2021 is consistent with the reduction in road usage brought about by COVID-19 travel restrictions, a pattern that has similarly been documented in Bangladesh and Canada. (8, 9). The stabilisation from 2022 onward, rather than a continued decline, is consistent with the resumption of travel after pandemic-period restrictions eased, and coincided with the implementation of Thailand's Road Safety Development Plan 2022–2027(10).

The demographic profile, with males accounting for 77.2% of deaths and the majority of fatalities concentrated in the 25 to 64-year age group, reflects global patterns of injury burden (2, 11). The high proportion of deaths classified under V89.2 (unspecified motor vehicle traffic accident) mirrors findings from Seresirikachorn et al. (3). Hua et al. (2023) similarly found that road traffic deaths in the WHO Mortality Database are frequently coded non-specifically, with 3 countries reporting unspecified transport crash deaths and 30 countries reporting unspecified unintentional deaths (ICD-10 codes V87.0–V87.8, V89.2). After correcting for these nonspecific codes, seven countries and territories on average saw a greater than 50% increase in age-adjusted road traffic mortality (2015–2020) (12).

The finding that the motorcyclist group represented 42.5% of all deaths aligns with previous national analyses and the motorcycle-dominated road user profile characteristic of the Southeast Asian region (1, 3). The cumulative burden of 3,231,661 YPLL, averaging 31.3 years per death, underscores the disproportionate impact on economically active populations, consistent with earlier estimates showing premature mortality accounts for 88% of Thailand's road traffic DALY burden(13).

The most analytically important finding is the association between provincial HCR and road traffic outcomes. Ecological evidence from Poland similarly examined healthcare resource availability and road traffic mortality(6). The pattern observed in Thailand most plausibly reflects the historical allocation of healthcare resources toward provinces bearing the heaviest burden and greatest industrial activity, such as Rayong and Chon Buri (3).

CONCLUSION

Between 2019 and 2024, a total of 104,530 road traffic deaths were recorded across Thailand's 77 provinces, with an average mortality rate of 26.7 per 100,000. The burden fell disproportionately on working-age adults, with males concentrated in the 25–44 age group; among deaths with a classifiable road user type, motorcyclists accounted for the largest share, underscoring the dominant role of motorcycle-related deaths in Thailand's road traffic mortality burden. The cumulative years of potential life lost totalled 3,231,661 years, averaging 31.3 years per death. The HCR index categorised provinces into three groups: Low (n = 26, median -0.525, IQR -0.642 to -0.392), Moderate (n = 25, median -0.107, IQR -0.151 to 0.047), and High (n = 26, median 0.460, IQR 0.323 to 0.761), with Mae Hong Son, Chanthaburi, and Rayong recording the highest HCR index over the study period. The HCR index was significantly associated with both road traffic mortality rates and YPLL rates, with statistically significant differences observed between Low and High HCR categories.

RECOMMENDATIONS

Future studies should adjust for provincial-level confounding factors, including vehicle registration density, road network characteristics, distance to definitive care, and emergency response time, to more precisely characterise the association between healthcare resources and road traffic mortality. Alongside these future studies, improved coding and surveillance practice at the point of data entry are recommended to address the structural gap represented by the large and undifferentiated V89.2 category. From a policy perspective, targeted interventions should focus on high-risk groups within high-burden provinces, such as youth motorcyclist protection and regional coordination of road safety planning across geographically clustered high-mortality provinces, including Rayong, Chon Buri, and Chanthaburi. Ultimately, strengthening the equitable distribution of healthcare resources should form a central part of any comprehensive strategy to reduce road traffic mortality and premature life loss.

ETHICAL DECLARATION

Ethical approval was obtained from the Institutional Review Board of Chulalongkorn University (IRB No. 132/69).

LIMITATIONS

Several limitations should be considered when interpreting these findings. First, mortality data, though drawn from a national death registry, remain subject to ICD-10 coding inconsistencies and incomplete case information; this is reflected in the large proportion of deaths classified under V89.2, accounting for 46.5% of all fatalities, which limits the precision of road-user-specific conclusions. Second, as an ecological study, findings reflect associations at the provincial level and cannot be applied or interpreted at the individual level. Third, Emergency data did not cover the full six-year study period; Emergency HCR figures were available only as a single cross-sectional snapshot, in contrast to the province-level counts spanning 2019–2024 used for the other indices. Fourth, this study did not adjust for plausible confounders of the HCR–outcome relationship, including traffic exposure, road infrastructure quality, geographic location, and GDP per capita. Finally, the HCR index measures resource quantity rather than true geographic accessibility, and so cannot capture travel time, distance to definitive care, or intra-provincial maldistribution of resources.

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Track III

Health Systems, Health Economics and Digital Health

ASSESSING ELECTRONIC MEDICAL RECORDS SYSTEM USAGE AMONG MEDICAL INTERNS IN UGANDA PUBLIC REFERRAL HOSPITALS

Masika Mercy Masitula[1], Piyapong Janmaimool[1]1, Orapin Laosee[1], Syarifah Aqilah[1]*

[1]ASEAN Institute for Health Development, Mahidol University, Thailand

***Corresponding author:** Syarifah Aqilah, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73170, Thailand. Email; syarifah.aqi@mahidol.ac.th*

ABSTRACT

Introduction: Electronic Medical Records (EMRs) improve clinical documentation and patient management but remain unevenly implemented in low- and middle-income countries. Uganda has expanded EMR use in public referral hospitals, yet usage among medical interns remains underexplored.

Objective: To determine EMR usage among medical interns and factors associated with its use in Uganda public referral hospitals.

Methodology: A cross-sectional online survey was conducted among medical interns (nurses and doctors) aged ≥18 years with more than six months of internship service. Cluster random sampling was used. EMR usage was measured by self-reported frequency of use from never (1) to always (4). Factors assessed included training, ICT support, infrastructure, digital skills, work environment, perceived ease of use, perceived usefulness, and EMR knowledge. Data were analyzed using descriptive statistics and binary logistic regression in SPSS version 31; significance was set at $p < 0.05$.

Results: Among 433 respondents, 54% were male, 72.3% were intern doctors, and 33% were from national referral hospitals. Overall, 68.8% reported high EMR usage. EMR training (AOR = 1.74), ICT officer support (AOR = 5.47), internet access (AOR = 1.81), reliable power supply (AOR = 2.28), and digital skills (AOR = 1.67) were significantly associated with higher odds of EMR usage. Additionally, 68.6% identified inadequate ICT literacy as the major barrier to EMR implementation and use.

Conclusion: EMR training, knowledge, digital skills, ICT support, reliable power supply, and internet connectivity were associated with EMR usage among medical interns. Strengthening continuous training, digital skills, technical support, and infrastructure may enhance EMR utilization.

Key words:

Electronic Medical Records; EMR Usage; Medical Interns; EMR Training; Uganda.

INTRODUCTION

Globally, healthcare systems are undergoing rapid digital transformation, shifting from paper-based records to Electronic Medical Record systems (EMRs) as a foundation for digital health. The World Health Organization recognizes digital health technologies, including EMRs, as essential tools for strengthening health systems, improving workforce efficiency, and advancing universal health coverage (1, 2). While high-income countries have achieved widespread EMR adoption with improvements in patient safety, care coordination, and clinical documentation(3, 4). Implementation remains uneven worldwide. In Sub-Saharan Africa, adoption is constrained by financial, infrastructural, and workforce limitations (5), highlighting the need to assess EMR utilization within specific healthcare workforce populations.

EMRs are computerized systems that create, store, manage, and retrieve patient health information within healthcare facilities (6). They typically contain demographic information, medical histories, diagnoses, laboratory results, treatment plans, and medication records. In Uganda, EMRs are increasingly used in public referral hospitals to support patient registration, clinical documentation, laboratory services, prescribing, scheduling, reporting, and healthcare management (7, 8). Evidence shows that EMRs improve clinical decision-making, enhance documentation quality, strengthen

disease surveillance, and support data-driven planning (9-11).

Despite these benefits, successful EMR implementation depends largely on effective utilization by frontline healthcare workers. Studies from Uganda and other low- and middle-income countries identify persistent barriers including inadequate infrastructure, unreliable electricity and internet connectivity, insufficient computer access, limited technical support, and inadequate digital literacy(12, 13). Consequently, many facilities rely on hybrid systems that combine paper and electronic records. This often results in duplicate documentation, increased workload, provider fatigue, and reduced efficiency in healthcare delivery (14). Similar challenges have been reported in Uganda, where workforce EMR training varies across facilities (15).

Uganda has invested significantly in digital health and scaled systems such as OpenMRS and UgandaEMR across many facilities(15-17). However, effective use depends on frontline healthcare workers, including approximately 1,900 medical interns deployed annually in public referral hospitals (18). These interns play a major role in clinical documentation, prescribing, diagnosis, and patient management, yet evidence regarding their EMR training and mentorship remains limited. Guided by the Technology Acceptance Model (19, 20), this study examines EMR system use among medical interns and its relationship with demographic, enabling factors, workplace environment, perceived ease of use, perceived usefulness, and EMR knowledge. Understanding these influences is essential for improving EMR utilization among medical interns who are at the frontline of healthcare service delivery in Uganda public referral hospitals.

METHODOLOGY

Research study design

This study employed a cross-sectional design using a self-administered online questionnaire distributed via Google Forms to official communication platforms of medical interns. The instrument measured six categories of independent variables, including demographics (e.g., age, sex, type of intern, type of hospital), enabling factors(e.g., history of EMR training, digital skills, availability of ICT officers, computers, internet connectivity and power supply), Work environment (e.g colleague support, time pressure and stress), Perceived ease of use, Perceived usefulness and Knowledge of EMR. The dependent variable was categorized as EMR use, which was measured using self-reported frequency of use recording never (1) to always (4). The content validity of the questionnaire was examined by experts in the study field, and it was more than 0.50. To evaluate internal reliability, the survey questionnaire was pretested among 30 medical interns from public referral hospitals outside the study. Cronbach's Alpha was used to assess the reliability of the questionnaire, and it was >0.70

Research Study population

The study included intern medical doctors and nurses, 18 years and above, from the 2025/2026 medical internship cohort in randomly sampled 11 Uganda public referral hospitals. The 11 public referral hospitals were from the five clustered groups, which are National referrals, Central, Western, Eastern, Northern, and Southern regional referral hospitals. Medical interns with 6 months or less of service at the selected hospital were excluded. Yamane's formula was used for sample size calculation, cluster random sampling for hospital classification, and proportionate allocation of medical interns.

Data collection

The questionnaire link was disseminated through the official communication groups of medical interns, with access support from the various hospital heads and medical intern leaders of the selected public referral hospitals to allow voluntary participation. The Google Form questionnaire was designed to allow participants to consent and meet the inclusion criteria before filling in their responses. Personal identification

was not collected to maintain anonymity. The form settings allowed only one response per respondent to prevent duplicate submissions.

Data Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 31. Prior to analysis, data were cleaned and checked for completeness, consistency, and accuracy. Statistical significance will be considered at $p < 0.05$. Descriptive statistics were used to summarize participant characteristics and study variables. Associations between categorical variables were assessed using Chi-square, as appropriate. Variables with a *p*-value of less than 0.25 in the bivariate analysis were included in the multivariable logistic regression model to identify predictors of EMR use.

RESULT

A total of 433 medical interns participated in this study. Most of the participants had a median age of 27 (6) years. The majority were medical doctors (72.3%), attached to national referral public hospitals (33.0%). They reported access to computers, access to power supply, internet connectivity, and onboarding EMR training. The complete distribution of participant characteristics is shown in Table 1.

Table 1 General characteristics of participants (N=433)

Characteristics	Frequency (n)	Percentage (%)
Sex		
Male	234	54.0
Female	199	46.0
Type of intern		
Intern Nurse	120	27.7
Intern Medical doctor	313	72.3
Type of hospital		
National RRH	143	33.0
Central RRH	70	16.2
Eastern RRH	79	18.2
Western RRH	74	17.1
Northern RRH	67	15.5
EMR Orientation training		
Yes	327	24.5
No	106	75.5
EMR Refresher training		
Yes	180	41.6
No	253	58.4
Digital skills		
Low	153	35.5
High	280	64.7
Access to the internet		
Yes	286	33.9
No	147	66.1
Access to computer		
Yes	360	83.1
No	73	16.9
Reliable power supply		
Yes	282	65.1
No	151	34.9

Characteristics	Frequency (n)	Percentage (%)
ICT officer		
Yes	381	88.0
No	52	12.0
Work Environment		
Low	182	42.0
High	251	58.0
Perceived Ease of Use		
Low	160	37.0
High	273	63.0
Perceived Usefulness		
Low	190	43.9
High	243	56.1
EMR Knowledge		
Low	199	46.0
High	234	54.0

Table 2 shows the association between the study variables and EMR use . The findings reported show that Sex, EMR orientation training, presence of an ICT officer, computer access, internet access, power supply access, digital skills, and knowledge were significantly associated with EMR use (p<0.005). However, type of hospital, EMR refresher training, perceived ease of use, and perceived usefulness were not significantly associated with EMR use. The detailed results of the Chi-square analysis are presented below in Table 2

Table 2 Bivariate association between the independent variables and EMR use in public referral hospitals using Chi-square test (N=433)

Variables	EMR use (N=433)		Chi-square	*P*-value
	Low EMR use n (%)	High EMR use n (%)		
Sex			6.514	0.011
Female	118 (59.3)	81 (40.7)		
Male	110 (47.0)	124 (53.0)		
Type of intern			0.031	0.861
Intern nurse	64 (53.3)	56 (46.7)		
Intern Medical doctor	164 (52.4)	149 (47.6)		
Type of hospital			3.030	0.553
National RRH	74 (51.7)	69 (48.3)		
Central RRH	35 (50.0)	35 (50.0)		
Eastern RRH	37 (46.8)	42 (53.2)		
Western RRH	43 (58.1)	31 (41.9)		
Northern RRH	39 (58.2)	28 (41.8)		
EMR Orientation training			3.357	0.067
No	64 (60.4)	42 ((39.6)		
yes	164 (50.2)	163 (49.8)		
EMR Refresher training			0.057	0.812
No	132 (52.2)	121 (47.8)		
Yes	96 (53.3)	84 (46.7)		

Variables	EMR use (N=433)		Chi-square	*P*-value
	Low EMR use n (%)	High EMR use n (%)		
Digital skills			13.781	<0.001
No	99 (64.7)	54 (35.3)		
Yes	129 (46.1)	151 (53.9)		
Presence of ICT officer			30.392	<0.001
No	46 (88.5)	6 (11.5)		
Yes	182 (47.8)	199 (52.2)		
Internet access			33.783	<0.001
No	106 (72.1)	41 (27.9)		
Yes	122 (42.7)	164 (57.3)		
Computer access			16.004	<0.001
No	54 (74.0)	19 (26.0)		
Yes	174 (48.3)	186 (51.7)		
Power supply			40.447	<0.001
No	111 (73.5)	40 (26.5)		
Yes	117 (41.5)	165 (58.5)		
Work environment			1.294	0.255
Low	90 (49.5)	92 (50.5)		
High	138 (55.0)	113 (45.0)		
Perceived ease of use			0.559	0.455
Low	88 (55.0)	72 (45.0)		
High	140 (51.3)	133 (48.7)		
Perceived usefulness			0.349	0.555
Low	97 (51.1)	93 (48.9)		
High	131 (53.9)	112 (46.1)		
EMR Knowledge			18.407	<0.001
Low	127 (63.8)	72 (36.2)		
High	101 (43.2)	133 (56.8)		

Factors associated with EMR use (Table 3). Chi-square analysis was initially performed to assess associations between independent variables and EMR use, followed by multivariable logistic regression to identify independent predictors of EMR use. After adjusting for potential confounders, only knowledge of EMR, the presence of an ICT officer, internet access, reliable power supply, and digital skills remained as the only independent predictors associated with high EMR use among medical interns in Uganda public referral hospitals.

After adjusting for potential confounders, the presence of an ICT officer remained the major predictor of high EMR use under enabling factors and thus Interns whose health facilities had ICT officers had **5**.74 times higher odds of reporting high EMR use than those without them (AOR = 5.47, 95% CI: 2.15-13.86, $p < 0.05$). Additionally, interns with adequate EMR knowledge had 1.74 times higher odds of reporting high EMR use than those with inadequate knowledge (AOR = 1.74, 95% CI: 1.12-2.68, $p < 0.05$). The adjusted odds ratios, 95% confidence intervals, and *p*-values are presented in Table 3.

Table 3 Multivariable logistic regression analysis of factors associated with EMR use among medical interns in Uganda Public Referral Hospitals. (N=433)

Variables	AOR	95% CI		*P*-value
		Lower	Upper	
Sex				
Male	1.393	0.902	2.153	0.135
Female	ref			
EMR Knowledge				
High	1.735	1.122	2.683	0.013
Low	ref			
Digital skill				
High	1.667	1.056	2.633	0.028
Low	ref			
EMR Orientation training				
Yes	1.116	0.651	1.913	0.691
No	ref			
Presence of ICT officer				
Yes	5.467	2.157	13.861	<0.001
No	ref			
Reliable power supply				
Yes	2.283	1.382	3.771	0.001
No	ref			
Internet access				
Yes	1.813	1.066	3.083	0.028
No	ref			
Computer access				
Yes	1.759	0.871	3.555	0.116
No	ref			

AOR = adjusted odds ratio; CI = confidence interval.

DISCUSSION

This study assessed the Electronic Medical Record (EMR) usage and its associated factors among medical interns in public referral hospitals. Overall, 68.8% of the medical interns reported high EMR use, thus indicating a relatively high level of EMR usage. The study further found that EMR knowledge, the availability of ICT officer support, internet access, reliable power supply, and digital skills were associated with higher EMR use. Additionally, most respondents perceived inadequate ICT literacy as the greatest barrier to successful EMR implementation and usage. Collectively, these findings demonstrate that both individual competencies and organizational resources play a significant role in promoting effective EMR utilization among medical interns.

A key finding of this study was that medical interns with adequate EMR knowledge had 1.74 times higher odds of reporting high EMR use than those with limited knowledge. This finding is consistent with recent studies from Ethiopia and other low- and middle-income countries, which have shown that healthcare professionals with better knowledge and adequate training are more likely to adopt and routinely use EMR systems because they are more confident in navigating system functions and integrating them into clinical workflows (21, 22).

Similarly, medical interns with better digital skills had 1.67 times higher odds of EMR use than those with less digital skills. This is also consistent with the study from Ethiopia showing supporting evidence that digital competence is key for successful adoption of health information

technologies. These findings emphasize the need to strengthen EMR digital skilling orientation and digital competency training before and during internship to improve utilization.

The present study also demonstrated that organizational and infrastructural factors significantly influenced EMR use. Medical interns working in environments with ICT officer support, reliable internet connectivity, and uninterrupted power supply were more likely to use EMRs effectively. Notably, the presence of ICT officer support showed the strongest association with EMR use, highlighting the importance of timely technical assistance and mentorship in resolving system challenges and promoting user confidence. These findings are consistent with previous studies reporting that technical support, stable electricity, reliable internet access, and institutional readiness are essential for successful EMR implementation and sustained utilization, particularly in resource-limited settings (12, 21). Strengthening health facility infrastructure alongside dedicated ICT support personnel may therefore substantially improve EMR usage among medical interns.

The observed associations between EMR knowledge, digital skills, and EMR usage suggested that limited ICT competency remains a major obstacle to maximizing the benefits of digital health systems. This complemented an important finding of this study where the majority of respondents (68.6%) identified inadequate ICT literacy as the greatest barrier to successful EMR implementation and use. This perception also aligns with similar barriers that have been reported in several studies, where inadequate computer literacy, insufficient user training, limited technical support, and unstable infrastructure were consistently identified as major challenges affecting EMR implementation in healthcare settings (12, 22). Addressing these barriers through continuous capacity building, mentorship, and investments in digital infrastructure may enhance EMR utilization and thus improve healthcare service delivery.

CONCLUSION

This study found that EMR use among interns in public referral hospitals was relatively high, with more than two-thirds of participants reporting high utilization. EMR knowledge, the availability of ICT officer support, internet access, reliable power supply, and digital skills were associated with higher EMR use, while inadequate ICT literacy was identified as the most common barrier to effective EMR implementation. These findings underscore the importance of strengthening both individual competencies and institutional support systems to promote optimal EMR utilization among interns. The study successfully addressed the objective of assessing the use of EMR systems among medical interns and factors associated with its use in 11 public referral hospitals from all five regions of Uganda.

RECOMMENDATION

Health facilities and relevant stakeholders should prioritize regular EMR knowledge capacity-building programs and digital skills training to facilitate continuous utilization of EMR systems by medical interns. Additionally, they should strengthen ICT support services by ensuring the availability of dedicated ICT personnel, and invest in reliable internet connectivity and uninterrupted power supply to facilitate effective EMR use among medical interns

ETHICAL DECLARATION.

The ethical approval was obtained from Mahidol University - Central Institutional Review Board (MUCIRB), Mahidol University, and Uganda National Council for Science and Technology on 29/05/2026 with Certificate of Approval (COA) number 2026/277.0505. The study was conducted in accordance with the principles of the Declaration of Helsinki. All participants first consented before participating in this study. Participation remained voluntary for all participants in this study.

LIMITATIONS

This study had some limitations. First, its cross-sectional design prevents conclusions about causality. Also, findings may not be generalizable to all medical interns since the inclusion criteria strictly focused only on two types of medical interns (medical doctors and nurses), excluding other categories such as pharmacists, midwives, and dental interns. Lastly, data collection using an online self-reported survey introduces potential subjective biases such as recall and social desirability bias.

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CHALLENGES AND SUGGESTIONS FOR DISEASE PREVENTION AND CONTROL PERFORMANCE OF DISTRICT HEALTH BOARDS IN HEALTH REGION 2, THAILAND

Woraphon Reangchan[1*] and Wutthichai Jariya[1]
[1]Faculty of Public Health, Naresuan University, Phitsanulok, 65000, Thailand
****Corresponding Author:*** *Woraphon Reangchan,*
Faculty of Public Health, Naresuan University, Phitsanulok, 65000, Thailand. Email: woraphonr67@nu.ac.th

ABSTRACT

Introduction: Thailand has advanced its district health system through multi-sectoral integration of public, private, and civil society sectors, with District Health Boards (DHBs) playing a pivotal role in promoting population health and well-being. However, Health Region 2 continues to face challenges in meeting disease prevention and control targets, together with operational problems such as budget constraints, limited inter-agency coordination, and inadequate communication. Understanding these challenges and practical suggestions from the perspectives of DHB members is essential for strengthening disease prevention and control performance at the district level.

Objectives: To identify the challenges and suggestions regarding the disease prevention and control performance of DHBs within Health Region 2, Thailand.

Methodology: This qualitative study collected data using open-ended questionnaires administered through an online platform. The sample consisted of DHB members within Health Region 2 selected through purposive sampling, yielding a total of 66 respondents. Data were analyzed using content analysis. Key words and phrases were extracted from responses to generate codes, which were then grouped by content similarity into two themes: challenges and suggestions. Response frequency was calculated to reflect the prominence of each theme, and findings were summarized through qualitative narrative description.

Results: Among 66 respondents, the majority were male (53.0%), aged 51–60 (57.6%), bachelor's degree holders (50.0%), and DHB members for over four years (50.0%). The most frequently reported challenge was inadequate and delayed budget allocation, which participants described as limiting operational flexibility, continuity, and inter-agency collaboration. Another major challenge was insufficient cooperation among DHB members and network partners, characterized by siloed operations, unclear inter-agency linkages, limited shared understanding of DHB roles, and over-reliance on public health agencies. Participants most frequently suggested adequate and more flexible budget support, along with stronger operational integration and network participation around shared district-level goals.

Conclusion: This study identified five key operational challenges among DHB members in Health Region 2: budget delays, insufficient multisectoral cooperation, personnel shortages, role ambiguity, and unclear operational goals. Participants suggested more adequate and flexible budget support, stronger multisectoral collaboration, clearer roles and shared goals, continuous coordination, and capacity development. These approaches may be considered in future DHB development; however, their effectiveness was not evaluated in this study.

Keywords:
Disease Prevention and Control; District Health System; District Health Boards.

INTRODUCTION

Thailand has advanced its district health system through multisectoral integration across public, private, and civil society sectors to foster community self-reliance. As the primary link between national policy and local implementation (1), the district health system delivers comprehensive services, serves as the

initial health promotion contact, and engages civil society (2). This structure aligns with the World Health Organization's Primary Health Care framework, emphasizing integrated life-course care, multisectoral management of health determinants, and community empowerment (3).

Thailand faces growing public health challenges, particularly non-communicable diseases, which impose substantial economic and social burdens (4-5). In Health Region 2, diabetes and hypertension incidence rates exceed the national average (6). To address local health needs, the Thai government established District Health Boards (DHBs) in 2018 under an "area-based, people-centered" framework. DHBs operate as multisectoral governance bodies driving health planning, implementation, guidance, and evaluation through cross-sector collaboration (7).

In 2024, an evaluation of DHB-driven disease prevention and control performance across 15 target districts in Health Region 2 covering road traffic accidents, non-communicable diseases, and dengue hemorrhagic fever revealed that six districts (40%) missed morbidity and mortality targets (8). Operational barriers including budget constraints, inefficient inter-agency coordination, inadequate communication, irregular meetings, community conflicts, and limited community ownership of shared health problems have been shown to directly compromise DHB performance (9-10).

Health Region 2 encompasses diverse topographies, from agricultural lowlands to mountainous borderlands, resulting in pronounced health inequities and a dual disease burden of non-communicable conditions and cross-border infectious risks (11-12). Consequently, DHBs operate under distinct contextual constraints requiring adaptive multisectoral governance, establishing Health Region 2 as a vital setting for evaluating local disease prevention and control performance.

Previous studies on DHBs have primarily highlighted operational challenges such as delayed budget allocations, role ambiguity among network partners, and health workforce shortages, while suggesting financial decentralization and multisectoral integration as practical solutions (13-15).

A review of existing research and operational evidence (11-12, 14) suggests that studies examining DHB performance in disease prevention and control within Health Region 2 remain limited. Understanding the challenges and practical suggestions from the perspectives of DHB members is therefore essential for strengthening disease prevention and control performance at the district level and informing evidence-based policy development.

METHODOLOGY

Study Design

This study presents the qualitative component of a larger cross-sectional study and uses open-ended questionnaire responses to explore challenges and suggestions related to DHB operations in disease prevention and control.

Study Setting and Period

The study was conducted in Health Region 2, Thailand, which comprises five provinces: Phitsanulok, Sukhothai, Phetchabun, Tak, and Uttaradit. The study covered 21 selected districts across these five provinces. Data were collected from December 2025 to April 2026.

Participants and recruitment

Participants were DHB members from selected districts in Health Region 2 who completed the questionnaire and provided written responses to the open-ended questions. The inclusion criteria were as follows: 1) membership in the DHB appointed in accordance with the Prime Minister's Office Regulation on Area-Based Quality of Life Development B.E. 2561 (2018);
2) representation from districts implementing Department of Disease Control activities during 2018–2025; and 3) a minimum tenure of three months as a DHB member. Of the 441 DHB members who completed the quantitative

survey, participation in the open-ended section was voluntary. A total of 66 members provided qualitative responses, and all of them were included in the qualitative analysis without secondary sampling or exclusion.

Data Collection

Data were collected via open-ended online questions focusing on operational challenges and suggestions for DHB disease prevention and control. Developed from the literature, the questionnaire was expert-validated (CVI=0.99) and pilot-tested with 30 participants for clarity. The researchers coordinated with local data collectors in each district to distribute the questionnaire to the target participants. Prior to data collection, all data collectors received an orientation to ensure a common understanding of the study objectives, target participants, and data collection procedures.

Data Analysis

Data were analyzed using content analysis. Responses were read repeatedly to gain an overall understanding of the data. Meaningful words, phrases, and statements related to DHB implementation challenges and practical suggestions were identified and coded. Similar codes were then grouped into categories under two analytical areas: challenges and suggestions. Each respondent could report multiple items within each challenge and suggestion domain. Frequencies were used descriptively to indicate how often each category was mentioned. The findings were summarized using qualitative narrative description, supported by representative quotations.

Trustworthiness

Trustworthiness was addressed through procedures related to credibility, dependability, confirmability, and researcher reflexivity (16). Credibility was enhanced through independent review and coding by the research team, followed by discussion on coding and category development. Dependability was supported by applying a consistent analytical process, including repeated reading, coding, comparison, and categorization. Confirmability was strengthened by checking the developed categories against the original written responses and by using representative quotations to support the findings. Researcher reflexivity was addressed through team discussion to minimize the influence of individual perspectives and prior experience with public health systems and DHB operations.

RESULTS

A total of 66 DHB members provided written responses to the open-ended questions and were included in the qualitative analysis. The results are presented as follows.

Demographic Characteristics

Of the 66 respondents, the majority were male (53%). The most common age group was 51–60 years (57.6%). Regarding educational attainment, half of the respondents held a bachelor's degree (50%). In terms of tenure, 50% had served as DHB members for more than four years (Table 1).

Table 1 Demographic characteristics of the sample (n=66)

Demographic Characteristics	Number	Percentage
Sex		
Male	35	53.0
Female	31	47.0
Age (years)		
25 – 40	8	12.1
41 – 50	18	27.3
51 – 60	38	57.6
> 60	2	3.0

Demographic Characteristics	Number	Percentage
Education Level		
Upper Secondary Education / Vocational Certificate	2	3.0
Bachelor's Degree	33	50.0
Postgraduate Degree	31	47.0
Tenure as DHB Member (years)		
< 1	2	3.0
1 – 4	31	47.0
> 4	33	50.0

Content Analysis

Theme 1: Challenges for Disease Prevention and Control Performance

The three most frequently reported challenges were: 1) inadequate and delayed budget allocation; 2) insufficient cooperation among DHB members and network partners; and 3) shortage of personnel to drive disease prevention and control operations (Table 2).

Table 2 Frequency of reported challenges among DHB members (n=66)

Challenges	Number	Percentage
Inadequate and delayed budget allocation	31	47.0
Insufficient cooperation among DHB members and network partners	9	13.6
Shortage of personnel to drive disease prevention and control operations	8	12.1
Excessive workload and unclear roles and responsibilities	8	12.1
Lack of clear goals and health problem challenges in the area	6	9.1

Note. n = 66. Percentages do not total 100% because respondents could report multiple items.

Inadequate and Delayed Budget Allocation

Inadequate and delayed budget allocation from central authorities compromised operational flexibility and continuity, limiting the ability to conduct on-site activities and in-person meetings, which represented a significant barrier to inter-sectoral network collaboration.

"The budget support from the central level isn't enough to get things done out in the field." (ID 04, Male, aged 59)

"The budget we get is pretty tight when it comes to running any kind of drive activities." (ID 32, Female, aged 54)

Insufficient Cooperation among DHB Members and Network Partners

DHB operations in the field lacked integration and continuity. Agencies often operated in silos under separate mandates, causing unclear network linkages and limited awareness of DHB roles. Crucially, operations relied excessively on public health agencies as the sole driving force.

"Work in the field still has a real problem with agencies not cooperating with each other." (ID 07, Female, aged 25)

"The way things are run still isn't clearly integrated. Each agency sometimes just does its own thing based on its own mission." (ID 24, Male, aged 51)

Shortage of Personnel to Drive Disease Prevention and Control Operations

A shortage of public health personnel directly impaired DHB operations. Frequent member turnover disrupted policy continuity, while a board predominantly composed of senior administrators led to limited reflection of frontline operational realities.

"Local administrative organizations are short on public health staff. Those are the people

who actually help push the mission forward." (ID 46, Female, aged 59)

"The appointed board members are executives who give the orders. In practice, I'd like to see frontline workers appointed to the DHB or subcommittees for each issue. That way, the people actually doing the work can speak to what's really happening on the ground, not just executives reflecting things from a policy angle." (ID 52, Male, aged 51)

Excessive Workload and Unclear Roles and Responsibilities

A significant challenge arose from excessive workloads among personnel across agencies, who were responsible for multiple duties, resulting in time constraints and an inability to fully fulfill their DHB roles. Additionally, most network partner agencies lacked clarity regarding their roles and responsibilities, with some agencies remaining unaware of the specific duties assigned to them.

"Staff have so much on their plate that they can't give DHB work the attention it really needs." (ID 09, Male, aged 53)

"When it comes to roles and responsibilities, some agencies just don't know what they're supposed to be doing." (ID 19, Male, aged 50)

Lack of Clear Goals and Health Problem Challenges in the Area

Unclear operational goals and task assignments failed to build policy understanding among network partners. Operations were further complicated by evolving local health issues, including non-communicable diseases, communicable diseases, emerging infections, and substance use, hindering effective plan implementation aligned with community contexts and schedules.

"The goals for driving the work aren't clear, especially when it comes to assigning tasks to each sector." (ID 19, Female, aged 52)

"There's just so much variety, and new diseases keep coming up all the time." (ID 05, Female, aged 52)

Theme 2: Suggestions for Disease Prevention and Control Performance

The three most frequently reported suggestions were: 1) adequate budget allocation and support; 2) systematic operational integration and promotion of network participation; and 3) continuous communication and meetings (Table 3).

Table 3 Frequency of reported suggestions among DHB members (n=66)

Suggestions	Number	Percentage
Adequate budget allocation and support	12	18.2
Systematic operational integration and promotion of network participation	9	13.6
Continuous communication and meetings	6	9.1
Continuous monitoring and operational support	3	4.5
Capacity development and knowledge enhancement	3	4.5

Note. n = 66. Percentages do not total 100% because respondents could report multiple items.

Adequate Budget Allocation and Support

Greater budget support is required to ensure comprehensive district-level operations. Providing direct central funding to DHBs enables flexible, context-specific problem-solving. Furthermore, integrating budgets with Local Administrative Organizations (LAOs) can engage network partners and secure adequate operational resources.

"The government should give DHBs a central budget that they can use to fix whatever problems come up in the area, based on what the board thinks needs sorting out." (ID 17, Male, aged 52)

"There should be budget support in areas that are actively pushing the work forward, so every agency can see the bigger picture and get on board with moving things ahead together." (ID 09, Female, aged 40)

Systematic Operational Integration and Promotion of Network Participation

A multidimensional integration mechanism and systematic participatory processes should be established across partner sectors to drive shared district goals. Strengthened agency-community collaboration will enable networks to collectively address problems and achieve targets effectively.

"It's about bringing together work across many different dimensions into one." (ID 02, Male, aged 49)

"DHB work needs to be pushed out so other agencies actually know about it and understand it. It shouldn't just be the public health agencies doing all the heavy lifting on their own." (ID 19, Male, aged 50)

Continuous Communication and Meetings

Meeting frequency should be increased to at least three to four times per year, or once every two to three months, to ensure operational continuity. Clarification meetings must provide clear task assignments for multisectoral collaboration, complemented by tailored communication approaches across all levels and age groups.

"There should be meetings to explain things clearly and lay out a clear plan for assigning tasks on issues where every sector needs to work together." (ID 16, Female, aged 54)

"The board should meet every two to three months to keep the activities going." (ID 41, Female, aged 55)

Continuous Monitoring and Operational Support

Ongoing monitoring and operational support should be maintained, along with morale-boosting initiatives for district-level agencies that consistently drive operations forward, in order to sustain motivation and operational effectiveness.

"Monitoring and support for operations should be kept up on a continuous basis." (ID 59, Male, aged 58)

"There should be something in place to boost the morale of districts that keep pushing the work forward consistently." (ID 22, Male, aged 57)

Capacity Development and Knowledge Enhancement

Systematic training should be provided to build understanding and enhance knowledge among DHB members, with the aim of strengthening their competencies and capabilities to effectively fulfill their roles and drive assigned missions.

"DHB members should really have their capacity built up properly." (ID 32, Female, aged 54)

"The team's knowledge base for doing the work needs to be developed." (ID 57, Male, aged 46)

The overall synthesis of the qualitative findings, mapping key implementation challenges directly to suggestions and target outcomes, is illustrated in Figure 1

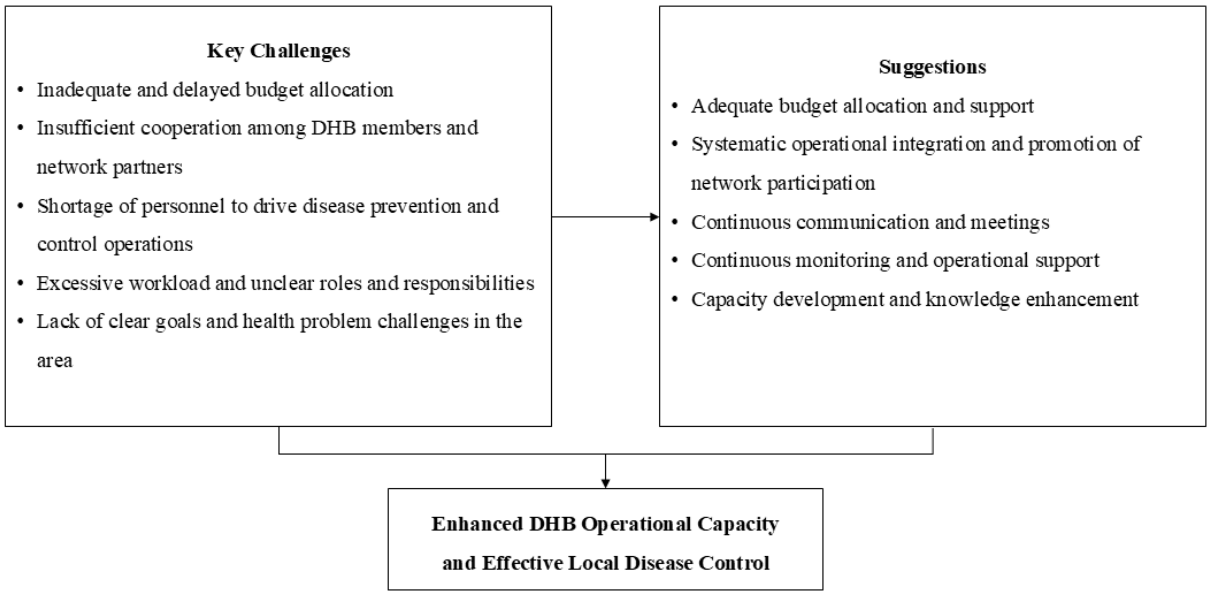

Figure 1 Summary of reported implementation challenges and participant-suggested strategies for DHB operations.

DISCUSSION

This study identified key operational challenges and suggestions regarding disease prevention and control operations among District Health Boards (DHBs) in Health Region 2, Thailand. Based on these findings, the key challenges are discussed below.

Inadequate and delayed budget allocation emerged as the primary operational challenge. This challenge may be related to rigid, top-down bureaucratic disbursement procedures that are less responsive to the changing needs of disease prevention and control. These findings reinforce prior studies from district health settings in Ghana (13), Sierra Leone (17), and Kenya (18), which reported that resource constraints and delayed funding were associated with difficulties in district-level management and budget execution. Delayed funding may also reduce participation and slow down collaboration among non-health partners. In response, participants emphasized the need for adequate and more flexible budget support. Flexible financing options, including greater use of Local Health Security Funds, may be considered.

Insufficient cooperation among DHB members and network partners may reflect organizational silos and institutional hierarchies. Non-health sector representatives often perceive health initiatives as secondary duties, leading to weak inter-agency integration and limited awareness of DHB roles. Similar structural friction was observed in primary health care systems in India (19) and South Africa (20), where inter-departmental hierarchies and centralized decision-making hindered effective multisectoral collaboration and local managerial autonomy. In this study, participants emphasized the need for stronger operational integration, greater network participation, and clearer shared goals. Approaches such as participatory decision-making, clearer inter-agency coordination, and shared targets may therefore be considered to strengthen collaboration, although their effectiveness should be evaluated further (21-22).

Personnel shortages may compromise the continuity of direction-setting and implementation of DHB activities. DHB responsibilities are often added to the existing duties of health staff without additional personnel or structural adjustment, consistent with findings

from district health systems in West Africa (13, 17) and regional health systems in Thailand (23). These workforce constraints may also increase perceived workloads and delay joint field activities. Capacity development and task-shifting approaches may therefore be considered as potential strategies for addressing workforce constraints (22).

Excessive workloads and unclear roles may limit members' ability to fully perform their DHB responsibilities. Unclear Terms of Reference (TOR) may also contribute to overlapping responsibilities and coordination difficulties across agencies. Similar challenges have been reported in public health workforce studies in South Africa (24) and Thailand (14–15), where role ambiguity and competing responsibilities were associated with poorer managerial performance. Previous research has also highlighted the importance of clear role perception and managerial capacity for effective DHB functioning (14). In this study, participants emphasized the need for clearer roles and better coordination among agencies. Clearer operational frameworks and designated coordinating roles may therefore be considered to support task division and inter-agency collaboration.

Finally, the lack of clear goals and locally identified health priorities may limit shared understanding and coordinated planning among network partners. Without clear and data-informed priorities, district health planning may become more reactive and provide fewer opportunities for partners to identify their roles in addressing local health problems (22, 25). Unclear goals may also contribute to inefficient use of limited resources, role ambiguity, and weaker multisectoral engagement. In this study, participants emphasized the need for clearer operational goals and stronger coordination. Local health information systems and collaborative planning approaches may therefore be considered to support priority setting and performance monitoring.

CONCLUSION

This study identified five key operational challenges among DHB members in Health Region 2: inadequate and delayed budget allocation, insufficient multisectoral cooperation, personnel shortages, excessive workloads with unclear roles, and unclear operational goals. Participants suggested adequate and more flexible budget support, stronger operational integration and network participation, continuous communication and coordination, ongoing monitoring and operational support, and capacity development.

RECOMMENDATIONS

Based on the findings of this study, relevant authorities may consider several approaches to strengthen DHB operations, including more adequate and flexible budget support, stronger operational integration and network participation, continuous communication and coordination, ongoing monitoring and operational support, and capacity development for DHB members. These approaches should be regarded as potential areas for policy and operational development rather than interventions proven to be effective by this study. Future research should evaluate their feasibility, acceptability, and effectiveness across different health regions and stakeholder groups.

ETHICAL DECLARATION

This study was approved by the Institutional Review Board of Naresuan University (COE No. 171/2025; IRB No. P2-0347/2568), with approval granted on August 28, 2025. All participants were fully informed of the study's objectives and data collection procedures, and voluntary participation was obtained prior to data collection.

LIMITATIONS

Several limitations of this study should be noted. First, as the study was conducted within Health Region 2, findings have limited generalizability. Second, the reliance on brief online written responses limited qualitative depth and lacked follow-up probing to clarify complex operational dynamics. Third, potential self-selection bias and socially desirable responses may have influenced participant engagement and self-reported data. Finally, unequal representation across districts and stakeholder sectors may underrepresent frontline workers and non-health partners. Future research using mixed methods approaches across diverse health regions is recommended.

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DIRECT MEDICAL COST OF CHRONIC KIDNEY DISEASE UNDER THE UNIVERSAL COVERAGE SCHEME IN THAILAND: A NATIONWIDE CROSS-SECTIONAL STUDY

Rongrit Nanthapaibul[1], Orapin Laosee[1], Piyapong Janmaimool[1] , Suhaimee Buya[1]*

[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand

****Corresponding Author:** Suhaimee Buya, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand, E-mail: suhaimee.buy@mahidol.ac.th*

ABSTRACT

Introduction: Chronic kidney disease (CKD) imposes a substantial clinical and economic burden globally, particularly in low- and middle-income countries. In Thailand, comprehensive national evidence on direct medical costs across all CKD stages under the Universal Coverage Scheme (UCS) remains absent.

Objective: To explore the direct medical costs of CKD across all disease stages and treatment modalities and to examine factors associated with direct medical costs, including healthcare utilization, using national data.

Methodology: A cross-sectional study was conducted using administrative claims data from the National Health Security Office (NHSO) for fiscal year 2023. CKD patients were identified using ICD-10 codes under the UCS. Direct medical costs were analyzed from the provider perspective, including hospital services (covering doctor fees), medications, diagnostics, and renal replacement therapy (RRT). Costs included both outpatient (OPD) and inpatient (IPD) services. Healthcare utilization variables—service type (OPD, IPD, both), length of stay, and number of visits—were examined. Descriptive statistics were applied, and cost differences across sociodemographic, clinical, and service-related factors were assessed using log-transformed data with t-tests and ANOVA.

Results: A total of 231,160 CKD patients were included. The mean annual direct medical cost was 68,216 THB (SD = 119,204), with a median of 27,963 THB. Costs increased markedly with disease severity, with stage 5 patients accounting for 75.1% of cases and incurring the highest costs. Patients receiving RRT had substantially higher costs than non-RRT patients. Higher costs were also associated with multiple comorbidities, complications, and intensive healthcare utilization, including longer hospital stays, frequent visits, and combined OPD/IPD use. Patients treated in private hospitals incurred the highest costs. Geographic variation was evident, with high-cost provinces exceeding the national average by approximately 29%, largely driven by advanced disease stage and high service utilization.

Conclusion: CKD costs in Thailand are primarily driven by advanced disease stages and intensive healthcare utilization. Strengthening early detection at the primary care level, improving referral systems, and enhancing disease management—particularly through better outpatient care, coordination of services, and management of comorbidities—may reduce disease progression, avoid unnecessary hospitalizations, and improve efficiency within the UCS.

Keywords: Chronic kidney disease, cost of illness, universal coverage scheme, healthcare utilization, renal replacement therapy

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and irreversible loss of kidney function or structural abnormalities of the kidneys (1). CKD is classified into five stages. Early stages are often asymptomatic, while advanced stages are associated with severe complications and require renal replacement therapy, which substantially increases healthcare costs (2).

Globally, CKD is a major public health concern, affecting more than 850 million people and contributing significantly to the burden of non-communicable diseases (3,4) . The economic burden is substantial, particularly for patients requiring renal replacement therapy (RRT), which consumes a disproportionate share of healthcare expenditure despite relatively low prevalence (5). Previous studies report wide variation in annual CKD costs depending on disease stage and treatment modality, with dialysis patients incurring especially high expenses (6).

In Asia, CKD burden continues to rise due to aging populations, increasing prevalence of diabetes and hypertension, and delayed diagnosis. However, cost-of-illness (COI) evidence remains limited and fragmented, particularly in Southeast Asia, where studies often rely on small samples or focus on specific treatments without capturing the full disease spectrum (7).

In Thailand, CKD presents a growing challenge under the universal coverage scheme (UCS), which covers approximately 75% of the population (8). Although policies such as the "PD First" and community-based CKD care have been implemented, existing economic evidence remains incomplete. Previous studies mainly focus on dialysis (9) or hospitalization (10) and lack comprehensive national-level analysis across all CKD stages and treatment modalities.

Various factors influence CKD-related costs, including disease severity, treatment modality, comorbidities, complications, and healthcare utilization patterns. Clinical factors such as CKD stage and comorbidity burden have been consistently associated with higher costs, while service-related factors—such as hospital type, service utilization, and length of stay—also contribute to cost variation (6,7,10,11). Understanding these factors is essential for improving resource allocation and healthcare efficiency.

This study aims to comprehensively assess the direct medical costs of CKD across all disease stages, treatment modalities, and key complications using nationwide administrative data from the National Health Security Office (NHSO). By capturing a complete picture of cost distribution and examining factors associated with direct medical costs within the UCS population, this study addresses critical evidence gaps and provides robust, policy-relevant insights to support efficient resource allocation, improve CKD management, and enhance long-term sustainability of Thailand's universal health system.

METHODOLOGY

Study Design

This study employs a cross-sectional design to estimate the average direct medical cost of CKD treatment by using the provider's perspective and identify associated cost-related factors. The secondary data were derived from healthcare facilities across Thailand that are registered with the NHSO. These facilities include both public and private providers that deliver services under the UCS, which covers approximately 75% of the Thai population. Therefore, the analysis reflects nationwide service coverage and utilization patterns for patients diagnosed with CKD.

Data Source

This study utilized secondary data from the NHSO database. The study population comprised patients diagnosed with CKD who received medical care under the UCS during Thailand's fiscal year 2023. Eligible patients were identified using relevant ICD-10 codes (N181, N182, N183, N184, N185, N189) covering all CKD stages, including those on RRT and those with major CKD-related complications.

The dataset was obtained through a formal request submitted by the Primary Health Care Management Program, ASEAN Institute for Health Development (AIHD), to NHSO. A predefined list of variables and cost components, based on the study framework, was included in the request. Upon approval, the NHSO securely transferred an anonymized dataset to the research team in compliance with data protection

regulations. The dataset was subsequently cleaned, validated, and analyzed to explore direct medical costs and identify factors associated with cost variation.

Data Management

The dataset comprised 231,160 patients with UCS-CKD, represented across a total of 452,695 records reflecting variations in expenditure type, hospital type, and service utilization. Records with incomplete or invalid age information were excluded from the analysis. Specifically, 444 records were removed due to missing age data, and an additional 3 records were excluded because they contained negative age values.

Table 1 outlines the operational definitions of variables used in the study, categorizing them into sociodemographic, clinical, and health service factors, and specifying their measurement types and classification criteria.

Age, comorbidity, complication, length-of-stay, and visit categories were created based on the observed data distribution to ensure adequate subgroup sizes for analysis.

Table 1 Operational definitions and categorization of study variables.

Variable	Type	Description
CKD cost (Outcome)	Ratio	The total individual CKD cost of patients in 2023
Sociodemographic Factors		
Gender	Binary	Male and female
Age group	Ordinal	12 groups
Clinical Factors		
CKD stage	Ordinal	G1–G5 (increasing severity), G9 (not specific)
Treatment modality	Binary	non-RRT and RRT
No. of comorbidities	Ordinal	8 groups
No. of complications	Ordinal	3 groups
Complications	Nominal	MI, HF, Stroke, AKI, and None
Health Service Factors		
Hospital type	Nominal	RH, CH, GH, UH, OG, PH
Service utilization	Nominal	IPD, OPD, OPD/IPD
Length of stay	Ordinal	4 groups
No. of visits	Ordinal	7 groups

MI=Myocardial Infraction; HF=Heart Failure; AK=Acute Kidney Injury; RH=Region Hospital; CH=Community Hospital; GH=General Hospital; UH=University Hospital; OG=Other Government Hospital; PH=Private Hospital; IPD=Inpatient Department; OPD=Outpatient Department.

Data analysis

Descriptive statistics were used to summarize all study variables. The distribution of cost data was assessed using quantile–quantile (Q–Q) plots and showed clear deviation from normality. Therefore, logarithmic transformation was applied to reduce skewness and approximate a normal distribution, allowing for more appropriate statistical analysis. Mean cost values were calculated and presented to facilitate interpretation of economic differences across categories.

Associations between CKD costs and explanatory variables (sociodemographic, clinical, and health service factors) were examined using boxplots and inferential statistics based on log-transformed cost data. Independent-samples t-tests were conducted for variables with two categories, while one-way ANOVA was used for variables with more than two categories. Statistical significance was

determined at a p-value of <0.05. To account for multiple comparisons, p-values were adjusted using the Benjamini-Hochberg false discovery rate (FDR) procedure. Where significant group differences were identified in ANOVA analyses, Games-Howell post hoc tests were performed for pairwise comparisons.

RESULTS

Table 2 presents the distribution of direct medical costs among chronic kidney disease (CKD) patients according to sociodemographic characteristics, clinical factors, and health service factors (N = 231,160). Overall, the mean direct medical cost was 68,216 THB (SD = 119,204), with a median of 27,963 THB (IQR: 4,428–90,489).

Table 2 summarizes the distribution of direct medical costs across sociodemographic, clinical, and health service characteristics. Higher costs were generally observed among younger patients, those with advanced CKD stages, patients receiving RRT, and those with greater comorbidity burden, complications, and healthcare utilization. Higher expenditures were also observed among patients treated in private hospitals and those utilizing both outpatient and inpatient services. Figures 1-3 further illustrate the distribution and variability of costs across these key subgroups.

Table 2 Direct medical costs by sociodemographic characteristic, clinical factor, and health service factor among CKD patients.

Variables	n (%)	CKD cost (THB)		
		Mean (SD)	Median (IQR)	Min - Max
Gender				
Female	121,107 (52.4)	68,673 (134,348)	28,256 (4,871-87,484)	0 - 9,613,518
Male	110,053 (47.6)	67,713 (99,918)	27,580 (4,000-94,120)	0 - 5,461,545
Age group (years)				
0-29	6,916 (3)	90,466 (126,626)	42,337 (8,040-162,262)	9 - 3,357,097
30-46	22,541 (9.8)	89,581 (133,004)	43,684.6 (10,563-167,880)	0 - 6,332,636
47-54	26,481 (11.5)	82,281 (113,797)	40,920 (9,992-140,400)	3 - 4,550,048
55-58	20,116 (8.7)	77,021 (107,492)	37,920 (7,880-123,232)	0 - 4,283,745
59-62	23,900 (10.3)	74,713 (113,362)	35,692 (6,443-114,270)	0 - 4,631,088
63-65	20,190 (8.7)	70,951 (106,543)	32,580 (5,684-104,548)	5.3 - 4,916,347
66-68	21,356 (9.2)	69,518 (134,175)	29,064 (4,594-93,700)	1.6 - 6,406,166
69-72	26,151 (11.3)	64,276 (113,209)	24,818 (3,442-82,098)	1 - 4,805,232
73-76	22,125 (9.6)	58,572 (138,761)	19,600 (2,000-65,623)	2.4 - 5,953,809
77-81	19,611 (8.8)	47,317 (111,441)	15,125 (1,300-47,519)	1.2 - 6,691,056
82-100	21,711 (9.4)	36,227 (100,459)	10,809 (890-36,434)	1.6 - 9,613,518
101-124	62 (0)	26,789 (48,189)	12,268 (1,092-30,697)	50 - 251,520
CKD stage				
1	593 (0.3)	2,075 (9,319)	266 (100-955)	23.7 - 169,247
2	1,702 (0.7)	2,990 (8,793)	300 (108-1,374)	2.4 - 113,582

Variables	n (%)	CKD cost (THB)		
		Mean (SD)	Median (IQR)	Min - Max
3	25,123 (10.9)	11,151 (23,736)	1,671 (300-15,355)	1 - 840,380
4	21,558 (9.3)	16,625 (31,300)	4,080 (450-21,531)	2 - 657,929
5	173,679 (75.1)	86,780 (131,406)	43,200 (13,256-149,560)	0 - 9,613,518
Unspecific	8,505 (3.7)	6,123 (31,720)	444 (150-3,108)	3 - 2,358,720
Treatment modality				
non-RRT	128,554 (55.6)	44,328 (128,776)	16,594 (3,435-45171)	0 - 9,613,518
RRT	102,606 (44.4)	98,145 (98,107)	47,280 (8,010-180,000)	0 - 1,567,060
Number of comorbidities				
0	65,988 (28.5)	67,874 (91,744)	16,000 (1,080-141,000)	0 - 1,326,980
1	22,454 (9.7)	44,300 (79,432)	6,039 (572-36,465)	1.6 - 946,200
2	27,049 (11.7)	42,101 (73,931)	11,587 (2,000-34,949)	2 - 1,032,987
3	27,143 (11.7)	46,638 (82,204)	19,320 (5,758-43,067)	3 - 4,932,132
4	23,851 (10.3)	55,966 (88,804)	30,276 (13,440-56,655)	5.3 - 4,916,347
5	18,656 (8.1)	67,716 (95,107)	42,391 (20,757-78,058)	8 - 4,086,777
6-7	23,069 (10)	85,265 (118,017)	59,472 (29,160-112,140)	28 - 5,953,809
8-32	22,950 (9.9)	144,899 (246,023)	100,811 (41,520-189,226)	5.3 - 9,613,518
Number of complications				
0	207,663 (89.8)	61,079 (89,170)	23,355 (3,048-74,458)	0 - 4,772,383
1	12,179 (5.3)	95,796 (126,354)	61,260 (30,300-132,072)	30 - 6,691,056
2-16	11,318 (4.9)	169,490 (339,333)	100,388 (42,960-209,277)	30 - 9,613,518
Complication from CKD				
MI	2,709 (1.2)	116,901 (232,077)	54,175 (15,553-165,380)	12 - 5,953,809
HF	5,772 (2.5)	106,501 (225,349)	56,791 (14,310-144,180)	10 - 9,613,518
Stroke	1,213 (0.5)	69,688 (102,693)	27,040 (2,000-97,406)	12 - 894,993
AKI	47 (0)	40,163 (83,502)	7,547 (1,302-32,685)	150 - 424,675
None	221,419 (95.8)	66,620 (112,797)	27,000 (4,137-87,000)	0 - 6,691,056
Hospital type				
RH	35,346 (15.3)	50,354 (140,908)	20,201 (2,000-47,030)	1.6 - 5,763,676
CH	58,482 (25.3)	56,767 (85,125)	24,892 (6,702-62,944)	1.2 - 4,248,681
GH	41,161 (17.8)	62,935 (134,611)	31,560 (5,322-61,396)	0 - 9,613,518
UH	14,745 (6.4)	49,944 (125,635)	5,697 (690-44,760)	0 - 6,691,056
OG	14,269 (6.2)	47,626 (100,517)	5,600 (463-46,522)	5.3 - 5,636,776
PH	67,157 (29.1)	99,211 (118,362)	56,640 (10,600-176,140)	0 - 6,406,166

Variables	n (%)	CKD cost (THB)		
		Mean (SD)	Median (IQR)	Min - Max
Service utilization				
IPD	30,722 (13.3)	46,255.5 (67,140)	27,170 (16,000-52,146)	1,045 - 3,852,815
OPD	123,631 (53)	55,031 (87,572)	8000 (600-47,880)	0 - 1,476,800
OPD/IPD	76,807 (33.2)	98,223 (165,062)	54,460 (24,500-143,460)	10 - 9,613,518
Length of stay (days)				
0	167,758 (72.6)	63,915 (88,825)	16,642 (1,400-101,035)	0 - 1,567,060
1-2	25,428 (11)	32,790 (34,253)	23,719 (15,071-39,678)	2,603 - 1,607,865
3-5	15,761 (6.8)	54,636 (51,321)	40,650 (24,135-67,125)	3,740 - 1,016,958
> 5	22,213 (9.6)	150,886 (276,651)	91,166 (51,738-173,612)	3,520 - 9,613,518
Number of visits				
1	62,640 (27.1)	18,126 (50,927)	5,827 (254-20,669)	0 - 4,805,232
2	30,022 (13)	30,709 (128,186)	7,000 (800-33,439)	0 - 6,691,056
3-4	28,582 (12.4)	41,078 (105,203)	11,448 (1,984-49,472)	26.5 - 5,636,776
5-7	18,849 (8.2)	60,229 (173,171)	18,361 (6,360-69,054)	47.2 - 6,406,166
8-18	22,262 (9.6)	78,558 (162,987)	28,980 (14,240-100,547)	225 - 9,613,518
19-49	22,593 (9.8)	49,006 (59,008)	42,800 (37,016-47,280)	560 - 2,286,601
50-203	23,377 (10.1)	136,269 (60,927)	14,2100 (91,320-172,080)	1,740 - 1,567,060
204-383	22,835 (9.9	234,747 (27,009)	245,640 (227,580-250,860)	75,937 - 997,700
Total	231,160	68,216 (119,204)	27,963 (4,428-90,489)	0 – 9,613,519

SD=Standard Deviation; IQR=Inter Quartile Range

Association of CKD Costs with Factor Variables

The distribution of CKD costs was highly skewed. However, after log transformation, the distribution was approximately normal. Therefore, the log-transformed CKD cost data were used in this study (test with a Q-Q plot).

The associations between CKD costs and factor variables, including sociodemographic characteristics, clinical factors, and health service factors, were examined using boxplots and statistical tests (Figures 1–3). All statistically significant associations remained significant after Benjamini-Hochberg FDR adjustment, while Games-Howell post hoc analyses confirmed significant differences across most category comparisons for sociodemographic, clinical, and health service factors.

Sociodemographic Characteristics Factors

Figure 1 presents the distribution of CKD costs according to sex and age group. Differences in CKD costs were observed across age groups, with younger patients generally showing higher costs than older patients. Female patients also demonstrated slightly higher CKD costs compared with male patients.

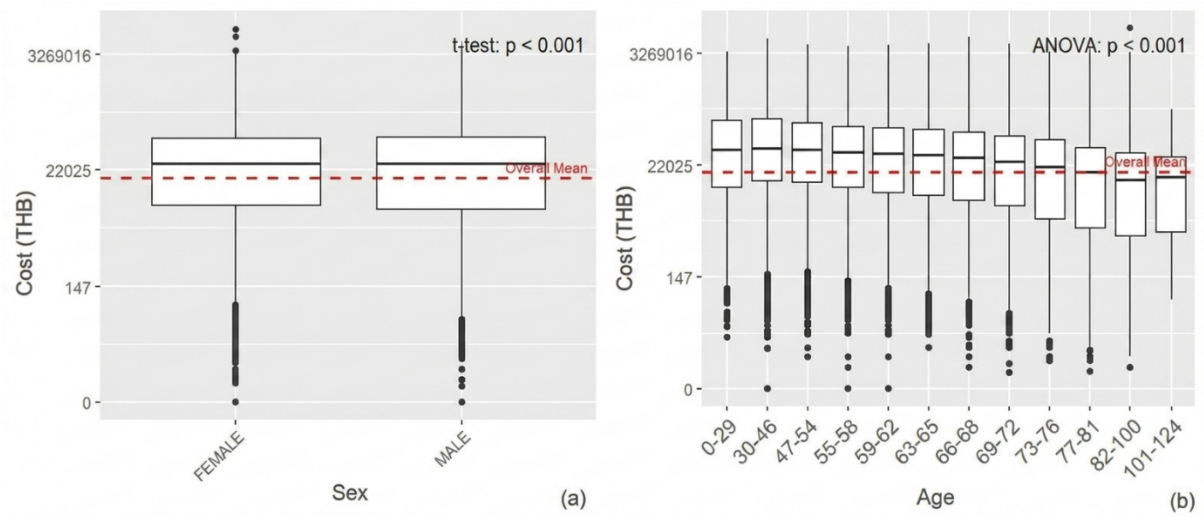

Figure 1 Boxplots of CKD costs according to sex (a) and age group (b).

Clinical Factors

Figure 2 presents the distribution of CKD costs according to CKD stage, treatment modality, number of comorbidities, number of complications, and CKD-related complications. CKD costs increased substantially with disease severity, with patients in CKD stage 5 incurring the highest costs. Similarly, patients receiving RRT had markedly higher costs than those receiving non-RRT treatment.

Costs also showed a positive relationship with the burden of comorbidities and complications. Patients with a greater number of comorbid conditions or multiple complications incurred considerably higher costs than those with fewer or no additional health conditions. Among specific CKD-related complications, patients with myocardial infarction and heart failure experienced the highest costs, whereas those without complications had substantially lower expenditures.

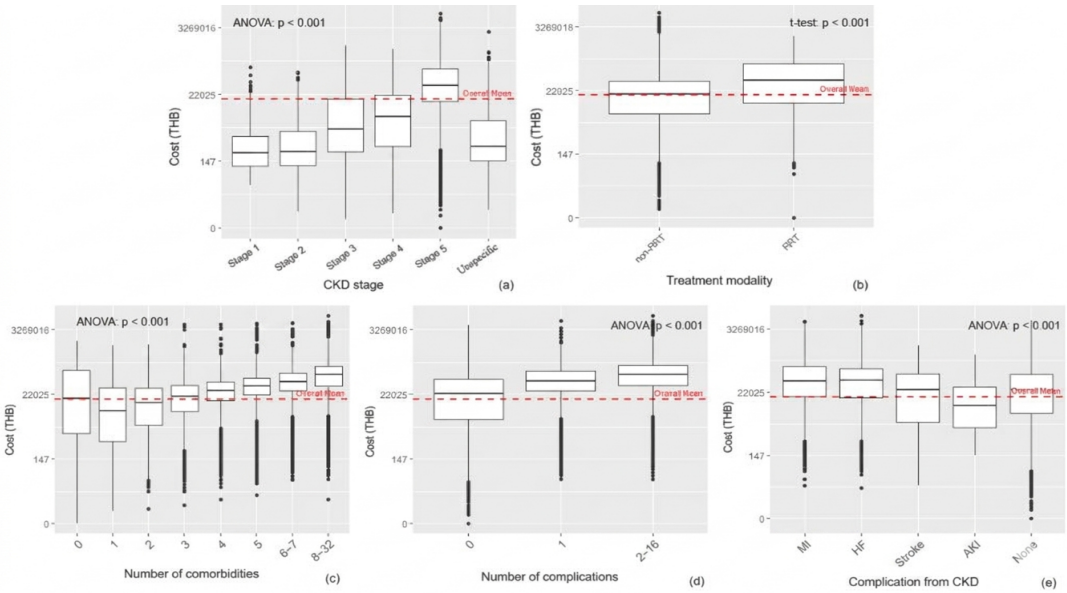

Figure 2 Boxplots of CKD costs according to CKD stage (a), treatment modality (b), number of comorbidities (c), number of complications (d), and CKD complications (e).

Health Service Factors

Figure 3 presents the distribution of CKD costs according to hospital type, service utilization, length of stay, and number of healthcare visits. Significant variations in CKD costs were observed across all health service factors. Patients receiving care at private hospitals incurred the highest costs compared with those treated at other hospital types. Similarly, patients who utilized both outpatient and inpatient services had substantially higher costs than those receiving either outpatient or inpatient care alone.

CKD costs also increased with greater healthcare utilization. Patients with longer hospital stays incurred progressively higher costs, with the highest expenditures observed among those hospitalized for more than five days. Likewise, costs increased with the frequency of healthcare visits, and patients with the greatest number of visits experienced the highest financial burden.

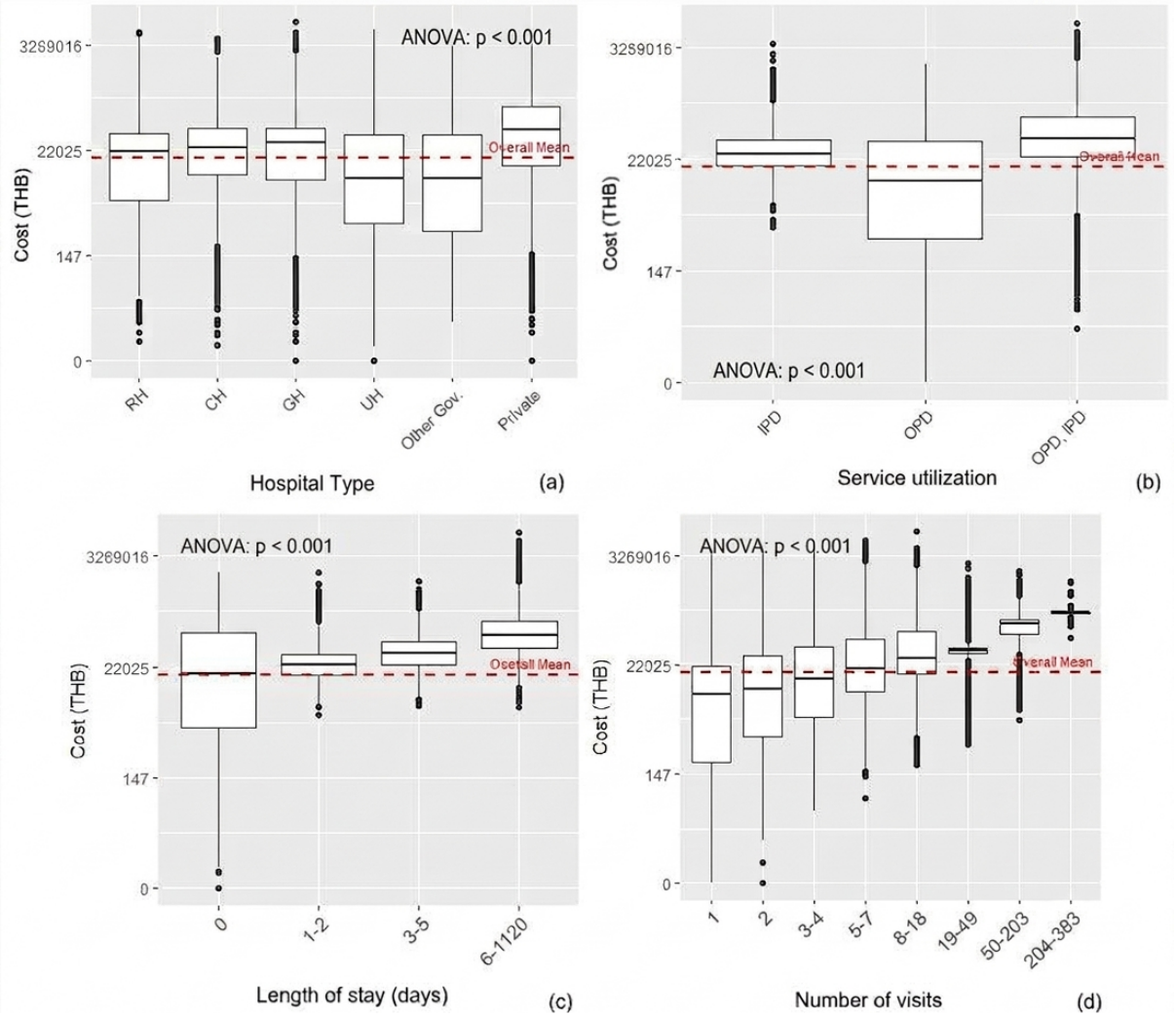

Figure 3 Boxplots of CKD costs according to hospital type (a), service utilization (b), length of stay (c) and number of visits (d).

Spatial Maps of Average CKD Costs

Figure 4 presents clear geographic variation in average CKD costs across Thai provinces in 2023. The highest costs are concentrated in a small group of provinces, led by Phuket (99,638 THB), followed by Sing Buri, Pathum Thani, Saraburi, Lamphun, Suphan Buri, Chiang Mai, and Chumphon (all above 85,000 THB). These provinces appear in the darkest shades, indicating costs near the upper end of the national range (45,896–99,638 THB). In contrast, many provinces—particularly in the North and

Northeast—show lighter shades, reflecting lower average costs.

The spatial pattern also indicates that high-cost provinces do not correspond to areas with the largest patient populations, as Bangkok is not among the highest-cost areas. Instead, cost variation is geographically uneven, with clusters of high-cost provinces distributed across regions, including the South (Phuket, Chumphon), Central (Saraburi, Pathum Thani, Suphan Buri, Sing Buri), and North (Chiang Mai, Lamphun). Overall, the map highlights substantial regional disparities, suggesting that CKD economic burden varies by location rather than being uniformly distributed nationwide.

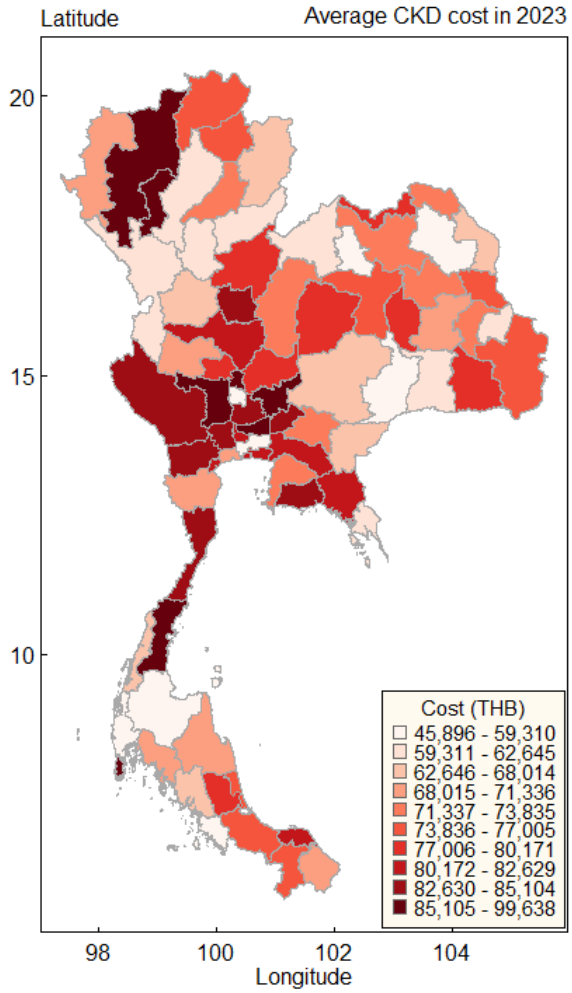

Figure 4 Spatial distribution of average CKD costs across provinces in Thailand, 2023.

DISCUSSION

This study identified key findings. CKD-related costs varied substantially across provinces and were more associated with disease severity than patient volume. High-cost provinces had larger proportions of advanced-stage CKD, particularly stage G5. RRT, healthcare utilization—especially among high-cost users—comorbidities, hospitalizations, and differences in service delivery (public vs. private) were associated with higher CKD costs.

Costs were not proportional to patient volume but were associated with severity, treatment modality, and utilization. This aligns with evidence that advanced CKD requires intensive management, frequent monitoring, and costly treatments such as dialysis, with higher hospitalization and complication rates leading to disproportionate expenditure even among smaller patient groups (6). These findings suggest that UCS resource allocation should

reflect case-mix and clinical complexity rather than volume alone.

Although CKD prevalence generally increases with age, the present study found that younger age groups were associated with higher direct medical costs. Because this study was cross-sectional and based on unadjusted comparisons, the underlying reasons for this pattern cannot be determined from the available data. Future studies incorporating additional clinical and treatment-related variables may help clarify the factors associated with higher costs among younger CKD patients

Advanced CKD predominated in high-cost provinces, where stage G5 exceeded 80% of cases. The high proportion of Stage 5 CKD patients (75.1%) reflects characteristics of the NHSO claims database rather than the true population distribution of CKD. Patients with advanced CKD typically require more frequent utilization, making them more likely to generate reimbursable claims than earlier-stage patients. This reflects established evidence that costs rise sharply in later stages due to greater complexity and hospitalization. Contributing factors may include limited screening and low health literacy (7). Strengthening early detection at the primary care level and improving referral systems are therefore essential.

RRT constituted a major share of CKD costs, consistent with prior studies identifying dialysis as associated with higher cost due to its long-term, resource-intensive nature (8). Its high use in costly provinces suggests a system focused on end-stage treatment rather than prevention, highlighting the need for stronger early-stage interventions.

Healthcare utilization was another factor associated with higher cost, with high-cost users contributing disproportionately. This aligns with literature indicating inpatient care as a key CKD cost driver (7). High utilization may reflect poor disease control, inadequate outpatient management, or fragmented services, underscoring the need for improved care coordination.

Although most patients had no complications or hospitalization, those with multiple comorbidities and longer stays incurred far higher costs, consistent with evidence linking comorbidity burden and prolonged hospitalization to increased expenditure (9). This supports integrated care approaches addressing both CKD and related conditions.

Service delivery variation also contributed to cost differences. While public hospitals provided most care, high-cost provinces relied more on private providers, where costs are typically higher due to pricing structures and limited subsidies (10). Monitoring provider mix is therefore important to ensure efficiency within the UCS.

Future research should integrate multiple data sources, adopt a societal perspective, and use longitudinal designs to examine cost trajectories and causality. Comparative analyses across insurance schemes and inclusion of clinical outcomes are also recommended.

CONCLUSION

This study examined the direct medical costs of CKD among patients under Thailand's UCS and identified significant variation across provinces, with high-cost areas exceeding the national average by approximately 29%. Costs were strongly associated with disease severity, treatment modality, and complications, with advanced-stage CKD—particularly stage G5—accounting for the majority of cases and expenditures. RRT, especially dialysis, was a major cost driver due to its long-term and resource-intensive nature.

Healthcare utilization also played a critical role, with a small group of high-utilization patients contributing disproportionately to total costs. Although most patients had no complications, those with comorbidities and prolonged hospital stays incurred substantially higher expenses. Variations in service delivery, including greater reliance on private providers in high-cost provinces, further contributed to cost differences.

ETHICAL DECLARATION

This study uses anonymized aggregate secondary data, with no direct involvement of human subjects. The dataset was obtained from NHSO, and the study was reviewed and approved by the MU-CIRB (No.2025/394.0711) on 7 November 2025. All data handling adheres to ethical guidelines and privacy regulations, ensuring that no personally identifiable information is used or accessible in the study.

LIMITATIONS

This study has several limitations. First, the NHSO administrative claims database may contain coding inaccuracies and lacks important clinical information, such as laboratory data and disease severity measures. Second, only direct medical costs were included, excluding indirect costs. Third, analyses were based on univariate comparisons without adjustment for potential confounders; therefore, findings should be interpreted as associations rather than independent effects. Finally, the cross-sectional design limits causal inference.

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EXPLORING HOW LOCAL PUBLIC FINANCIAL MANAGEMENT PRACTICES SHAPE THE DELIVERY OF PRIMARY HEALTH CARE: AN EXPLANATORY STUDY WITHIN THE PHILIPPINES' UNIVERSAL HEALTH CARE IMPLEMENTATION

Gillian Lauren Lipumano Garcia[1], May Chan Oo[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

***Corresponding author**: May Chan Oo, College of Public Health Sciences, Chulalongkorn University, Email. 6874003553@student.chula.ac.th, maychan.o@chula.ac.th*

ABSTRACT:

Introduction: Public financing is essential to achieving Universal Health Care (UHC), and public financial management (PFM) systems influence how resources are planned, allocated, executed, and accounted for in primary health care (PHC). In the Philippines, local government units (LGUs) have fiscal autonomy, which has contributed to a fragmented PFM system and health service delivery. As the country advances UHC implementation, understanding local PFM practices in selected LGUs is important for strengthening equitable and efficient PHC delivery.

Objectives: This study aimed to explore how local PFM, through the budget cycle processes and practices, shapes the delivery of PHC under UHC implementation in selected LGUs in the Philippines.

Methodology: An explanatory case-study design was adopted. In-depth interviews were conducted with 26 purposively sampled key informants from 16 conveniently sampled LGUs (8 provinces, 5 cities, and 3 municipalities) until data saturation was reached. Thematic and content analyses were conducted using deductive and inductive coding strategies. Cross-case pattern matching was applied to compare experiences across LGU cases.

Results: Under UHC implementation, performance-based capitation and pooling mechanisms through the Special Health Fund enabled strategic purchasing. LGUs that implemented pooled procurement leveraged economies of scale, partly addressing inefficiencies from fiscal decentralization. However, local autonomy and rigid PFM rules hindered the implementation of financial consolidation and pooled procurement. Budget planning was constrained by the lack of earmarked health funds and the prioritization of programs and activities of local chief executives. Delays in budget execution due to the tedious procurement process affected PHC delivery. Accountability and budget planning were also affected by skill gaps among health managers in operational, program, and financial management. Furthermore, because fund utilization was treated as the core accountability metric, health managers tended to prioritize service rendering over broader performance and system-improvement goals. These budget cycle practices affected the efficient delivery of PHC services.

Conclusion: Local PFM practices in 16 selected LGUs can either enable or constrain PHC delivery under UHC implementation. To translate financing reforms into stronger PHC, decision-makers should address budget allocation, fund execution, procurement, and accountability challenges while strengthening financial consolidation and health managers' financial management capacity.

Keywords:

Health Financing; Public Financial Management; Primary Health Care; Universal Health Care; Local Government Units

INTRODUCTION

High-quality public financial management (PFM) systems are essential for achieving Universal Health Care (UHC) as they determine how resources are planned, allocated, executed, and accounted for (1-4). In contrast, fragmented PFM systems can limit fund allocation and create bottlenecks in budget execution and service delivery integration (5).

In the Philippines, fragmentation followed the passage of the Local Government Code of 1991, which provided greater fiscal autonomy and devolved the provision of health services to local governments, headed by the local chief executive. (LCE) (6). Fiscal autonomy came with the National Tax Allotment (NTA)—40% of all national taxes—distributed to provinces, cities, municipalities, and barangays based on population, land area, and equal sharing. While LGUs also generate local revenues and receive PhilHealth payments and legislative donations, this autonomy has not automatically resulted in efficient resource mobilization for PHC service delivery (7). As reflected in Figure 1, LGUs manage the funds and inputs required for their respective health facilities, with several inputs coming from the national level. This responsibility has led to LGU contribution to the country's total health expenditure (THE) of only 9.3% in 2022, with wide variations in per-capita spending on health inputs, ranging from less than 8.3 USD to up to 116.7 USD (8, 9). Most households still rely on out-of-pocket payments for their health expenditure, sitting at 44% of THE.

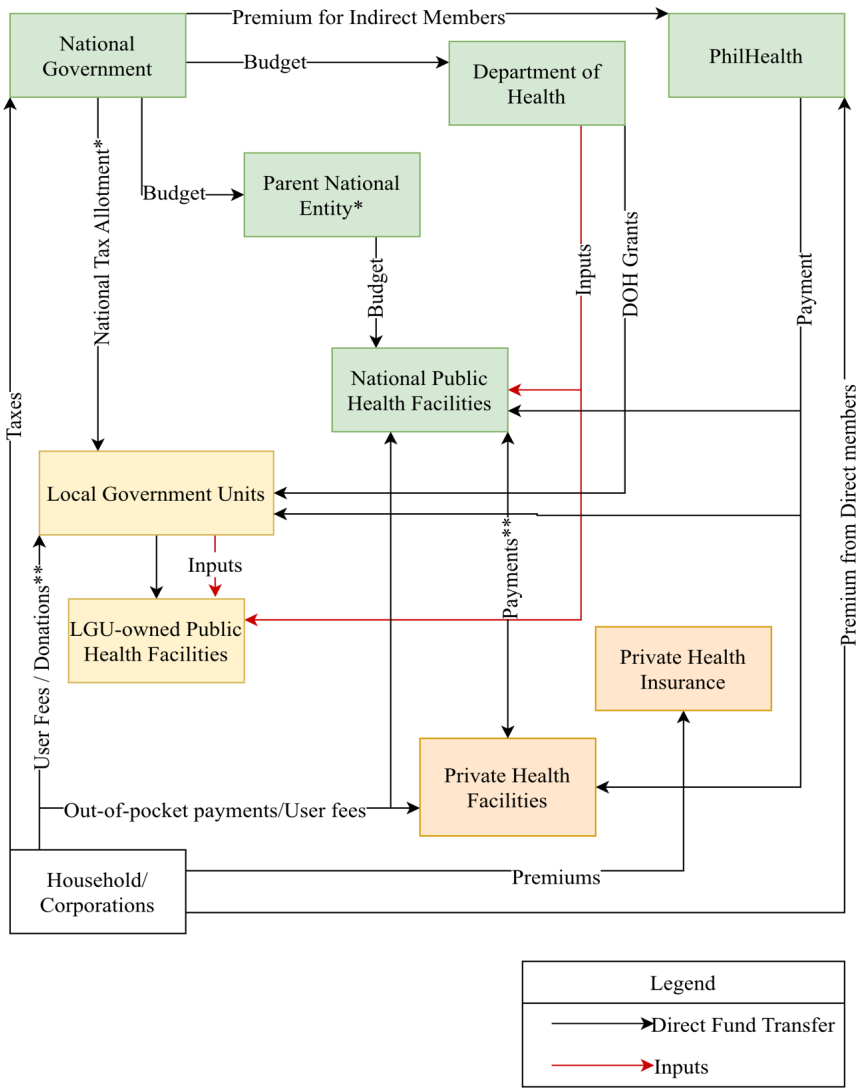


Figure 1 Funding flows in the Philippine health system

The 2019 Mandanas-Garcia ruling ensured LGUs receive their full share of national taxes. Previously, only Bureau of Internal Revenue collections were included, but now all national taxes are part of the share. This increased the NTA and expanded LGU responsibility for devolved services, significantly impacting PHC service delivery as DOH inputs like medicines and human resources (Figure 1) are now transferred to LGUs. Theoretically, fiscal decentralization and health devolution aim for efficiency; however, this was not historically observed in the Philippines. A quantitative study investigated the impact of health devolution as measured by a health expenditure decentralization ratio and found that it has a positive effect on the mean of the inefficiency distribution(10). This quantitative result was consistent with the documented experience of health devolution in the country, where issues such as mismatch between local fiscal capacity and devolution functions, and fragmentation of health service delivery created inefficiency (7, 10). Efficiency with fiscal decentralization can also be affected by political and institutional environments. The presence of corruption, rent-seeking interests, and elite capture can hamper the potential benefits and efficiency gains from decentralization (11).

The Philippines aims to achieve Universal Health Coverage (UHC). Equitable access to quality, affordable healthcare requires efficient local health systems. However, existing literature focuses on national-level health financing, leaving local PFM processes underexplored. This creates a knowledge gap in understanding how local PFM systems operate and influence PHC service delivery under UHC implementation. This study explores how local PFM processes shape PHC delivery in selected Philippine LGUs, describing practices and identifying implementation gaps.

METHODOLOGY

An explanatory case-study design was used to examine how PFM processes and practices shape PHC financing in LGUs under UHC implementation. Cases were analyzed through three budget-cycle stages: formulation, execution, and accountability. Cross-case pattern matching was conducted to compare LGUs' experiences and identify implementation gaps. Study cases were included based on the presence of a local government-owned PhilHealth Yakap provider, the comprehensive PHC benefit package mandated by the UHC law, and a declaration as a UHC Integration Site. Convenience sampling was used for site selection, while representation across provinces, cities, and municipalities was considered to capture diverse LGU experiences in PHC delivery. Key informants were purposively sampled from current LGU employees involved in health budgeting with at least six months of service. Guided by the depth and richness of the data rather than a predefined number, the minimum sample size was 9 study cases and 18 core informants. Participant recruitment was also guided by data saturation. The study followed a clear step-by-step research design process (Figure 2).

Semi-structured in-depth interviews covered the themes of PHC financing, service delivery, and budget cycle processes. Thematic and content analysis employed deductive and inductive coding, guided by Creswell (12). Public documents, including health budgets, health service reports, and other relevant materials, were reviewed to contextualize each case.

Data triangulation involved cross-case pattern matching, cross-referencing with document reviews and published literature, and stakeholder perspectives from respondents with different technical expertise (13). To ensure its reliability through rigor and dependability, all collected data were maintained (14, 15). Proper contextualization was followed to properly transfer the data (13). Participant consent was sought from all informants, ensuring data protection through confidentiality and anonymity.

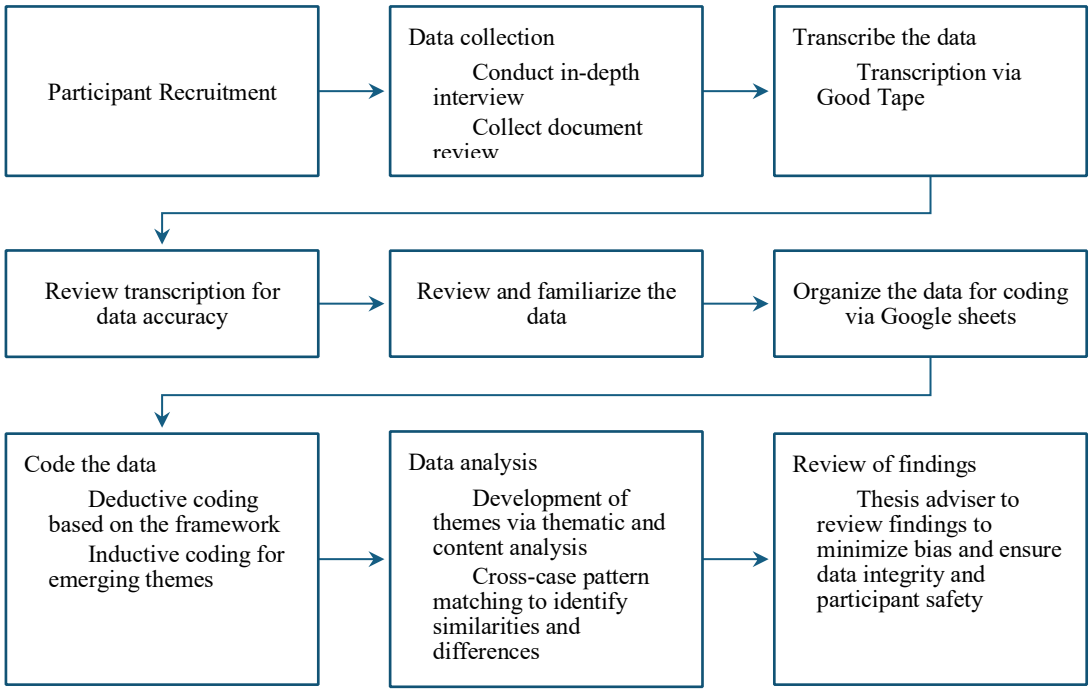


Figure 2 Research design process

RESULTS

Site and participant characteristics

Of 28 invited UHC Integration Sites, the study reached data saturation at 16 LGUs (8 provinces, 5 cities, 3 municipalities) (Table 1) and twenty-six key informants. The key informants had diverse positions and averaged 14 years of service (Table 2). Study sites varied widely in population (38,617 to 3.68M), total funds ($4.3M to $611M), and per capita health spending ($4 to $52), which indicate substantial differences in fiscal capacity across LGUs.

Table 1 Summary of site characteristics

Characteristics	Mun1	Mun2	Mun3	City1	City2	City3	City4	City5	Prov1	Prov2	Prov3	Prov4	Prov5	Prov6	Prov7	Prov8
Population (2024) (in thousands)	38.62	66.35	72.94	1,712.95	100.43	853.05	3,084.27	703.25	681.23	1,980.34	1,568.16	634.42	845.07	3,687.35	2,082.62	472.68
NTA (in millions USD*)	3	3.6	3.8	68.9	12.84	36.66	119.83	32.39	31.91	71.17	46.69	26.86	31.82	81.35	62.86	31.37
LGU Income (in millions USD*)	0.7	0.7	2.0	74	4.22	244.04	480.96	160.04	20.09	38.47	10.16	15.20	14.59	15.54	22.03	3.95
Total Fund sources (in millions USD)	4.5	4.3	5.8	142.8	17.25	287.98	611.44	207.52	61.70	115.45	59.06	42.06	46.46	118.16	84.91	35.78
Health, Nutrition and Population Control Budget (HNP) (in millions USD)	0.488	0.407	0.388	10.11	1.00	44.08	70.77	18.16	8.31	31.20	12.16	2.52	15.86	27.71	10.19	4.53
HNP Budget as % of NTA	16.06	11.17	10.23	14.69	7.79	120.24	59.06	56.06	26.03	43.83	26.04	9.39	49.84	34.06	16.21	14.44
HNP Budget per capita (in USD)	13	6	5	6	9.96	51.67	22.94	25.82	12	16	8	4	19	8	5	10

*1 USD = 60 PHP

Table 2 Summary of Participant Characteristics

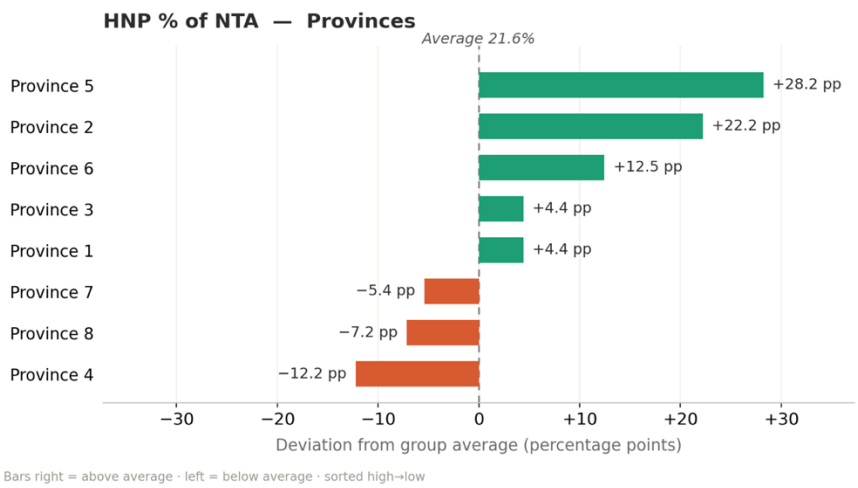
Participant Characteristic	Count
Location	
Municipality	5
City	7
Province	14
Gender	
Female	15
Male	11
Designated Office	
Health Office	22
Budget Office	2
Treasury	1
Accounting	1
Position Type	
Office Head	14
Administrative Officer	5
Mid-level Manager	7
Average years of service	14

Overview of local PFM processes and practices

All sites relied on LGU general funds—including the NTA and local income—which competed with other departmental priorities and were influenced by LCE priorities due to the absence of earmarked health funds.

"Now, it is up to the chief executive to decide which one to prioritize." Budget Officer, F, Mun3

This is reflected in the variations in health allocations from the National Tax Allotment (NTA) (Figure 3). The top-performing LGU in each category allocated nearly double the average for that LGU type.



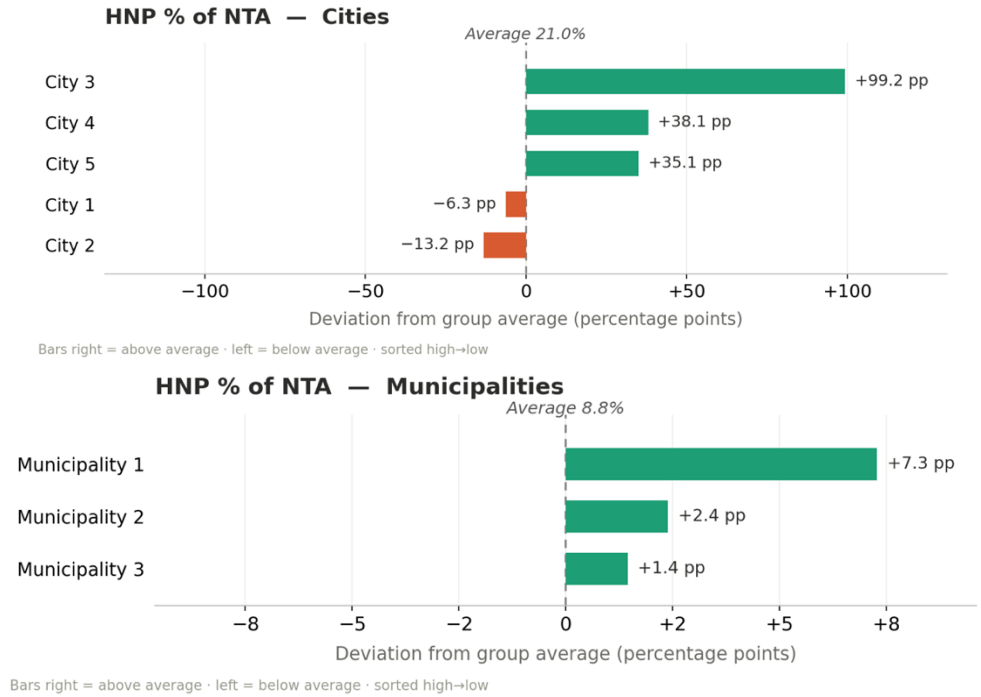


Figure 3 Percent of health, nutrition, and population (HNP) expenditure of study sites to their NTA.

The Special Health Fund (SHF), a pooling mechanism under the UHC Act for consolidating PhilHealth payments, grants, and other health-related funds, was used by eight sites, while others placed these in trust funds.

Table 3 Summary of funding sources across all study sites

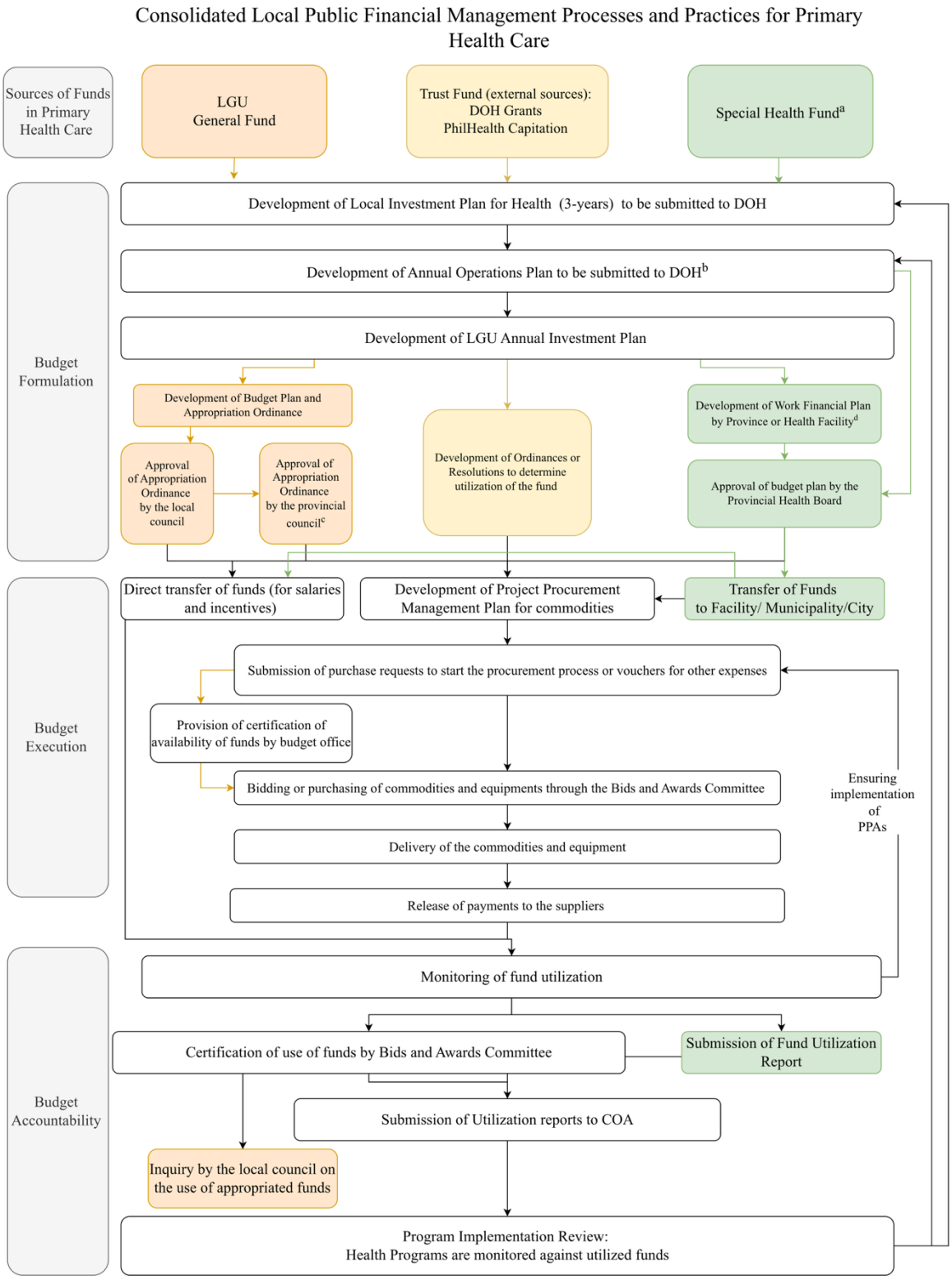
Study Site Code	LGU General Fund	Trust Fund	Special Health Fund	Other Sources
Mun1		Capitation and Reimbursements (C&R)	X	
Mun2		Capitation	X	
Mun3		C&R	Recipient for Capitation	
City1		C&R	Not functioning (NF)	
City2		Reimbursements	Recipient for Capitation	
City3		C&R		
City4		C&R	NF	
City5		DOH Grants	C&R	
Prov1		C&R	NF	
Prov2	NTA and locally sourced income	Reimbursements DOH Grants	Capitation	
Prov3		Reimbursements	DOH Grants	
Prov4		DOH Grants	C&R	Local Economic Enterprise
Prov5		DOH Grants Reimbursements	Capitation	Civil society organizations and international health partners
Prov6		C&R and DOH Grants	NF	
Prov7		C&R	DOH Grants	
Prov8		C&R and DOH Grants	NF	World Bank Project Recipient

All funds underwent local PFM processes regardless of source (Figure 4). Budget formulation started with DOH-required planning documents, which were later converted into LGU documents such as the Annual Investment Plan (AIP) that informed the annual budget. Eleven sites used participatory budgeting, while eight used data-driven planning.

"We do forecasting. We must forecast how much budget we need for this year. We don't just do it. We base it on the top 10 morbidity and mortality of the municipality. We discuss the priority medicines for the year, the medical supplies needed, and the laboratory supplies needed." Health Officer, M, Mun1

The budget office converted AIP items funded by the local general fund into appropriation ordinances. Because lump-sum appropriations were not permitted, each line-item budget needed local council approval and was subject to prioritization by the LCE. Seven study sites reported receiving less than their proposed amount. For the SHF, budget and plan approval fell under the provincial or city health board. Two study sites mentioned that unappropriated programs were moved to the SHF. For SHF and trust funds, health boards or health managers had some discretion over capitation allocation.

All funds followed the procurement process during execution and were considered utilized only after supplier payments were released. External sources also required liquidation reports. Fund utilization was the main monitoring practice in all twelve study sites (n=12), guiding purchase request processing and future planning. For the SHF, utilization reports were collected from facility managers. Figure 4 summarizes these local budget-cycle processes.



Notes
a - Special health fund is the pool of resources for health under the Universal Health Care Framework.
b - Five study sites mentioned that the Annual Operations Plan is the planning document used for the Special Health Fund
c - Component municipalities and cities are required to have their budgets approved by the Provincial Council
d - Two study sites mentioned that a work financial plan is the planning document used for the Special Health Fund

Figure 4 Summary of the processes in the local budget cycle

Impact of UHC on Local PFM

UHC Act health financing reforms, particularly PhilHealth Yakap (a performance-based capitation package for PHC services) and the SHF, enabled LGUs to act as strategic purchasers. PhilHealth Yakap provided more predictable PHC revenue and was recognized as critical additional funding in ten study sites. Placing these funds in the SHF or trust funds gave LGUs increased flexibility, as long as they are used mainly for health services according to benefit guidelines. These payments also supported vital system-level investments.

"Then, the good thing here is that because of what we get from the city's capitation, which is used for operational costs and facility costs, there is now an augmentation for the supply. The manpower ratio also improved because we need to have a physician in all our health centers." Program Manager, F, City1

Compared to the general fund, the SHF functioned as a more agile pooling mechanism. It accelerated facility improvements and supported pooled procurement, which allows several study sites to leverage economies of scale for essential services.

"My parameter seems to be the service capability of the different facilities. Before SHF, this is all they had. But after SHF, this is now what they have." Health Officer, F, Prov2

However, provincial study sites identified SHF as one of the most complex administrative milestones in UHC implementation. Decentralized governance made province-wide integration dependent on the political will of municipal and city mayors, with some LGUs viewing pooled arrangements as a loss of fiscal control.

"That's a loophole in the law because we are anchored on the Local Government Code unless it's amended, that they will be under the province. Until the provision is still stated, we will really have a hard time." Health Officer, F, Prov4

These financial gains were challenged by the concurrent Mandanas-Garcia Ruling, which shifted responsibility for essential health commodities from the DOH to LGUs. Study sites reported difficulties restructuring and executing budgets due to limited purchasing power. This created a complex PHC financing environment, as LGUs had to maintain baseline services while absorbing new financial responsibilities

"It seems like the LGU will procure. And to tell you honestly, we have different budgets per municipality. The budget from the national level at least is fixed; for example, TB meds it's a high cost (for us)". Health Officer, M, Mun1.

Policy and implementation gaps in PFM affecting service delivery

Limitations in fiscal space and lack of earmarked health funds forced health managers to prioritize immediate needs over long-term systemic investments. Some managers used administrative and political workarounds, including the Seal of Good Local Governance (SGLG), to justify health investments.

"If there are budgets that will be denied. We will appeal. We have magic words. For some reason, when we tell the budget (office), we won't pass SGLG. They will provide the budget." Program Manager, F, City1

Procurement delays affected PHC service targets in five study sites. These delays reflected limited understanding of health commodity procurement and centralized procurement arrangements that created systemic bottlenecks.

"COA has to understand the dynamics of procurement of commodities for health facilities. Because they thought that, after buying, we use it immediately. We encounter problems because we cannot pay the supplier until it is used. So it will come to a point that everything is utilized and out of stock, but we can't procure because we haven't paid, or payments haven't been provided." Health Officer, F, Prov2

Such delays also reduced confidence in SHF absorptive capacity, especially for pooled procurement.

"If the province is not ready, and they see that, hey, it took so long for you to procure, to deliver. It will have a ripple effect on the services because they will say, oh, we don't have the

medicine because it took so long for the province to procure, or oh we don't have the reagents because it took long to procure. So, we will be blamed for that." Health Officer, F, Prov4

Additionally, the misalignment between clinical training and PFM demands remained a critical implementation gap. Eight study sites highlighted the need to strengthen financial forecasting, fund utilization, and resource allocation. This gap contributed to inefficient health spending and weakened the translation of financing reforms into PHC service improvements.

"Number one, because they should know, the MHOs, the managers, the chief of hospitals, should also be capacitated on public finance management, PFM. Because now, the chiefs of hospitals, they just keep on spending. They do not think, where will we get these funds? Is this cost warranted? That's what I would like for the chiefs of hospitals in making decisions. Those things... on whether they should save their money for something... those kinds of things." Health Officer, F, Prov8

Table 4 shows that UHC health financing reforms improve spending efficiency and service delivery, but gaps in local PFM and decentralization create barriers.

Table 4 Factors enabling and hindering efficient financing for health spending and service delivery

Health Financing Function	Enabling Factors	Barriers
Revenue Raising	• Performance-based capitation • Increase in NTA	• Lack of earmarked funds for health • Minimal absorptive capacity
Pooling	• Financial consolidation	• Lack of political will
Strategic Purchasing	• Performance-based capitation • Pooled Procurement	• Procurement process • Minimal absorptive capacity • Line-item budgeting
Across all functions		• Skill gap in health workers • Varying exercise of local autonomy; subject to the priorities and decisions of the LCE (political actor)

DISCUSSION

The findings of this study show that the reliability of available funds and their execution, as reflected in the budget cycle process, are relevant. Health financing reforms were seen to enable efficiency, while gaps in local PFM processes and decentralized functions were barriers.

Lack of earmarked health funds and resource competition create barriers to service delivery. This aligns with two Philippine studies on local health financing that identified LCE prioritization as a source of budget constraints (8, 16). The literature has shown methodological challenges in measuring PHC spending (17). A study on PHC financing also identified the need to establish these thresholds, especially in low-and-middle income countries (18). A modelling study by Stenberg et al. across 67 LMICs estimated PHC spending per capita at 59 USD (19), yet none of the study LGUs reached this level. The use of SGLG to secure allocations was also reported elsewhere (16), which suggests that

performance-based incentives or payment mechanisms may support more predictable PHC funding.

Financial pooling enabled more efficient spending and service delivery by reducing fragmentation. However, local autonomy and budget execution delays continue to hinder implementation. Similar challenges have been reported in Philippine municipalities, including political dynamics, delayed remittances or budget execution, and transparency issues in utilization reporting (16).

Implementing performance-based capitation increased revenue and enabled strategic purchasing, showing that provider payment mechanisms can improve resource allocation—as seen in Indonesia's risk-based performance capitation system for PHC. (20). However, using line-item budgeting for performance-based capitation and SHF could limit flexibility in budget execution, monitoring, and evaluation.

LGUs' focus on service delivery and full budget utilization reflects behaviours embedded in line-item budgeting systems. Similar findings on tedious procurement processes and reporting requirements were observed in Indonesia, where strict utilization restrictions and reporting led to budget underspending. (20). These rigid PFM rules and strict public accountability codes restrict the underlying incentives embedded in capitation payments, which typically improve resource efficiency, as highlighted by health financing experts (21). The lack of PFM skills among health managers further compounds these challenges, as also found in a Philippine study on service delivery network operationalization (22).

CONCLUSION

Local PFM practices in 16 selected LGUs enabled and constrained efficient PHC delivery under UHC implementation. Local autonomy and rigid PFM systems, including line-item budgeting, procurement, and utilization reporting, influenced the implementation of PHC financing reforms such as the PhilHealth Yakap capitation scheme and SHF pooling mechanisms.

RECOMMENDATIONS

To achieve Universal Health Coverage (UHC) gains and strengthen primary health care (PHC), decision-makers should develop clear policies to protect PHC budget allocations, streamline fund execution and procurement processes, and enhance accountability measures that address political will and the role of politics in local autonomy. These efforts can promote transparent, aligned, and collaborative governance between national policy and decentralized LGU implementation, ensuring adequate funding and efficient spending for health services. Additionally, strengthening health managers' financial management capacity can improve how financing reforms translate into efficient PHC delivery.

ETHICAL DECLARATION

This study was also approved by the St. Frances Cabrini Medical Center – Asian Eye Institute Ethics Review Committee on April 28, 2026, under Protocol No. 2026-005.

LIMITATIONS

The study provides contextualized implementation insights from diverse LGU stakeholders while maintaining site and participant anonymity. Data and analyses were reviewed by both authors and triangulated to ensure accuracy and mitigate bias. Limitations include reliance on LGU-identified informants, publicly available documents, and the higher-income class. Findings are not intended for statistical generalization but may be transferable to similar decentralized financing arrangements. Future research should examine lower-income LGUs and network-contracting under UHC.

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FACTORS RELATED TO THE REVISIT INTENTION TO THAI MASSAGE SERVICES AMONG INTERNATIONAL TOURISTS IN BANGKOK, THAILAND

Sukanya Watanapradit[1], Saw Praising[1], Pankaew Tantirattanakulchai[2] and Nuchanad Hounnaklang[1*]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand
[2]Department of Health Education and Behavioral Sciences, Mahidol University, Bangkok, Thailand
[*]Corresponding Author: *Nuchanad Hounnaklang,*
College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, E-mail: Nuchanad.H@chula.ac.th

ABSTRACT

Introduction: Thailand is a leading destination for wellness tourism, a rapidly growing sector that generates substantial revenue and contributes to the national economy. Thai massage is a core component of this sector for international tourists. Revisit intention refers to a tourist's conscious plan or willingness to use Thai massage services again in the future. Service-related perceptions and customer satisfaction may be associated with this intention. Understanding these relationships can inform service improvement and support the continued development of Thailand's wellness tourism sector.

Objectives: This study aimed to determine the prevalence of revisit intention to Thai massage services and its associated factors among international tourists in Bangkok, Thailand.

Methodology: A cross-sectional study was conducted in May 2026 among 446 English-speaking international tourists recruited by purposive sampling at 37 participating Thai massage establishments across seven tourist areas in Bangkok. Eligible participants were aged 18 years or older, had received Thai massage in Thailand, did not reside or work in Thailand, and could communicate in English. After screening, trained research staff provided study information, obtained verbal informed consent, and administered a paper-based, self-administered questionnaire on-site. The instrument covered participant and tourism characteristics, massage experiences, service-related factors, customer satisfaction, and future intentions. The dependent variable was the single yes/no item asking whether the participant intended to revisit Thai massage services in Bangkok; the recommendation item was reported descriptively and was not included in the outcome. Multivariable logistic regression was used to identify factors associated with revisit intention.

Results: Among the 446 participants, 350 (78.5%) intended to revisit Thai massage services and 96 (21.5%) did not. The final multivariable logistic regression model included nationality, travel companionship, purpose of visit, and customer satisfaction. Positive customer satisfaction was associated with higher odds of revisit intention than neutral/negative satisfaction (AOR = 4.199, 95% CI: 2.141–8.233, $p < 0.001$). Compared with European/Western tourists, ASEAN tourists (AOR = 2.104, 95% CI: 1.108–3.995, $p = 0.023$) and other Asian tourists (AOR = 2.035, 95% CI: 1.186–3.492, $p = 0.010$) had higher odds of revisit intention. Health tourists also had higher odds than business tourists (AOR = 2.699, 95% CI: 1.314–5.546, $p = 0.007$). Travel companionship and leisure travel were not statistically significant after adjustment. The final multivariable logistic regression model had a −2 log-likelihood of 429.104, a Cox and Snell R^2 of 0.076, and a Nagelkerke R^2 of 0.118, indicating modest explanatory power.

Conclusion: Customer satisfaction, nationality, and purpose of visit were independently associated with revisit intention to Thai massage services among international tourists. Because only English-speaking tourists were included and purposive sampling was used, the findings may not generalize to all international tourists. Service providers and tourism authorities may use these findings to support satisfaction-focused service improvement and wellness-oriented strategies, while recognizing that the cross-sectional design does not establish causality.

Keywords:
Thai Massage; Satisfaction; Revisit Intention; Perceived Service Quality; Cultural Experience; Tourists.

INTRODUCTION

Wellness tourism has emerged as one of the fastest-growing sectors within the global tourism industry, driven by increasing awareness of health, well-being, and preventive healthcare. Travelers are increasingly seeking experiences that promote physical, mental, and emotional wellness, integrating health-related activities into their travel plans. According to the Global Wellness Institute (1, 2), wellness tourism continues to expand worldwide and contributes substantially to the global economy, reflecting growing consumer demand for wellness-oriented travel experiences. As a result, destinations that offer distinctive wellness products and services have become increasingly competitive in attracting international tourists (3).

Thailand's tourism industry is a major engine of economic growth, accounting for approximately 12–20% of the country's GDP, with Bangkok attracting over 22 million international tourists annually. Among Thailand's diverse tourism offerings, Thai massage holds a distinctive position as both a cultural heritage practice and a wellness service deeply embedded in the tourism experience (1, 4).

Revisit intention refers to a tourist's conscious plan to return to a service or destination in the future and is considered an important indicator of customer loyalty and business sustainability (5). Previous studies have demonstrated that tourists who are satisfied with their experiences are more likely to revisit a destination and recommend it to others (6, 7).

In the context of wellness tourism, revisit intention is influenced by several factors, including service quality, perceived value, cultural experience, customer satisfaction, safety, and affordability (8-10). Perceived value reflects tourists' assessment of benefits relative to costs, while cultural experience captures the authenticity and cultural richness of the service encounter (9, 11). Customer satisfaction, derived from the Expectancy–Disconfirmation Theory, is widely recognized as one of the strongest predictors of future behavioral intentions (12). This study aims to determine the proportion of revisit intention to Thai massage services among international tourists in Bangkok, Thailand and to assess factors associated with revisit intention to Thai massage services among international tourists in Bangkok, Thailand.

METHODOLOGY

Research Design

A cross-sectional study design was employed.

Study Setting and Population

Data were collected at 37 participating Thai massage establishments located across seven Bangkok tourist areas with high concentrations of international visitors: Wat Pho, Khaosan Road, Silom/Patpong, Nana (Sukhumvit Soi 4), Phetchaburi-Pratunam, Ratchathewi, and Sutthisan-Ratchadaphisek-Huai Khwang. The study population comprised international tourists aged 18 years or older who had received Thai massage services in Thailand, could communicate in English, were willing to participate, and did not reside or work in Thailand.

Sample Size

The required sample size was calculated using the Cochran formula, assuming a conservative prevalence estimate of 50%, a 5% margin of error (e = 0.05), and a 95% confidence level (Z = 1.96), yielding 385 participants. Adding a 10% non-response allowance, the final target sample was 424 participants.

Instrument

A structured, self-administered questionnaire was developed and reviewed by three experts (item-objective congruence index = 0.66–1.00) and pilot-tested with 30 eligible participants. Cronbach's alpha values of at least

0.79 supported the internal consistency of the multi-item scales; internal consistency was not estimated for the single-item customer satisfaction construct. The instrument comprised six parts: (1) demographic characteristics; (2) tourism experience; (3) type of Thai massage services received; (4) purpose of receiving Thai massage; (5) influencing factors—perceived service quality (23 items), perceived value (8 items), cultural experience (6 items), customer satisfaction (1 item), safety and security (4 items), and cost and affordability (5 items), each rated on a 5-point Likert scale; and (6) two separate future-intention items. The dependent variable was only the yes/no item, "Do you intend to revisit Thai massage services in Bangkok?" The yes/no recommendation item was analyzed descriptively and was not combined with revisit intention.

Data Collection

Data were collected in May 2026 using purposive sampling. Before recruitment, an information leaflet was displayed at participating establishments. The principal researcher and four trained international-student research assistants approached potential participants, applied five eligibility screening questions, provided the participant information sheet, obtained verbal informed consent, and distributed the paper questionnaire. Participants completed the questionnaire on-site in approximately 20–30 minutes. Research staff checked questionnaires for completeness immediately after completion; incomplete questionnaires were excluded.

Data Analysis

Data were analyzed using SPSS version 29. Descriptive statistics included frequencies, percentages, means, and standard deviations. For each Likert-based factor, scores were expressed as a percentage of the maximum possible score and categorized using Bloom's cut-off points: positive, 80.00–100.00%; neutral, 60.00–79.99%; and negative, <60.00%. Because negative responses were absent, the negative and neutral categories were combined for regression analysis and labeled "neutral/negative"; thus, analyses compared positive versus neutral/negative. For the single customer satisfaction item, ratings of 4–5 were positive, 3 was neutral, and 1–2 were negative before the latter two categories were combined. Binary logistic regression used revisit intention (yes/no) as the dependent variable. Variables with $p < 0.20$ in bivariate analyses were entered into the multivariable model: nationality, travel companionship, purpose of visit, and customer satisfaction. Reference groups were European/Western nationality, traveling alone, business travel, and neutral/negative satisfaction. Leisure was retained as a category of purpose of visit and was compared with business; it was not omitted. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported, with $p < 0.05$ indicating statistical significance. Numerical goodness-of-fit statistics were not available in the supplied analysis output

RESULTS

Socio-demographic Characteristics

Participant characteristics are summarized in Table 1. Other Asian tourists constituted the largest nationality group (42.8%), 75.1% traveled with a group, and 65.0% visited primarily for busines

Table 1 Socio-demographic characteristics and tourism experience among international tourists in Bangkok, Thailand (n = 446)

Variables	Frequency	(%)
Gender		
Male	183	(41.0)
Female	263	(59.0)

Variables	Frequency	(%)
Age		
≤ 30	36	(8.1)
31–40	107	(24.0)
41–50	198	(44.4)
> 50	105	(23.5)
Marital Status		
Single	175	(39.2)
Married	271	(60.8)
Educational Level		
Below college	17	(3.8)
College/University	402	(90.1)
Postgraduate	27	(6.1)
Nationality		
ASEAN	104	(23.3)
Other Asian	191	(42.8)
European/Western	151	(33.9)
Tourism Experience		
Traveling alone	111	(24.9)
Traveling with group	335	(75.1)
Purpose of visit		
Leisure	43	(9.6)
Health tourism	113	(25.3)
Business	290	(65.0)

Table 2 Distribution of influencing factors among international tourists in Bangkok, Thailand (n = 446)

Variables	Frequency (n)	Percentage (%)
Perceived Service Quality – Tangibility		
Positive	365	(81.8)
Neutral	81	(18.2)
Perceived Service Quality – Reliability		
Positive	370	(83.0)
Neutral	76	(17.0)
Perceived Service Quality – Responsiveness		
Positive	313	(70.2)
Neutral	133	(29.8)
Perceived Service Quality – Assurance		
Positive	379	(85.0)
Neutral	67	(15.0)
Perceived Service Quality – Empathy		
Positive	352	(78.9)
Neutral	94	(21.1)
Perceived Value		
Positive	350	(78.5)
Neutral	96	(21.5)
Cultural Experience		
Positive	314	(70.4)
Neutral	132	(29.6)

Variables	Frequency (n)	Percentage (%)
Customer Satisfaction		
Positive	390	(87.4)
Neutral	56	(12.6)
Safety and Security		
Positive	304	(68.2)
Neutral	142	(31.8)
Cost and Affordability		
Positive	354	(79.4)
Neutral	92	(20.6)

Table 3 Revisit intention to Thai massage services among international tourists (n = 446)

Variables	Frequency	(%)
Dependent variable: intend to revisit Thai massage services in Bangkok?		
Yes	350	(78.5)
No	96	(21.5)
Descriptive item only: Recommend Thai massage to friends/family?		
Yes	358	(80.3)
No	88	(19.7)

Revisit intention, the study's dependent variable, was reported by 350 participants (78.5%). The separate recommendation item was endorsed by 358 participants (80.3%) and is presented descriptively only (Table 3).

The final multivariable model included nationality, travel companionship, purpose of visit, and customer satisfaction (Table 4). Positive customer satisfaction was associated with higher odds of revisit intention than neutral/negative satisfaction (AOR = 4.199, 95% CI = 2.141–8.233, p < 0.001). ASEAN tourists (AOR = 2.104, 95% CI = 1.108–3.995, p = 0.023) and other Asian tourists (AOR = 2.035, 95% CI = 1.186–3.492, p = 0.010) had higher odds than European/Western tourists. Health tourists had higher odds than business tourists (AOR = 2.699, 95% CI = 1.314–5.546, p = 0.007). Travel companionship and leisure travel were not statistically significant after adjustment. The final multivariable logistic regression model had a −2 log-likelihood of 429.104, a Cox and Snell R^2 of 0.076, and a Nagelkerke R^2 of 0.118, indicating modest explanatory power.

Table 4 Multivariable logistic regression analysis of factors associated with revisit intention to Thai massage services (n = 446)

Variables	Category	AOR	95% CI	P-value
Nationality				
	European/Western	Ref.	–	–
	ASEAN	2.104	1.108–3.995	0.023*
	Other Asian	2.035	1.186–3.492	0.010*
Travel companionship				
	Traveling alone	Ref.	–	–
	Traveling with a group	0.588	0.307–1.126	0.109

Variables	Category	AOR	95% CI	P-value
Purpose of Visit				
	Business	Ref.	–	–
	Leisure	1.329	0.584–3.022	0.498
	Health Tourism	2.699	1.314–5.546	0.007**
Customer Satisfaction				
	Neutral/negative	Ref.	–	–
	Positive	4.199	2.141–8.233	<0.001***

*p < 0.05; **p < 0.01; ***p < 0.001. AOR, adjusted odds ratio; CI, confidence interval; Ref., reference category. All variables shown were entered into the final multivariable model. The dependent variable was revisit intention (yes/no); recommendation was not included.

DISCUSSION

This cross-sectional study examined factors associated with revisit intention among 446 international tourists in Bangkok. After adjustment, revisit intention was associated with customer satisfaction, nationality, and purpose of visit; these associations should not be interpreted as causal effects.

Customer Satisfaction

Customer satisfaction showed the strongest adjusted association with revisit intention. Tourists reporting positive satisfaction had approximately 4.2 times the odds of revisit intention compared with those reporting neutral/negative satisfaction (AOR = 4.199, 95% CI = 2.141–8.233, p < 0.001). This finding is consistent with Oliver's (1999) Expectancy–Disconfirmation Theory, in which satisfaction following an experience may contribute to favorable behavioral intentions (12). Customer satisfaction may reflect tourists' overall evaluation of their Thai massage experience. Prior research in wellness tourism has similarly reported associations between satisfaction and subsequent behavioral intentions (6, 10, 13).

Perceived service quality, perceived value, and cultural experience were not statistically significant in the final model. Therefore, this study does not establish them as direct predictors of revisit intention, and their possible indirect relationships with satisfaction require testing in studies designed for mediation analysis.

Nationality

Nationality was significantly associated with revisit intention. Compared with European and Western tourists, ASEAN tourists (AOR = 2.104, 95% CI = 1.108–3.995, p = 0.023) and other Asian tourists (AOR = 2.035, 95% CI = 1.186–3.492, p = 0.010) were significantly more likely to report revisit intention. Geographical proximity and travel accessibility plausibly explain this finding: ASEAN and other Asian tourists face shorter distances, lower costs, and greater convenience when traveling to Thailand, enabling more frequent repeat visits. Cultural familiarity further strengthens revisit intention among these travelers, who share historical and social commonalities with Thailand and may perceive Thai wellness services as more familiar and accessible.

European and Western tourists, while likely to appreciate Thai massage as a unique experience, often face constraints of distance, cost, and limited opportunities for repeated travel to the same destination. Long-haul travelers frequently diversify destinations across trips, which reduces revisit intent despite positive service experiences. These findings are consistent with prior tourism research demonstrating that nationality, cultural background, and travel accessibility shape revisit behavior (14, 15).

Purpose of Visit

Purpose of visit was the third significant factor. Tourists visiting for health tourism purposes were significantly more likely to intend

to revisit than those visiting for business (AOR = 2.699, 95% CI = 1.314–5.546, p = 0.007); no significant difference was found between leisure and business travelers (AOR = 1.329, 95% CI = 0.584–3.022, p = 0.498). Health tourists travel with explicit wellness motivations; for them, Thai massage is a central component of their itinerary rather than an incidental activity. Accordingly, positive service experiences are more likely to generate strong revisit intention.

Business travelers, by contrast, may engage with Thai massage as a supplementary activity amid work-related commitments. Their time constraints, structured schedules, and primary focus on professional rather than wellness objectives reduce the salience of massage experiences in shaping future travel decisions. This interpretation aligns with the Global Wellness Institute's distinction between primary and secondary wellness tourists and with findings reported by Voigt and Pforr (2013) and Moriuchi et al. (2024) (3, 16).

CONCLUSION

The prevalence of revisit intention toward Thai massage services among international tourists in Bangkok was 78.5%. Positive customer satisfaction, ASEAN or other Asian nationality, and visiting for health tourism were independently associated with higher odds of revisit intention. Perceived service quality, perceived value, and cultural experience were not independently associated with the outcome in the final model and should not be interpreted as direct predictors.

Thai massage providers may prioritize maintaining customer satisfaction through professional, safe, and culturally respectful services. Tourism authorities may also consider wellness-oriented and regionally tailored communication. These recommendations should be interpreted cautiously because the cross-sectional design identifies associations rather than causal effects. Future research should use longitudinal designs, multi-item measures of satisfaction, and formal mediation analyses where appropriate.

ETHICAL DECLARATION

This study was reviewed and approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (RECCU) (COA No. 121/69). All participants provided verbal informed consent. Data were anonymized, stored securely, and retained for five years in accordance with institutional guidelines.

LIMITATIONS

This study has several limitations. First, the cross-sectional design precludes causal inference. Second, purposive sampling from major tourist areas in Bangkok limits generalizability to other geographic settings and tourist populations. Third, the restriction to English-speaking tourists may have introduced language-based selection bias. Finally, self-reported data are subject to recall bias and social desirability effects.

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HEALTHCARE PROFESSIONALS' KNOWLEDGE AND ATTITUDES AS INDICATORS OF ARTIFICIAL INTELLIGENCE READINESS FOR HEALTHCARE PRACTICE AND LEARNING IN YANGON REGION, MYANMAR

Mi Mi Thet Chal [1]***, May Chan Oo*** [1*]

[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.*

[*] ***Corresponding Author****: May Chan Oo, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: 6874015053@student.chula.ac.th, Maychan.O@chula.ac.th*

ABSTRACT

Introduction: Artificial intelligence (AI) is increasingly used in clinical decision support, healthcare delivery, and professional learning. Healthcare professionals' knowledge and attitudes toward AI are important readiness indicators for successful adoption. However, evidence regarding healthcare professionals' knowledge and attitudes toward AI in Myanmar remains limited.

Objective: This study aimed to assess AI-related knowledge and attitudes and identify associated socio-demographic, professional, and digital-access factors among healthcare professionals in Yangon Region, Myanmar.

Methods: A cross-sectional study was conducted among 403 healthcare professionals in Yangon Region, Myanmar. Data were collected using a structured self-administered questionnaire through convenience sampling. AI readiness was operationalized through knowledge and attitude scores, categorized using median cut-off values. Data were analyzed using IBM SPSS Statistics version 29.0.2.0. Descriptive statistics, Chi-square tests, and multivariable binary logistic regression analyses were performed. A p-value <0.05 was considered statistically significant.

Results: Among the 403 healthcare professionals, 50.4% demonstrated good knowledge of AI in healthcare, while 41.4% exhibited a positive attitude toward AI. Most participants reported high internet access (91.3%), frequent internet use (90.6%), and high digital health literacy (95.0%), whereas only 28.3% had prior AI training or exposure. In multivariable analysis, postgraduate education was associated with higher odds of good AI knowledge (AOR = 4.44, 95% CI: 1.84–10.73), while nurses and other healthcare professionals had lower odds of good AI knowledge than doctors. Low internet access (AOR = 0.30, 95% CI: 0.11–0.81) and infrequent internet use (AOR = 0.40, 95% CI: 0.17–0.97) were also associated with lower odds of good knowledge. For attitude, 3-5 years of work experience, low internet access and low self-rated internet skills were associated with lower odds of positive attitudes, whereas public sector employment was associated with higher odds (AOR = 2.11, 95% CI: 1.12–3.97).

Conclusion: Knowledge and positive attitudes toward AI were suboptimal among healthcare professionals. The findings suggest that AI readiness is uneven across professional and digital-access groups, highlighting the need for targeted AI education, digital skills training, and workplace-based capacity-building initiatives. Strengthening these areas may improve healthcare professionals' readiness to engage with AI in healthcare practice and learning.

Keywords:

Artificial Intelligence; Healthcare Professionals; Knowledge; Attitude; Myanmar

INTRODUCTION

Artificial intelligence (AI) refers to computer-based systems capable of performing tasks typically requiring human cognition and action, including learning, problem-solving, and decision-making (1). Advances in machine learning, large datasets, and computational capacity have accelerated AI adoption across sectors, including healthcare (2). AI is increasingly applied in disease diagnosis,

treatment planning, hospital management, public health surveillance, clinical decision support, and professional learning (2–6). Evidence shows that AI improves diagnostic accuracy, supports clinical decisions, reduces administrative workload, and enhances healthcare delivery (5–7).

Successful AI integration depends not only on technological availability but also on healthcare professionals who use these tools (8–10). As AI is intended to support rather than replace clinical judgment, healthcare workers' knowledge and attitudes are essential for responsible adoption (8–10). AI readiness is a multidimensional concept encompassing cognition, ability, vision, and ethics, as described in the Medical Artificial Intelligence Readiness Scale for Medical Students (MAIRS-MS) framework (11). It is a broader concept that encompasses multiple dimensions, including knowledge, skills, and attitudes. In this study, knowledge and attitudes were examined as selected dimensions of AI readiness based on the Medical Artificial Intelligence Readiness Scale (MAIRS-MS) framework. AI is also increasingly used for accessing medical information, scientific literature, and continuing professional development (14–17). In addition, digital health literacy (DHL) is an important component of AI readiness because AI-enabled tools rely on digital platforms and electronic health systems. Evidence suggests that higher DHL is associated with greater engagement with digital health technologies and effective use of online health information (12).

Myanmar has begun exploring AI and digital health technologies through pilot projects and AI-assisted diagnostic and screening systems (13–16). Given persistent workforce shortages and resource constraints, AI has promising potential to improve healthcare efficiency and delivery (17–19).

However, to advance beyond current AI initiatives, baseline evidence on healthcare professionals' readiness to engage with AI remains limited. Existing studies have mainly focused on information and communication technology literacy and readiness for electronic medical record systems rather than AI-specific knowledge and attitudes, which are important indicators of AI readiness (20,21). Therefore, this study assessed knowledge and attitudes regarding AI in healthcare practice and learning and identified associated factors among healthcare professionals in Yangon Region, Myanmar. The findings may inform future AI training, policy development, and implementation strategies.

METHODOLOGY

Study Design and Setting

A cross-sectional study was conducted among healthcare professionals in Yangon Region, Myanmar. Yangon, the country's main healthcare hub with relatively greater exposure to digital health technologies and AI-related applications.

Study Population, Sample Size and Sampling

The study included 403 healthcare professionals aged ≥20 years, with ≥6 months of clinical experience, practicing in public, private, and NGO/INGO healthcare facilities in Yangon. Other HCPs included dentists, pharmacists, laboratory and radiology professionals, physiotherapists, nurse aides, medical assistants, dental assistants, and radiation therapists. The sample size was calculated using Cochran's formula with a 5% non-response allowance. Participants were recruited through convenience sampling by disseminating the survey link through the researcher's professional networks, healthcare-related social media groups, and messaging applications (Facebook, Messenger, Viber, and Telegram), with periodic reminders.

Data Collection and Measurement

Data were collected in June 2026 using a self-administered online questionnaire via Google Forms. Electronic informed consent was obtained before participation. The questionnaire included sociodemographic, professional, contextual, DHL, and AI-related knowledge and attitude sections. DHL was measured using the eight-item eHealth Literacy Scale (eHEALS) and

categorized as low (<26) or high (≥26) (22). Knowledge was assessed using 15 True/False/Not sure items and attitudes using 14 four-point Likert-scale items. Because validated cut-off points were unavailable, scores were dichotomized at their sample medians: knowledge scores < 10 were classified as poor and ≥ 10 as good, while attitude scores < 39 were classified as negative and ≥ 39 as positive. Content validity through expert review (IOC >0.70), and reliability by pilot testing (Cronbach's alpha and KR-20 >0.70) were confirmed.

Data Analysis

Among the 441 individuals who participated in the online survey, responses from 38 participants were excluded because they were incomplete or did not meet the eligibility criteria, leaving 403 complete and eligible responses for analysis and yielding a valid-response rate of 91.4%. Data were analyzed using IBM SPSS Statistics version 29. Continuous variables were presented as median (IQR), and categorical variables as frequencies and percentages. Pearson's chi-square test assessed bivariate associations, with variables having $p < 0.20$ entered multivariable binary logistic regression. Model diagnostics included assessment of multicollinearity using tolerance and variance inflation factor (VIF) values, overall model significance using the Omnibus test, and goodness-of-fit using the Hosmer–Lemeshow test. Results were reported as adjusted odds ratios (AORs) with 95% confidence intervals (CIs); $p < 0.05$ was considered statistically significant.

RESULTS

Descriptive Statistics

Table 1 summarizes the characteristics of the 403 participants. Median age was 30 years. Most participants were female (66.3%), held a bachelor's degree (60.5%), worked as doctors (45.7%), and were employed in private healthcare facilities (60.5%). The median work experience was 5 years. High internet access (91.3%), frequent internet use (90.6%), and high DHL (95.0%) were common, whereas only 28.3% reported prior AI training or exposure.

Table 1 Number and percentage distribution of respondents' characteristics

Variables	Study Participants (n = 403)	
	No.	**Percentage (%)**
I. Sociodemographic characteristics		
Age Group (years)		
20 - 27	121	30.0
28 - 34	184	45.7
≥ 35	98	24.3
	Median (IQR) 30 (27 - 34) Min-Max 20 - 57	
Sex		
Male	136	33.7
Female	267	66.3
Educational background		
Diploma and other	90	22.3
Bachelor's degree	244	60.5
Postgraduate	69	17.1

Variables	Study Participants (n = 403)	
	No.	Percentage (%)
II. Professional factors		
Professional role		
Doctor	184	45.7
Nurse	107	26.6
Other HCPs	112	27.8
Years of experience		
<3 years	99	24.6
3-5 years	106	26.3
6-10 years	121	30.0
> 10 years	77	19.1
	Median (IQR) 5 (3 – 10) Min-Max 0.5 - 32.5	
Primary workplace sector		
Public	100	24.8
Private	244	60.5
NGO/INGO-run healthcare facility	59	14.6
Dual Practice		
No	222	55.1
Yes	181	44.9
III. Contextual factors		
Prior AI training or exposure		
No	289	71.7
Yes	114	28.3
Prior use of digital health systems		
No	123	30.5
Yes	280	69.5
Access to internet		
High access	368	91.3
Low access	35	8.7
Access to digital devices		
No	9	2.2
Yes	394	97.8
Frequency of internet use for healthcare practice or learning		
Infrequent use	38	9.4
Frequent use	365	90.6
Self-rated internet usage skills		
Low skill	150	37.2
High skill	253	62.8

Variables	Study Participants (n = 403)	
	No.	Percentage (%)
AI use among colleagues		
No	81	20.1
Yes	322	79.9
IV. Digital health literacy		
Low DHL: < 26	20	5.0
High DHL: ≥ 26	383	95.0

Overall, 50.4% of respondents had good AI knowledge, while 49.6% had poor knowledge. Figure 1 shows higher correct responses for AI applications, training and preparedness, but lower responses for basic AI concepts, AI implementation, and ethical and privacy issues.

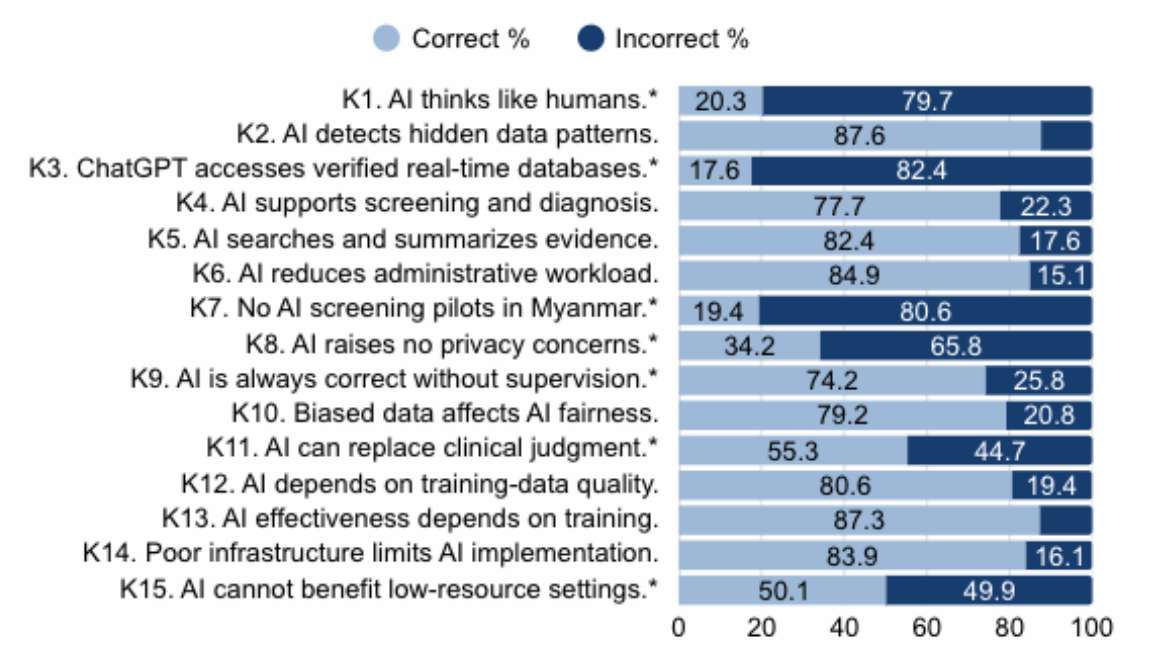

Figure 1 Distribution of correct and incorrect answers regarding knowledge of AI in healthcare

Regarding attitudes, 41.4% had positive attitudes, while 58.6% had negative attitudes. As shown in Figure 2, respondents generally expressed favorable attitudes toward the potential of AI to improve healthcare and supported AI-related training alongside concerns regarding trust, reliability, patient privacy, AI-related errors, and its impact on healthcare professionals.

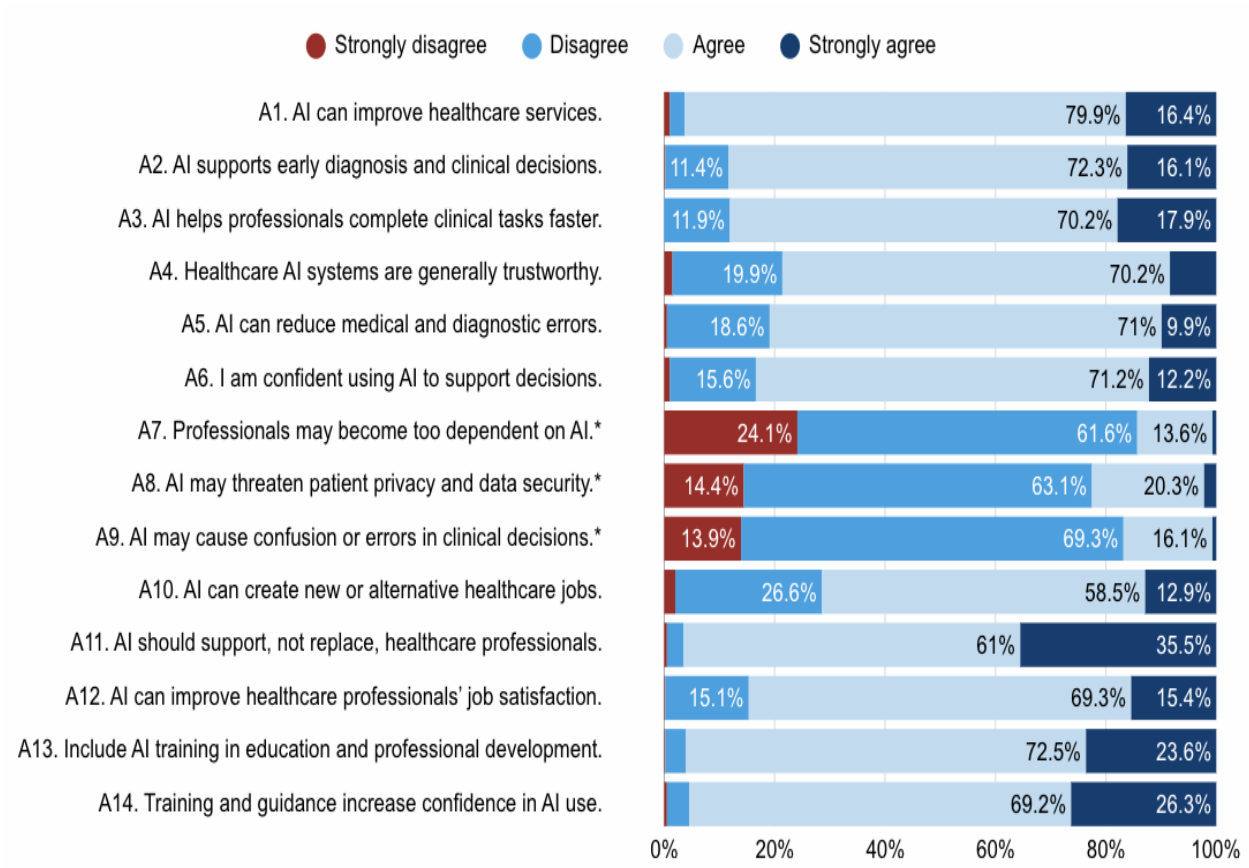

Figure 2 Number distribution of respondents' answers regarding attitude towards AI in Healthcare

Inferential Statistics

In bivariate analysis, as shown in Table 2, AI knowledge was significantly associated with sex, education, professional role, dual practice, internet access, digital device access, frequency of internet use, self-rated internet skills, and DHL (all $p < 0.05$). Good knowledge was more common among males, postgraduates, doctors, and those with high internet access and high DHL.

Attitudes toward AI were significantly associated with sex, years of experience, workplace sector, dual practice, prior use of digital health systems, internet access, frequency of internet use, self-rated internet skills, and DHL (all $p < 0.05$). Positive attitudes were more common among males, participants with >10 years of experience, those working in NGO/INGO-run facilities, and those with high DHL.

Table 2 Association between independent variables, knowledge of, and attitude toward AI in healthcare

Variables	Knowledge			Attitude		
	Poor n (%)	Good n (%)	p-value	Negative n (%)	Positive n (%)	p-value
Age Group (years)	$\chi2$= 0.5751		0.056	$\chi2$= .501[a]		0.778
20 - 27	71 (58.7)	50 (41.3)		70 (57.9)	51 (42.1)	
28 - 34	83 (45.1)	101 (54.9)		111 (60.3)	73 (39.7)	
≥ 35	46 (46.9)	52 (53.1)		55 (56.1)	43 (43.9)	
Sex	$\chi2$=9.326[a]		0.002*	$\chi2$= 4.252[a]		0.039*
Male	53 (39.0)	83 (61.0)		70 (51.5)	66 (48.5)	
Female	147 (55.1)	120 (44.9)		166 (62.2)	101 (37.8)	
Educational background	$\chi2$=39.867[a]		<0.001**	$\chi2$= .218[a]		0.897
Diploma and other	65 (72.2)	25 (27.8)		51 (56.7)	39 (43.3)	
Bachelor's degree	120 (49.2)	124 (50.8)		145 (59.4)	99 (40.6)	
Postgraduate	15 (21.7)	54 (78.3)		40 (58.0)	29 (42.0)	
Professional role		$\chi2$=56.502[a]	<0.001**	$\chi2$= .488[a]		0.784
Doctor	55 (29.9)	129 (70.1)		108 (58.7)	76 (41.3)	
Nurse	78 (72.9)	29 (27.1)		60 (56.1)	47 (18.9)	
Other HCPs	67 (59.8)	45 (40.2)		60 (60.7)	47 (39.3)	
Years of experience		$\chi2$=7.424[a]	0.060	$\chi2$= 9.177[a]		0.027*
<3 years	59 (59.6)	40 (40.4)		62 (62.6)	37 (37.4)	
3-5 years	54 (50.9)	52 (49.1)		72 (67.9)	34 (32.1)	
6-10 years	50 (41.3)	71 (58.7)		65 (53.7)	56 (46.3)	
> 10 years	37 (48.1)	40 (51.9)		37 (48.1)	40 (51.9)	
Primary workplace sector		$\chi2$=3.842[a]	0.146	$\chi2$= 14.931[a]		<0.001**
Public	55 (55.0)	45 (45.0)		50 (50.0)	50 (50.0)	
Private	122 (50.0)	122(50.0)		161 (66.0)	83 (34.0)	
NGO/INGO-run facility	23 (39.0)	36 (61.0)		25 (42.4)	34 (57.6)	
Dual Practice		$\chi2$=5.009[a]	0.025*	$\chi2$= 4.996[a]		0.025*
No	99 (44.6)	123 (55.4)		141 (63.5)	81 (36.5)	
Yes	101 (55.8)	80 (44.2)		95 (52.5)	86 (47.5)	

Variables	Knowledge			Attitude		
	Poor n (%)	Good n (%)	p-value	Negative n (%)	Positive n (%)	p-value
Prior AI training or exposure		$\chi2$=.626[a]	0.429	$\chi2$= .253[a]		0.615
No	147 (50.9)	142 (49.1)		167 (57.8)	122 (42.2)	
Yes	53 (46.5)	61 (53.5)		69 (60.5)	45 (39.5)	
Prior use of digital health		$\chi2$=.733[a]	0.392		$\chi2$= 6.909[a]	0.009*
No	65 (52.8)	58 (47.2)		84 (68.3)	39 (31.7)	
Yes	65 (48.2)	58 (51.8)		152 (54.3)	128 (45.7)	
Access to the internet		$\chi2$=14.144[a]	<0.001**		$\chi2$=14.225[a]	<0.001**
High access	172 (46.7)	196 (53.3)		205 (55.7)	163 (44.3)	
Low access	28 (80.0)	7 (20.0)		31 (88.6)	4 (11.4)	
Access to digital devices		$\chi2$=5.676[a]	0.017*		$\chi2$=3.489[a]	0.062
No	8 (88.9)	1 (11.1)		8 (88.9)	1 (11.1)	
Yes	192 (48.7)	202 (51.3)		228 (57.9)	166 (42.1)	
Frequency of internet use...		$\chi2$=5.928[a]	0.015*		$\chi2$= 16.522[a]	<0.001**
Frequent use	174 (47.7)	191 (52.3)		202 (55.3)	163 (44.7)	
Infrequent use	26 (68.4)	12 (31.6)		34 (89.5)	4 (10.5)	
Self-rated internet skills		$\chi2$=4.736[a]	0.030*		$\chi2$=21.487[a]	<0.001**
High skill	115 (45.5)	138 (54.5)		126 (49.8)	127 (50.2)	
Low skill	85 (56.7)	65 (43.3)		110 (73.3)	40 (26.7)	
AI use among colleagues		$\chi2$=.299[a]	0.585		$\chi2$=2.745[a]	0.098
No	38 (46.9)	43 (53.1)		54 (66.7)	27 (33.3)	
Yes	162 (50.3)	160 (49.7)		182 (56.5)	140 (43.5)	
Digital Health Literacy (DHL)		$\chi2$=11.515[a]	<0.001**		$\chi2$= 7.766[a]	0.005*
Low DHL	16 (80.0)	4 (20.0)		19 (95.0)	1 (5.0)	
High DHL	184 (48.0)	199 (52.0)		217 (56.7)	166 (43.3)	

*p-value < 0.05, **p-value < 0.001

Both logistic regression models showed adequate fit, with non-significant Hosmer–Lemeshow tests for knowledge and attitude at p = 0.675 and p = 0.298, respectively, and significant Omnibus tests for both at p <0.001. No substantial multicollinearity was detected; tolerance ranges were 0.822 to 0.951 and 0.830 to 0.961, and VIF ranges were 1.052 to 1.217 and 1.041 to 1.205, for the knowledge and attitude models, respectively.

Multivariable analysis (Table 3) showed that postgraduate education was associated with higher odds of good AI knowledge (AOR = 4.44, 95% CI: 1.84–10.73) while nurses (AOR = 0.22, 95% CI: 0.12–0.41), other healthcare professionals (AOR = 0.37, 95% CI: 0.21–0.66), low internet access (AOR = 0.30, 95% CI: 0.11–0.81), and infrequent internet use (AOR = 0.40, 95% CI: 0.17–0.97) had lower odds of good knowledge.

For attitudes, positive attitudes were less likely among participants with 3–5 years of experience (AOR = 0.39, 95% CI: 0.20–0.76), low internet access (AOR = 0.31, 95% CI: 0.10–0.97), and low self-rated internet skills (AOR = 0.50, 95% CI: 0.30–0.81), but more likely among those working in public than private healthcare facilities (AOR = 2.11, 95% CI: 1.12–3.97).

Table 3 Multivariable binary logistics regression analysis of factors associated with knowledge of and attitude toward AI

Variables	Knowledge of AI in Healthcare			Attitude toward AI in Healthcare		
	B	Exp(B) (95% CI)	Sig.	B	Exp(B) (95% CI)	Sig.
Age Group (years)						
20 - 27		1 (Ref)	0.903	—	—	—
28 - 34	0.189	1.207 (0.509–2.863)	0.669	—	—	—
≥ 35	0.142	1.153 (0.573–2.318)	0.69	—	—	—
Sex						
Female		1 (Ref)			1 (Ref)	
Male	0.164	1.178 (0.708–1.963)	0.528	0.353	1.423 (0.892–2.271)	0.138
Educational background						
Diploma and other		1 (Ref)	0.003*	—	—	—
Bachelor's degree	0.473	1.605 (0.857–3.006)	0.14	—	—	—
Postgraduate	1.491	4.442 (1.839–10.73)	<0.001**	—	—	—
Professional role						
Doctor		1 (Ref)	<.001**	—	—	—
Nurse	-1.524	0.218 (0.115–0.414)	<.001**	—	—	—
Other HCPs	-0.992	0.371 (0.21–0.656)	<.001**	—	—	—
Years of experience						
>10 years		1 (Ref)	0.158		1 (Ref)	0.034*
<3 years	-0.283	0.753 (0.298–1.904)	0.549	-0.671	0.511 (0.256–1.021)	0.057
3-5 years	0.26	1.296 (0.553–3.042)	0.551	-0.939	0.391 (0.202–0.756)	0.005*
6-10 years	0.495	1.64 (0.732–3.676)	0.229	-0.378	0.685 (0.364–1.289)	0.241
Primary workplace sector						
Private		1 (Ref)	0.616		1 (Ref)	0.044*
Public	-0.366	0.693 (0.334–1.438)	0.325	0.746	2.109 (1.121–3.967)	0.021*
NGO/INGO-run healthcare facility	-0.078	0.925 (0.502–1.705)	0.803	0.444	1.558 (0.874–2.78)	0.133
Dual Practice						
Yes		1 (Ref)			1 (Ref)	
No	0.358	1.43 (0.855–2.391)	0.173	-0.174	0.84 (0.519–1.36)	0.479

Variables	Knowledge of AI in Healthcare			Attitude toward AI in Healthcare		
	B	Exp(B) (95% CI)	Sig.	B	Exp(B) (95% CI)	Sig.
Access to the internet						
High access		1 (Ref)			1 (Ref)	
Low access	-1.199	0.301 (0.112–0.809)	0.017*	-1.162	0.313 (0.101–0.97)	0.044*
Access to digital devices						
Yes		1 (Ref)			1 (Ref)	
No	-1.491	0.225 (0.024–2.156)	0.196	-0.564	0.569 (0.059–5.52)	0.626
Frequency of internet use for healthcare practice or learning						
Frequent use		1 (Ref)			1 (Ref)	
Infrequent use	-0.914	0.401 (0.165–0.973)	0.043*	-1.098	0.334 (0.108–1.032)	0.057
Self-rated internet usage skills						
High skill		1 (Ref)			1 (Ref)	
Low skill	-0.174	0.84 (0.511–1.383)	0.493	-0.704	0.495 (0.303–0.807)	0.005*
AI use among colleagues						
Yes	—	—	—		1 (Ref)	
No	—	—	—	-0.36	0.698 (0.394–1.236)	0.217
Digital Health Literacy (DHL)						
High DHL		1 (Ref)			1 (Ref)	
Low DHL	-0.066	0.936 (0.257–3.418)	0.921	-1.597	0.203 (0.025–1.655)	0.136

*p-value < 0.05, **p-value < 0.001

DISCUSSION

In this study, 50.4% of healthcare professionals demonstrated good AI knowledge, whereas only 41.4% showed positive attitudes. Although awareness of AI applications was generally high, gaps remained in basic AI concepts, implementation, and ethics. Similar findings were reported in Pakistan, Saudi Arabia, and India, where healthcare workers recognized AI's potential but lacked detailed knowledge of its applications and limitations (1,3,23). Concerns about trust, privacy, and AI-related errors may explain the low proportion of positive attitudes.

Postgraduate education was significantly associated with good AI knowledge, which may reflect greater exposure to research, emerging technologies, and AI-related information. This finding is supported by a study in India, which reported greater AI-related awareness among faculty members than nurses and students (24). However, a study in Pakistan found no association between education level and AI knowledge, possibly due to differences in study populations (25).

Professional role was also associated with knowledge. Nurses and other healthcare professionals were less likely than doctors to demonstrate good knowledge, consistent with findings from India (24). Doctors may have greater exposure to AI-related literature, clinical decision-support systems, and continuing professional education.

Internet-related factors were significantly associated with both knowledge and attitudes. Low internet access and infrequent internet use were associated with poorer AI knowledge, while low internet access and self-rated internet skills reduced the likelihood of positive attitudes. These findings suggest that digital access and skills may be related to exposure to AI technologies and confidence in their use, consistent with studies from Myanmar and China (20,26,27).

Regarding attitudes, healthcare professionals with 3–5 years of experience were less likely to report positive attitudes than those with more than 10 years of experience.

Participants in public healthcare facilities were more likely to have positive attitudes than those in private facilities. Similar findings were reported in China that greater experience and stronger institutional support increased willingness to adopt AI (28).

CONCLUSION

This study assessed healthcare professionals' knowledge and attitudes regarding AI for healthcare practice and learning and identified associated socio-demographic, professional, and digital-access factors in Yangon Region, Myanmar. Only 50.4% of participants demonstrated good AI knowledge, and 41.4% had positive attitudes toward AI. Postgraduate education was associated with higher odds of good AI knowledge, whereas nurses and other healthcare professionals, low internet access, and infrequent internet use were associated with lower odds of good knowledge. For attitudes, 3–5 years of work experience, low internet access, and low self-rated internet skills were associated with lower odds of positive attitudes, while public-sector employment was associated with more positive attitudes.

RECOMMENDATIONS

The findings indicate the need for targeted AI capacity-building rather than general awareness activities. Healthcare facilities in Yangon should incorporate practical AI training into continuing professional development, with greater emphasis on nurses and other healthcare professionals who demonstrated lower odds of good AI knowledge. Training should cover basic AI concepts, clinical applications, implementation, ethics, privacy, and limitations, reflecting the knowledge gaps identified in this study. Facilities should also provide hands-on opportunities to use AI-related tools and guided learning resources, particularly for staff with limited internet access or lower self-rated internet skills. Workplace-based initiatives could include short in-service AI training sessions, practical demonstrations, peer-supported learning, and access to relevant digital learning materials. Such targeted approaches may strengthen healthcare professionals' knowledge, confidence, and attitudes and support responsible AI integration into healthcare practice and learning.

ETHICAL DECLARATION

Ethical approval was obtained from the Ethical Committee for Research Involving Human Subjects, Health Science Group, Chulalongkorn University, prior to data collection (COA No. 139/69).

LIMITATIONS

This study provides timely evidence on AI readiness among healthcare professionals in Myanmar. However, its cross-sectional design precludes causal inference. Convenience online sampling through professional networks may have introduced selection bias, as digitally active or AI-interested professionals may have been more likely to participate. Self-reported data may also introduce reporting bias, while restriction to Yangon Region may limit generalizability.

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THE ASSOCIATION BETWEEN OUT-OF-POCKET EXPENDITURES AND TREATMENT CONTINUATION AMONG ADULT CANCER PATIENTS IN BANGLADESH: A SECONDARY RESEARCH

A K M Shahriar[1,*] and Pokkate Wongsasuluk[1,2]

[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

[2] Excellent Center for Health and Social Sciences and Addiction Research, Thailand

***Corresponding author**: A K M Shahriar, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: 6774517753@student.chula.ac.th*

ABSTRACT

Introduction: The relative growth rate of cancer incidence is escalating most rapidly within lower- and middle-income (LMIC) nations. According to Global Cancer Observatory (GLOBOCAN) 2022 estimates, the global burden reached an estimated 20 million new cases and 9.7 million deaths, with nations like Bangladesh accounting for a rising proportion of this total. Out-of-Pocket (OOP) expenditures account for roughly three-quarters of all healthcare spending in Bangladesh, representing one of the highest shares globally. This financial burden is further exacerbated by the total absence of a national cancer-financing scheme. While estimates indicate that only 20% of patients receive regular medical treatment, hospital-level longitudinal data on patient retention or dropout are lacking. Identifying the clinical and socioeconomic variables that differentiate continuing patients is an essential research gap that must be bridged to establish targeted financial-protection frameworks in Bangladesh.

Objective: To estimate the association between out-of-pocket expenditure and treatment continuation, and to identify the financial, socio-demographic, and clinical characteristics associated with continuing prescribed treatment, among newly registered adult cancer patients at Ahsania Mission Cancer and General Hospital (AMCGH), Dhaka, Bangladesh.

Methodology: This secondary analysis used routinely collected records of all 12,907 adults (≥18 years) newly registered with cancer at AMCGH during 1 January 2023 – 31 December 2024. OOP was calculated from itemized billing records; continuation was defined by recorded attendance through the prescribed course. Because OOP was skewed, we compared median OOP between patients who continued and those who discontinued (Mann–Whitney U test). Because the outcome was dichotomous, we then used multivariable logistic regression (binary outcome: continued vs discontinued) to examine continuation, adjusting for age, sex, education, residence, occupation, smoking, cancer type, comorbidity, discount receipt, and OOP category. Because this was a cross-sectional study, associations are correlational, not causal.

Results: Of 12,907 patients, 49.9% were male and 50.1% female; median age was 56 years (IQR 20; range 18–105). Only 43.2% continued prescribed therapy; 56.8% discontinued. Continuers' recorded median OOP far exceeded discontinuers' (BDT 116,173 vs 1,950; Mann–Whitney $p < 0.001$), and adjusted odds of continuation rose steeply with spending (AOR 221.41; 95% CI 133.18-368.10; $p<0.001$). However, because OOP accrues as treatment proceeds, this gradient is largely mechanical; continuation drives spending as much as the reverse and reflects ability to pay, not a causal effect. More policy-relevant were exogenous factors: continuation was higher among patients who received a hospital fee discount (AOR 2.91; 95% CI 2,53-3.35; $p<0.001$), women (AOR 1.25; $p=0.008$), residents of Dhaka (1.66; $p<0.001$), Rajshahi (1.53; $p=0.004$), Khulna (AOR 1.30; $p=0.047$), and students (1.99; $p=0.019$), and lower with patients with comorbidity (0.81; $p<0.001$). Bone, soft-tissue, male-genital, and haematologic cancers continued more than oral cancers; the model explained substantial variation (Nagelkerke $R^2 \approx 0.75$).

Conclusion: Fewer than half of patients continued treatment, concentrated among heavy spenders (continuers' median OOP ~BDT 116,000, ~sixty times that of discontinuers). Because fee discounts were the strongest modifiable factor associated with continuation, hospitals and the national cancer program

should formalize means-tested waivers at registration, prioritizing patients with comorbidity and those traveling from outside Dhaka – the two groups least likely to continue in this cohort.

Keywords:
Cancer; Out-of-pocket expenditure; Treatment continuation; Financial toxicity; Bangladesh

INTRODUCTION

Cancer incidence is rising worldwide, and the relative growth rate is escalating most rapidly within low- and middle-income countries. According to global Cancer Observatory (GLOBOCAN) estimates, the global burden reached approximately 19.3 million new cases in 2020 and an estimated 20 million new cases and 9.7 million deaths in 2022, with nations such as Bangladesh accounting for a rising proportion of this total. (1). Low- and middle-income countries (LMICs) bear a disproportionate share of this burden, and almost two-thirds of cancer deaths are expected to occur in these settings (2). As incidence rises and therapies become more prolonged and costly, patients increasingly experience "financial toxicity," the material and psychological distress arising from the cost of cancer treatment (3). Where insurance coverage is limited, this burden falls directly on households and can lead patients to delay, forgo, or abandon care, with consequences for survival and quality of life (4, 5). Bangladesh exemplifies these pressures. The country records an estimated 150,000–200,000 new cancer cases each year, with late presentation and a high case-fatality ratio (6, 7).

Out-of-pocket expenditures account for roughly two-thirds to three-quarters of all healthcare spending in Bangladesh, among the highest shares globally, meaning households and patients, rather than the government or any pooled insurance mechanism, finance most care. (7, 8). This burden is further exacerbated by the absence of a national cancer financing scheme. A recent hospital-based costing study estimated the average annual OOP cost per cancer patient at about US$6,504 (approximately BDT 640,000), more than twice the average household income, and reported that around 90% of affected families experience financial distress, such as borrowing or selling assets (7). Consistent with this, only about one in five cancer patients in Bangladesh is thought to receive regular treatment (9).

Bangladeshi studies have established the scale of the economic burden – average annual costs exceeding household income, and distress financing in around nine in ten affected families- and have quantified the incidence of catastrophic health spending (10). What remains unknown is which patients sustain treatment under this burden. No Bangladeshi study has linked patient-level expenditure records to treatment continuation, so the characteristics distinguishing patients who remain in care from those who drop out have not been described. Identifying which patients remain in treatment, and what distinguishes them, is therefore an essential gap to bridge before designing targeted financial-protection measures.

Accordingly, this study examines the association between out-of-pocket expenditure and treatment continuation, and identifies the financial, socio-demographic, and clinical characteristics associated with continuing prescribed treatment, among newly registered adult cancer patients at a tertiary cancer hospital in Dhaka, Bangladesh. Because OOP spending on cancer care necessarily accrues as treatment proceeds, the analysis treats the observed cost–continuation relationship as correlational and focuses on more exogenous predictors directly relevant to coverage design.

METHODOLOGY

Study design and setting

This was a hospital-based, cross-sectional secondary data analysis using routinely collected administrative and clinical records from Ahsania Mission Cancer and General Hospital (AMCGH), a tertiary cancer centre in Dhaka,

Bangladesh. AMCGH serves patients from across the country's administrative divisions and maintains billing and clinical records through its hospital management system.

Study population

All new adult cancer cases (aged ≥18 years) diagnosed and registered at AMCGH between 1 January 2023 and 31 December 2024 were eligible. Records were excluded if they lacked a valid cancer diagnosis, had no recorded hospital visits, or had missing key data. After cleaning, we included 12,907 patients. Because the observation window was fixed, we assessed treatment continuation only for visits and sessions within this period; patients diagnosed late in 2024 therefore had shorter potential follow-up.

Variables

The primary outcome was treatment continuation. A patient was classified as continuing if the records showed attendance at the prescribed follow-up visits or treatment sessions through the end of the prescribed course or the end of the observation window, whichever came first. We classified patients whose records ended before the prescribed course was completed, with no further recorded visit, as having discontinued. The primary exposure of interest was OOP expenditure. Rather than being self-reported, it was calculated per patient from itemized charges recorded in the hospital billing system, summed across all visits within the observation window, net of any fee discount applied, and expressed in Bangladeshi Taka (BDT). We analyzed it both continuously and in categories (<10,000; 10,000–49,999; 50,000–149,999; 150,000–299,999; ≥300,000 BDT). Receipt of a hospital fee discount – a binary indicator of any hospital fee waiver or charity relief recorded in the billing system (yes/no) – captured financial relief. The indicator records whether relief was granted, not its monetary value. Covariates comprised age, sex, education, division of residence, occupation, smoking status, cancer type (ICD-10 site group), and comorbidity. We examined treatment type (chemotherapy/radiotherapy vs other modalities) as a secondary outcome. Data quality was checked before analysis: billing totals were cross-checked against clinical treatment records for consistency, expenditure and age values were screened against plausible ranges, and out-of-range or internally inconsistent entries were verified against the source record or excluded.

Data Extraction and Management

Patient records were extracted from the hospital management system as a de-identified dataset covering all registrations in the study period. The hospital's Cancer Research and Registry team extracted data using a fixed field list; records were then de-duplicated by patient identifier, billing entries were aggregated per patient, and free-text diagnosis fields were coded to ICD-10 site groups. The authors documented variable coding and recoding in a data directory.

Statistical analysis

We summarised continuous variables as medians with interquartile range (IQR) and categorical variables as frequencies and percentages. Because OOP values were non-normally distributed (Shapiro–Wilk $p < 0.001$), we used the Mann–Whitney U test to compare median OOP between patients who continued and discontinued treatment. We tested bivariate associations between categorical predictors and continuation using chi-square tests; multivariable logistic regression (binary outcome: continued vs discontinued) was used because the outcome is dichotomous and the model estimates the association of each predictor with continuation while adjusting for the others, which produced adjusted odds ratios (AOR) with 95% confidence intervals (CI) and p-values. We assessed model performance using Nagelkerke R^2 and the Hosmer–Lemeshow test, and checked multicollinearity using the variance inflation factor. We performed analyses in SPSS, with statistical significance set at $p < 0.05$.

Interpretation notes

Because out-of-pocket expenditure on cancer care accumulates as treatment continues, the cost-continuation relationship is bidirectional: continuation generates spending, and spending enables continuation. Adjusted odds ratios for spending therefore reflect associations with ability to pay rather than causal effects. Greater interpretive weight is therefore placed on predictors determined before, or independently of, the treatment episode – sex, division of residence, comorbidity, cancer type, and receipt of a fee discount.

RESULTS

Socio-demographic and clinical characteristics

The cohort was middle-aged (median age 56 years; IQR 20; range 18–105) and had a near-even sex distribution (50.1% female, 49.9% male). A graduate degree or higher was recorded for 6.8% of patients, 28.0% had higher secondary education or below, and 73.0% were recorded under "Others". Dhaka Division accounted for the largest share of patients (41.9%), followed by Chittagong (20.3%) and Mymensingh (12.3%). At least one comorbidity was present in 43.8% of patients. The most frequent cancer groups were digestive-organ cancers (21.3%), breast cancer (17.6%), and respiratory/intrathoracic malignancies (17.4%), followed by lip/oral/pharyngeal (10.7%) and female-genital cancers (9.7%). Patients attended the hospital a median of two times (IQR 4; range 1–58). Characteristics are summarised in Table 1.

Table 1 Socio-demographic and clinical characteristics of participants (N = 12,907)

Characteristic	Value
Age (years): median 56 (IQR 20; range 18–105)	
18–39	1,943 (15.1%)
40–59	5,852 (45.3%)
60 and above	5,112 (39.6%)
Sex	
Male	6,442 (49.9%)
Female	6,465 (50.1%)
Education	
Graduate and above	884 (6.8%)
Higher secondary or below	3,607 (28.0%)
Others / not formally recorded	9,416 (73.0%)
Division of residence (top three)	
Dhaka	5,411 (41.9%)
Chittagong	2,615 (20.3%)
Mymensingh	1,582 (12.3%)
Comorbidity	
Present	5,659 (43.8%)
Absent	7,248 (56.2%)
Cancer type (top five, ICD-10)	
Digestive organs (C15–C26)	2,749 (21.3%)
Breast (C50)	2,266 (17.6%)

Characteristic	Value
Respiratory/intrathoracic (C30–C39)	2,242 (17.4%)
Lip, oral cavity, pharynx (C00–C14)	1,384 (10.7%)
Female genital organs (C51–C58)	1,254 (9.7%)
Hospital visits: median 2 (IQR 4; range 1–58)	
1–2 visits	7,331 (56.8%)
3 or more visits	5,576 (43.2%)

IQR = interquartile range.

Out-of-pocket expenditure

Direct medical OOP expenditure was highly skewed. The median total OOP was BDT 28,080 (IQR 109,958; range 500–1,724,531). About 38.5% of patients spent less than BDT 10,000 and 19.9% spent BDT 10,000–49,999, whereas 12.5% spent BDT 150,000–299,999 and 5.5% spent at least BDT 300,000 (≈ US$2,728). Medicines accounted for 37% and oncology services 32% of total spending, accounting for roughly 69% of expenditure, with hospital services (18%) and laboratory tests (12%) contributing the remainder.

Treatment continuation, modality, and expenditure by group

Only 43.2% (n = 5,576) of patients continued their prescribed treatment, while 56.8% (n = 7,331) discontinued at some point. Among all patients, 97.3% received chemotherapy and/or radiotherapy, and 2.7% received other treatment only. Patients who continued treatment had incurred a far higher recorded median OOP than those who discontinued (BDT 116,173 vs 1,950; p < 0.001) (Table 2). A parallel pattern was seen by modality.

Table 2 Out-of-pocket expenditure by treatment continuation and modality (N = 12,907)

Group	Median (BDT)	IQR (BDT)	p-value
By treatment continuation			
Continued	116,173	154,029	< 0.001
Discontinued	1,950	24,900	
By treatment modality			
Chemotherapy/radiotherapy	30,369	112,820	< 0.001
Other treatment	1,750	8,352	

Mann–Whitney U test. IQR = interquartile range.

Determinants of treatment continuation

In the multivariable logistic regression, adjusted odds of continuation increased steeply and monotonically across OOP categories, relative to spending under BDT 10,000 each category now carries CI and p: 5.19 (4.42-6.09; p<0.001); 13.18 (11.10-15.66; p<0.001); 68.80 (54.11-87.48; p<0.001); 221.41 (133.18-368.10; p<0.001). Among the more exogenous predictors, patients who received any fee discount had roughly 2.9 times higher adjusted odds of continuing treatment than those who did not (AOR 2.91; 95% CI 2.53-3.35; p<0.001). Continuation was also independently higher for the p-values appended to each: 1.25 (p=0.008; 1.66 (p<0.001); 1.52 (p=0.004); 1.30 (p=0.047); 1.99 (p=0.019); 1.37 (p=0.002); 0.81 (p<0.001). Relative to lip/oral/pharyngeal cancers, higher continuation was seen for the p-values appended to each: 2.42, 2.09, 1.82, 1.77 (all p<0.001); 1.29

(p=0.008). Age, education, and most occupational categories were not significant after adjustment. The model explained a substantial share of variation (Nagelkerke $R^2 \approx 0.75$), with satisfactory Hosmer–Lemeshow fit. Key estimates appear in Table 3.

Table 3 Multivariable logistic regression: factors associated with treatment continuation (selected predictors; N = 12,907)

Predictor	AOR	95% CI	p-value
Direct medical OOP category (ref. < 10,000 BDT)			
10,000–49,999	5.19	4.42–6.09	< 0.001
50,000–149,999	13.18	11.10–15.66	< 0.001
150,000–299,999	68.80	54.11–87.48	< 0.001
≥ 300,000	221.41	133.18–368.10	< 0.001
Financial relief and socio-demographic factors			
Fee discount received (any waiver/charity relief; ref. none)	2.91	2.53–3.35	< 0.001
Female (ref. male)	1.25	1.06–1.47	0.008
Residence: Dhaka (ref. Barisal)	1.66	1.37–2.03	< 0.001
Residence: Rajshahi	1.52	1.14–2.01	0.004
Residence: Khulna	1.30	1.00–1.68	0.047
Occupation: student (ref. retired)	1.99	1.12–3.56	0.019
Former smoker (ref. current)	1.37	1.13–1.66	0.002
Comorbidity present (ref. absent)	0.81	0.73–0.90	< 0.001
Cancer type (ref. lip/oral/pharynx, C00–C14)			
Bone/cartilage (C40–C41)	2.42	1.44–4.08	< 0.001
Mesothelial/soft tissue (C45–C49)	2.09	1.46–3.00	< 0.001
Male genital organs (C60–C63)	1.82	1.29–2.57	< 0.001
Lymphoid/haematopoietic (C81–C96)	1.77	1.37–2.29	< 0.001
Digestive organs (C15–C26)	1.29	1.07–1.55	0.008

AOR = adjusted odds ratio; CI = confidence interval; OOP = out-of-pocket. Model adjusted for age, sex, education, division of residence, occupation, smoking, cancer type, comorbidity, discount receipt, and OOP category. Nagelkerke $R^2 \approx 0.75$.

DISCUSSION

In this census of 12,907 new adult cancer cases at a major tertiary hospital in Dhaka, fewer than half (43.2%) of patients continued their prescribed treatment, while 56.8% discontinued. Financial relief, rather than clinical need, was most strongly associated with staying in care, and continuation was strongly patterned by financial capacity. Patients who continued had recorded roughly sixty times the median OOP of those who discontinued, and adjusted odds of continuation rose steeply across spending categories. This pattern is consistent with the concept of financial toxicity as a decisive barrier to sustained cancer care in Bangladesh (3, 7).

The steep cost–continuation gradient, however, must be read with care. Because OOP spending on cancer care accrues as treatment proceeds, continuation mechanically generates spending, and spending in turn reflects the ability

to remain in care; the relationship is therefore bidirectional rather than a clean causal effect of spending on adherence. For this reason, the most informative policy results are the associations with characteristics largely determined before, or independently of, the treatment episode. Receipt of a hospital fee discount nearly tripled the odds of continuation, indicating that even partial financial relief is associated with staying in care—an actionable lever for hospitals and funders. Continuation was also lower among patients with comorbidity and varied by sex, region, and cancer type, suggesting that clinical complexity, geographic access, and disease characteristics shape who completes treatment beyond raw ability to pay (11).

These findings align with national and regional evidence. Bangladeshi costing studies report that average annual OOP cancer costs exceed household income and that the large majority of affected families resort to distress financing (7, 12), while only about one in five patients receives regular treatment (9). Systematic reviews from LMICs likewise document high financial toxicity and its association with treatment abandonment (4, 5). Specialist oncology is concentrated in a small number of tertiary centers, mostly in Dhaka: patients self-refer and pay per service at the point of care; there is no linkage to a national cancer registry, so patient histories exist only within each hospital's management system; and there is no pooled insurance, which is why hospital-level billing records are the practical source of expenditure data. The geographic gradient—higher continuation among residents of Dhaka and certain divisions- is consistent with the concentration of oncology services in the capital and the travel burden faced by rural patients. (6).

CONCLUSION

Among newly registered adult cancer patients at a tertiary hospital in Dhaka, fewer than half continued their prescribed treatment, and continuation was concentrated among patients able to spend heavily on care. Although the steep cost–continuation gradient partly reflects that treatment itself generates spending, the consistent associations of continuation with fee discounts, comorbidity, sex, region, and cancer type indicate where financial protection is most needed. Expanding hospital fee waivers, medicine and oncology subsidies, and national pre-payment or insurance schemes prioritising comorbid and geographically disadvantaged patients could help ensure that decisions to continue cancer treatment are driven by clinical need rather than by ability to pay. Confirming the direction and magnitude of these effects will require richer data and study designs better suited to causal inference.

RECOMMENDATION

The finding that continuation tracks financial relief rather than clinical need implies that, under current financing, treatment completion is rationed by ability to pay. First, for hospital administration (waivers at registration), quantitatively, patients receiving any fee discount had about 2.9-fold higher adjusted odds of continuation (AOR 2.91; 95% CI 2.53-3.35; $p<0.001$), so means-tested fee waivers and charity funds should be expanded and formalized. Second, the Directorate General of Health Services and procurement bodies (medicine and oncology price measures), because medicines and oncology services drive the highest spending, pooled procurement, price regulation, and targeted subsidies for essential chemotherapy and radiotherapy would most directly relieve the cost of continuing. Third, any emerging national insurance scheme (a catastrophic-cost ceiling), the presence of a measurable group spending at least BDT 300,000 (≈ US$2,728) per episode supports defining a national catastrophic-cost threshold and a high-cost cancer benefit within any emerging social health-insurance scheme, so that costs beyond a ceiling are publicly funded (8). Prioritizing comorbid and geographically disadvantaged patients, alongside decentralized services and earlier detection, would help ensure that continuation reflects clinical need rather than ability to pay.

To address the endogeneity of spending, future work could apply instrumental-variable approaches using instruments that predict cancer OOP but not continuation directly, such as non-cancer OOP or insurance deductible/co-insurance levels, and longitudinal, multi-center designs that capture cancer stage, household income, financing type, indirect costs, and survival. Subsequent studies should also test whether the factors identified here predict increases in treatment continuation, for example by prospectively evaluating a waiver expansion; hospital billing systems in similar settings can also monitor treatment continuation without new data collection. Such data would allow stronger causal estimates and evaluation of specific financial-protection interventions.

ETHICAL DECLARATION

The study followed the ethical guidelines of the Institutional Review Board (IRB) of AMCGH, and ethical approval (AMCGH/ECA-09/25-06) was obtained on 29.09.2025 (Ref: DAM/AMCGH/1900/2025-1194) before analysis. Only de-identified, routinely collected data were used, and patient confidentiality was maintained throughout.

STRENGTHS AND LIMITATIONS

Strengths include the large, near-complete two-year census of a high-volume tertiary center and the use of real-world routine data. Several limitations apply. The design is cross-sectional and single-center, so findings may not generalize to patients who never reach hospital care, and causal inference is not possible. We captured only direct medical costs at AMCGH; we did not capture non-medical expenses (transport, lodging, lost income) or costs at other facilities, so we likely underestimated the true economic burden. We did not record cancer stage, household income, or social support, limiting adjustment for important confounders, and administrative fields such as education and occupation were frequently coded as “others.” In particular, because out-of-pocket spending accrues as treatment continues, the exposure and outcome are subject to endogeneity and simultaneity; the cost-continuation association is bidirectional and should not be interpreted causally. Finally, we measured continuation only within the observation window, which may understate long-term adherence for patients entering late in 2024.

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Track IV

Mental Health, Health Behaviours and Digital Media

ASSOCIATION BETWEEN SHORT-VIDEO USE AND DEPRESSION AMONG FEMALE UNDERGRADUATE STUDENTS IN SHANGHAI: A CROSS-SECTIONAL STUDY

Yiying Chen[1], Nuchanad Hounnaklang[1*], Onuma Zongram[1]
[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.
****Corresponding Author**: Nuchanad Hounnaklang, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand. Email: Nuchanad.h@chula.ac.th*

ABSTRACT

Introduction: Short-video use has become increasingly common among university students in China and is considered an important component of daily screen-based behavior. Previous studies have suggested that excessive short-video use may be associated with mental health problems, including depressive symptoms. Meta-analytic evidence indicates that depressive symptoms are consistently more prevalent among females than males, and female undergraduate students may therefore be particularly affected by factors such as academic performance pressures, health behaviors, and digital-media use. However, limited evidence is available regarding the association between short-video use and depressive symptoms among female undergraduate students in Shanghai.

Objective: This study aimed to determine the prevalence of depression and to examine the association between short-video use and depressive symptoms among female undergraduate students in Shanghai.

Methodology: A cross-sectional study was conducted among 217 female undergraduate students in Shanghai, China. Data were collected using a structured, self-administered online questionnaire covering sociodemographic characteristics, smoking and alcohol use, short-video use behaviors including daily viewing time, and depressive symptoms assessed using the PHQ-9. Descriptive statistics were used to summarize participant characteristics, and univariable and multivariable logistic regression analyses were performed to examine factors associated with depressive symptoms. Daily viewing time and smoking status were included in the multivariable model.

Results: Among the 217 participants included in the study, 56.7% reported depressive symptoms. In the univariable analysis, former smoking was significantly associated with higher odds of depressive symptoms (OR = 3.411; 95% CI: 1.537–7.572; P = 0.003), whereas a daily viewing time exceeding 2 hours was associated with lower odds of depressive symptoms (OR = 0.438; 95% CI: 0.215–0.895; P = 0.024). In the multivariable logistic regression analysis, daily short-video viewing time exceeding 2 hours remained significantly associated with lower odds of depressive symptoms (AOR = 0.352; 95% CI: 0.166–0.746; P = 0.006) after adjusting for smoking.

Conclusion: More than half of the female participants exhibited depressive symptoms. A PHQ-9 score of ≥10 was used to classify depressive symptoms. The prevalence was higher than that reported in other countries. Former smoking was associated with higher odds of depressive symptoms, whereas daily short-video use exceeding two hours showed an unexpected inverse association with depressive symptoms. This finding should not be interpreted as a protective effect because of the cross-sectional design, single-city female sample, possible residual confounding, and potential reverse causality. Targeted smoking-related health measures are therefore recommended to support student mental health. The association between short-video use and depressive symptoms merits further research, particularly to clarify its direction and underlying explanation.

Keywords:
Short-Video Use; Depression; Female Undergraduate Students; Mental Health; Cross-Sectional Study

INTRODUCTION

Depression is a common mental health problem among university students. A systematic review conducted in Southeastern Asia reported that the median prevalence of depression among university students was 29.4% (1). In China, a recent systematic review and meta-analysis involving 93,679 university students reported a pooled depression prevalence of 34.7% (2). Previous studies also reported that female students had a higher prevalence of depressive symptoms than male students (2,3). These findings show that depression among female undergraduate students is an important issue for university health research.

Short video use has become increasingly common among young adults. According to previous studies, more than 870 million people in China use short video applications (4). These applications provide personalized content based on users' preferences and viewing behavior (4). Previous studies reported that college students are one of the main user groups of short video applications (4). For example, perceived stress was positively associated with short video application use among Chinese college students (4). This shows that short video use is closely related to student life and student mental health.

Numerous research efforts have examined the relationship between short video use and mental health. A systematic review reported that frequent TikTok use was associated with anxiety and depression among adolescents and young adults (5). Previous studies also reported that female university students were more likely to experience problematic TikTok use (5). Additionally, short video use was associated with attention difficulties and reduced concentration among university students (6). Similarly, a study among university students reported that female students had higher levels of short video addiction than male students (7). These findings indicate that short video use may be associated with depressive symptoms among female students.

The association between short video use and depression among female undergraduate students has received increasing attention. However, evidence from female undergraduate students in China remains limited. The objective of this study is to examine the association between short video use and depression among female undergraduate students in Shanghai, China.

METHODOLOGY

Study Design and Participants

A cross-sectional study was conducted among undergraduate students in Shanghai, China. The study focused on female undergraduate students aged 18–26 years. Data were collected online using a structured questionnaire.

The required sample size was calculated using the single population proportion formula: $n = Z^2p(1-p)/d^2$. A 95% confidence level, an expected proportion of 50%, and a 5% margin of error were used. The estimated minimum sample size was 385. A total of 413 questionnaires were collected online. Students were eligible if they were aged 18–26 years and were studying at universities in Shanghai. Students with diagnosed mental disorders, psychiatric medication use, or other chronic diseases were excluded from the study. After screening based on these criteria, 217 eligible female undergraduate students were included in the final analysis.

Measurement Tool

Depression was measured using the Patient Health Questionnaire-9 (PHQ-9) (8). Short video use was assessed using self-reported questions regarding daily short video use. Participants were classified according to their short video use patterns. Socio-demographic information included age, household registration status, only-child status, grade point average (GPA), *smoking status, and alcohol consumption.*

Data Collection

Data was collected through Wenjuanxing, an online survey platform in China. The questionnaire was distributed electronically

through university networks and online communication channels. Participation was voluntary and anonymous, and responses could be submitted through a survey link. Completed questionnaires were recorded and exported for statistical analysis.

Statistical Analysis

Data were analyzed using SPSS version 29.0. Descriptive statistics were used to summarize age, household registration, only-child status, GPA, smoking status, alcohol use, and depression status. Categorical variables were presented as frequencies and percentages. Univariate binary logistic regression was used to examine factors associated with depression. Crude odds ratios (CORs) with 95% confidence intervals (CIs) were reported. Variables with a p-value <0.05 in the univariate analysis were included in the multivariable binary logistic regression model. Adjusted odds ratios (AORs) with 95% CIs were reported. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics of Participants

A total of 217 female undergraduate students were included in the study. The majority of participants were aged more than 20 years (64.5%). More than half of the participants were from rural areas (50.2%) and were only children (65.4%). Most participants reported a GPA of 3.0–3.5 (45.2%) and were non-smokers (76.5%). The proportion of participants with depression was 56.7% (Table 1).

Factors Associated with Depression

Bivariate analysis was conducted to examine factors associated with depression. Significant associations were observed for former smoking (OR = 3.411, 95% CI = 1.537–7.572, p = 0.003) and daily viewing time of more than two hours (OR = 0.438, 95% CI = 0.215–0.895, p = 0.024). No significant associations were observed for age, household registration, only-child status, GPA, alcohol use, or purpose of short video use (Table 2).

Association between Smoking Status, Daily Viewing Time, and Depression

Multivariable analysis showed that smoking status and daily viewing time remained significantly associated with depression. Significant associations were observed for Former smoking (AOR = 4.089; 95% CI: 1.778–9.404; P < 0.001) and daily viewing time of more than two hours (AOR = 0.352; 95% CI: 0.166–0.746; P = 0.006).

Table1 Demographic characteristics of study participants (N=217)

Variable	Category	Frequency n	Percentage %
Age (years)	18–20	77	35.5
	More than 20	140	64.5
Household registration	Urban	108	49.8
	Rural	109	50.2
Only-child status	No	142	65.4
	Yes	75	34.6
GPA (4.0 scale)	1.5–2.9	36	16.6
	3.0–3.5	98	45.2
	3.5–4.0	83	38.2
Smoking status	Never smoked	166	76.5
	Former smoker	42	19.4
	Current smoker	9	4.1
Alcohol use status	Never drank	47	21.7
	Former drinker	9	4.1

Variable	Category	Frequency n	Percentage %
	Current drinker	161	74.2
PHQ-9 depression status	No depression symptoms	94	43.3
	Depression symptoms	123	56.7

Table 2 Univariate logistic regression analysis of factors associated with PHQ-9 depression status

Variable	Category	Crude OR	95% CI	p-value
Age	18–20 (Ref)	1.00		
	More than 20	0.824	0.469–1.448	0.500
Household Registration	Urban (Ref)	1.00		
	Rural	1.181	0.690–2.022	0.544
Only Child	Yes (Ref)	1.00		
	No	1.043	0.593–1.834	0.883
GPA (4.0 scale)	1.5–2.9 (Ref)	1.00		
	3.0–3.5	1.691	0.783–3.649	0.181
	3.5–4.0	1.459	0.665–3.200	0.346
Smoking Status	Non-smoker (Ref)	1.00		
	Former smoker	**3.411**	**1.537–7.572**	**0.003**
	Current smoker	0.744	0.193–2.869	0.668
Alcohol Use	Non-drinking (Ref)	1.00		
	Former drinking	1.481	0.330–6.651	0.608
	Current drinking	0.939	0.487–1.811	0.851
Purpose of Short Video Use	Entertainment (Ref)	1.00		
	Study	0.824	0.325–2.092	0.684
	Social interaction	0.780	0.401–1.517	0.464
	Others	0.863	0.285–2.614	0.795
	Shopping	1.786	0.776–4.111	0.173
Daily Viewing Time	<1 hour (Ref)	1.00		
	1–2 hours	0.573	0.287–1.145	0.115
	>2 hours	**0.438**	**0.215–0.895**	**0.024**

Table3 Multivariate logistic regression analysis of factors associated with PHQ-9 depression status

Variable	Category	Adjusted OR (AOR)	95% CI	p-value
Daily Viewing Time	Less than 1 hour (Ref)	1.00		
	1 hour to less than 2 hours	0.581	0.287–1.179	0.133
	More than 2 hours	**0.352**	**0.166–0.746**	**0.006**
Smoking Status	Never smoked (Ref)	1.00		
	Former smoker	**4.089**	**1.778–9.404**	**<0.001**
	Current smoker	0.775	0.193–3.111	0.719

DISCUSSION

Depression was reported by 56.7% of undergraduate female students in Shanghai. This prevalence was higher than that reported among university students in Southeastern Asia (29.4%) and among university students in China (34.7%) (1,2). These findings show that depression among undergraduate female students is an important issue for university health research.

This study found that short-video use was negatively associated with depressive symptoms. This suggests that short-video use may be a protective factor in this sample. Previous studies have reported different patterns of association. The relationship may depend on the pattern, purpose, and intensity of use.

Some studies found that excessive short-video use or short-video addiction was associated with higher depression. A recent multicenter study in China found that longer daily short-video use was associated with a higher prevalence of depressive symptoms. Compared with less than 30 minutes per day, daily use of 1–3 hours and more than 3 hours was significantly associated with a higher prevalence of depressive symptoms (9). Zhu et al. found that higher short-form video use and short-form video addiction were associated with higher depression among Chinese adolescents (10). Zhao et al. found that college students with short-video addiction had more negative emotions (11). Li et al. also found that college freshmen with more severe short-video addiction had higher depressive symptoms (12). This differs from our finding that viewing short videos for more than two hours per day was associated with lower odds of depressive symptoms, suggesting that viewing duration alone may not fully explain the relationship.

Other studies have reported a negative association between digital-media use and depression. Davila et al. found that positive and supportive online interactions were associated with fewer depressive symptoms among young adults (13). Hu and Yu reported a U-shaped association between internet use and depression, suggesting that moderate use may be related to lower depression (14). Liao et al. also reported that the type and pattern of internet use were associated with depression risk (15).

The present finding is consistent with studies showing that appropriate digital-media use may be related to lower depression. When short videos are used moderately and do not become addictive, they may provide entertainment, relaxation, social connection, and useful information. Positive content may also help reduce stress and improve mood. Therefore, the association between short-video use and depression may differ according to whether use is controlled or addictive and whether the content is positive or negative.

Because this was a cross-sectional study, causality cannot be confirmed. Future studies should examine the duration, purpose, content, and addictive pattern of short-video use.

Former smoking was associated with depression. Students who reported former smoking had higher odds of depression than non-smokers. Similar findings were reported in previous studies (16). In contrast, current smoking was not significantly associated with depression. This may be due to the small number of current smokers in this study (n = 9, 4.1%), which may have limited the ability to detect a significant association. Smoking behavior should be considered when addressing depression among university students.

Age, household registration, only-child status, GPA, alcohol use, and purpose of short video use were not associated with depression. Appropriate interventions are needed to strengthen depression screening and psychological support among undergraduate female students.

CONCLUSION

Depression was reported by 56.7% of undergraduate female students in Shanghai. Short-video viewing time and smoking status were significantly associated with depression. Students who viewed short videos for more than two hours per day had lower odds of depression, whereas former smokers had higher odds of depression.

These findings suggest that short-video use may not always be harmful. When use is moderate and does not become addictive, it may provide entertainment, relaxation, and emotional support. This finding is consistent with previous studies showing that appropriate digital-media use may be associated with lower depressive symptoms. However, excessive or addictive short-video use may still be related to poorer mental health.

Public health interventions for undergraduate female students should promote healthy and controlled short-video use rather than only reducing screen time. Smoking prevention and smoking-cessation support should also be included in depression prevention programs.

RECOMMENDATIONS

For future studies, participants from different universities and regions are suggested to provide a broader understanding of depression among undergraduate students. More information related to short-video viewing behavior and smoking status may also be collected to compare their relationship with depression. Moreover, longitudinal studies are recommended to further examine the association between short-video use, smoking behavior, and depression among undergraduate female students.

ETHICAL DECLARATION

Ethical approval for this study was granted by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (RECCU) (Study No. 690097; COA No. 166/69) on 18 June 2026.

LIMITATIONS

Since this study was cross-sectional, causality cannot be established. It may not be representative of undergraduate female students in other regions of China, as participants were recruited only from universities in Shanghai. Furthermore, the reliance on self-reported questionnaires may have affected the accuracy of the responses. These factors may limit the generalizability of the findings.

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ASSOCIATION BETWEEN SKINCARE KNOWLEDGE, ATTITUDES, PRACTICES, AND SKIN HEALTH AMONG INTERNATIONAL UNIVERSITY STUDENTS IN THAILAND

***Vasundhara Nagini Ramisetty*[1], *Nuchanad Hounnaklang*[1]*, *Onuma Zongram*[1]**
[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.*
***Corresponding author**: Nuchanad Hounnaklang,*
College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: nhounnaklang@yahoo.com

ABSTRACT

Introduction: Skin diseases are a major global health burden, and international students in tropical climates such as Thailand are vulnerable owing to ultraviolet radiation, heat, humidity, and cultural adaptation. Evidence linking skincare knowledge, attitudes, and practices (KAP) to skin health in this group is limited.

Objectives: This study aimed to assess skincare KAP and their association with skin health among international university students in Thailand.

Methodology: This cross-sectional study recruited 100 international university students in Thailand by convenience sampling. A self-administered questionnaire captured sociodemographics, lifestyle, skin health, and KAP, classified as good (≥80%), moderate (60–79%), or poor (<60%) using Bloom's cutoffs. Data were analyzed in SPSS 29.0 using descriptive statistics and multivariable logistic regression with univariate screening.

Results: Mean age was 28.28 ± 4.03 years; 55% were male. Poor knowledge was almost universal (95%), while 47% had good attitudes and 46% good practices. Current skin conditions affected the face in 55% and the body in 46%. In multivariable analysis, higher daily water intake was independently associated with good perceived skin health (AOR = 1.21, 95% CI: 1.07–1.36, p = 0.002), whereas higher attitude scores were inversely associated (AOR = 0.74, 95% CI: 0.57–0.96, p = 0.023).

Conclusion: Skin conditions were common despite comparatively favorable attitudes and practices, and poor knowledge was near-universal, indicating a need for targeted skincare education, including during university orientation. Given the convenience sample (N = 100), findings, including the inverse attitude association (likely reverse causality), should be interpreted cautiously. Larger, longitudinal studies are recommended.

Keywords:
Skincare Knowledge; Attitudes; Practices; Skin Health; International University Students; Thailand

INTRODUCTION

Skin diseases contribute to the health burden in an important but often under-recognised way. The Global Burden of Disease Study 2021 estimated that there were 41.9 million disability-adjusted life years (DALYs) due to skin and subcutaneous conditions globally, equivalent to 4.69 billion incident cases, representing the top ten causes of disability worldwide (1).

International students who relocate to tropical settings such as Thailand face particular risks, making them a particularly vulnerable population. When international students move to Thailand, they encounter high levels of ultraviolet (UV) radiation and high ambient temperature and humidity in the tropical environment, which are known to damage skin barrier function and increase trans-epidermal water loss (TEWL), inflammatory dermatoses, and fungal dermatoses (2, 3). Climate-related exposures, including heat and air pollution, more broadly disrupt the skin's capacity to maintain homeostasis and can exacerbate conditions such as atopic dermatitis, acne vulgaris, and psoriasis (4). In Thailand, diseases of the skin and subcutaneous tissue were diagnosed in 12.6% of the residents of one primary care catchment area

over a five-year period, most commonly infections and dermatitis (5). The cultural adaptation demands, lifestyle changes, and previously cited healthcare access challenges add to these environmental stressors (6), and among international undergraduates in Thailand, acculturative stressors have been linked to poorer wellness where social support is limited (7).

In public health studies, the Knowledge-Attitude-Practice (KAP) model is used to explore the relationship between knowledge, attitudes, and health actions. In the dermatological setting, positive KAP profiles are hypothesized to be associated with preventive behaviors of cleaning, moisturizing, and photoprotection, which subsequently support skin barrier integrity and help decrease the burden of dermatological disease (8). However, despite this theoretical construct, integrated evidence of the relationship between KAP and student outcomes is scant among internationally mobile student populations in tropical climate settings. Among university students in Indonesia, for instance, photoprotection knowledge and photoprotective behavior were both low, although better knowledge was associated with more acceptable behavior (9).

Some of the previous studies have explored the association between skincare readiness and outcomes in domestic student samples as well as in the wider community, yet a single KAP-outcome framework was not developed in the context of specific environmental and cultural transitions experienced by international students. To fill this gap, this study analyzed the relationship between skin care KAP dimensions and self-reported skin health among 100 international university students in Thailand.

METHODOLOGY

Study design and Population

This study employed quantitative analytical cross-sectional research design. Data were gathered between March and June 2026 from 100 international university students enrolled across higher education institutions throughout Thailand. Convenience sampling was used to recruit participants through international student associations, academic class communication groups, and social media platforms commonly used by students.

The participants were only eligible if they were non-Thai nationals, at least 18 years old, attending undergraduate, master's, or doctoral programs at a Thai university, and interested and willing to participate. Short-term exchange or visiting students, those who failed to complete the questionnaire, and those with physician-diagnosed chronic dermatological conditions that required continuous treatment or persistent skin conditions of more than six months (such as atopic dermatitis, chronic eczema, and rosacea) were not included.

Research Instrument

The self-administered questionnaire covered seven thematic areas: socio-demographic characteristics; skincare knowledge (10 binary items scored 0–10); attitudes toward skincare (6 five-point Likert items scored 6–30); skincare practices (10 frequency items scored 10–50); skin health profile including body and facial skin type and pre-existing conditions; health-seeking behaviors; and lifestyle behaviors covering diet, sleep quality, smoking, alcohol consumption, daily water intake, and physical activity. Responses for each of the KAP areas were classified as good (≥80%), moderate (60–79%) or poor (<60%) using Bloom's taxonomy thresholds, which were applied uniformly across all areas. The item objective congruence (IOC) index was used to determine content validity, and Cronbach's alpha was used to assess internal consistency. The outcome self-reported skin health was dichotomized into good (very good/good) and poor (average/could be better/poor).

Data Collection

Eligible participants were invited through the recruitment channels described above

(international student associations, class communication groups, and social media platforms), which shared a single online link to the self-administered questionnaire hosted on Google Forms. Before accessing the questionnaire, participants were shown an electronic information sheet describing the study and indicated their consent by ticking 'agree' or 'do not agree'; only participants who selected 'agree' were able to proceed to the questionnaire. The research ethics review committee (COA no. 168/69; project no. 690099) approved the study. Participation was entirely voluntary, and no personal or identifiable information was collected that could be linked to an individual's responses. As the survey relied on an anonymous, self-administered online format without institutional email verification, no additional technical measures (e.g., duplicate-submission or mandatory-field checks) were applied beyond the informed-consent gate; this is acknowledged as a limitation of the online, convenience-sampling approach used in this study.

Statistical Analysis

Participant characteristics and responses to the questionnaires were summarized using descriptive statistics, including frequencies, percentages, and means ± standard deviations. Two logistic regression analyses were performed: a univariate model to screen candidate variables ($p < 0.05$), and a multivariable logistic regression model using simultaneous entry to identify independent predictors of good perceived skin health. Summary data are presented as crude (COR) and adjusted odds ratios (AOR) with 95% confidence intervals (CI). A p value of < 0.05 was considered statistically significant throughout. SPSS version 29.0 was used for all analyses.

RESULTS

Socio-demographic Characteristics

A total of 100 international university students participated in the study. The mean age was 28.28 ± 4.03 years (range: 20–38 years), with two-thirds (66.0%) aged 25 years or older. Fifty-five percent of the respondents were male. Participants' nationalities were Chinese (40.0%), Japanese (30.0%), and Myanmar (30.0%). Most participants (58.0%) had lived in Thailand for more than 6 months. Medical field students represented the largest field-of-study group (56.0%), and master's students represented the largest level-of-study group (46.0%). Monthly allowance was approximately equally split above and below 20,000 THB (Table 1).

Table 1 Socio-demographic characteristics of participants (N = 100)

Variable	Category	n	%
Age	<25 years	34	34.0
	≥25 years	66	66.0
	Mean ± SD: 28.28 ± 4.03 (Range: 20–38)		
Gender	Male	55	55.0
	Female	45	45.0
Nationality	Chinese	40	40.0
	Japanese	30	30.0
	Myanmar	30	30.0
Duration of stay in Thailand	<6 months	42	42.0
	≥6 months	58	58.0

Variable	Category	n	%
Field of study	Medical	56	56.0
	Non-medical	44	44.0
Level of study	Undergraduate	25	25.0
	Master's	46	46.0
	Doctoral	29	29.0
Monthly allowance	≤20,000 THB	49	49.0
	>20,000 THB	51	51.0

KAP scores

The overall knowledge of skin care was not satisfactory in most of the participants (95.0% poor, 3.0% moderate and 2.0% good - mean score 3.17 ± 1.41 out of 10). Attitude and practice distributions were more favorable, in contrast. Attitudes were good in 47.0%, moderate in 31.0%, and poor in 22.0% (mean 22.02 ± 5.16 out of 30). Practice levels were good in 46.0%, moderate in 31.0%, and poor in 23.0% (mean 36.49 ± 8.22 out of 50). Near-universal poor knowledge and comparatively favorable attitudes and practices indicate that affective and behavioral aspects of skincare can be learned in informal settings (e.g., by means of social media and peers), separate from formal dermatological teaching (Table 2).

Table 2 Overall KAP classification and scores (N = 100)

Domain	Classification	n	%	Mean ± SD
Knowledge	Good (≥80%)	2	2.0	3.17 ± 1.41
	Moderate (60–79%)	3	3.0	
	Poor (<60%)	95	95.0	
Attitude	Good (≥80%)	47	47.0	22.02 ± 5.16
	Moderate (60–79%)	31	31.0	
	Poor (<60%)	22	22.0	
Practice	Good (≥80%)	46	46.0	36.49 ± 8.22
	Moderate (60–79%)	31	31.0	
	Poor (<60%)	23	23.0	

Skin Health Profile and Prevalence of Skin Conditions

Combination skin was the most common facial skin type (26.0%), followed by oily (20.0%) and sensitive (17.0%). For the body, dry skin predominated (25.0%), followed by normal (20.0%) and sensitive (16.0%). Pre-existing skin conditions were highly prevalent, reported by 72.0% of participants for the face and 70.0% for the body. Overall skin health was rated as good or very good by 35.0% of participants. Current skin conditions were reported by 55.0% on the face and 46.0% on the body. Among facial conditions, psoriasis was most frequently reported (14.5%), followed by increased sensitivity (9.0%) and acne (10.0%). Among body conditions, irritation was most prevalent (17.4%), followed by fungal infection (9.0%) and eczema (8.0%) (Table 3).

Table 3 Skin health profile of participants (N = 100)

Variable	Category	n	%
Facial skin type	Normal	15	15.0
	Dry	12	12.0
	Oily	20	20.0
	Combination	26	26.0
	Sensitive	17	17.0
	Don't know	10	10.0
Body skin type	Normal	20	20.0
	Dry	25	25.0
	Oily	15	15.0
	Combination	14	14.0
	Sensitive	16	16.0
	Don't know	10	10.0
Pre-existing facial skin condition	Yes	72	72.0
	No	28	28.0
Pre-existing body skin condition	Yes	70	70.0
	No	30	30.0
Overall perceived skin health	Very good	12	12.0
	Good	23	23.0
	Average	25	25.0
	Could be better	22	22.0
	Poor	18	18.0
Current body skin condition	Yes	46	46.0
	No	54	54.0
Current facial skin condition	Yes	55	55.0
	No	45	45.0

Univariate Logistic Regression

In univariate binary logistic regression, two variables were significantly associated with good perceived skin health. Attitude level was inversely associated with good skin health (crude OR = 0.77, 95% CI: 0.62–0.95, p = 0.017), indicating that participants with higher attitude scores had lower odds of reporting good skin health. Daily water intake was positively associated with good skin health (crude OR = 1.17, 95% CI: 1.04–1.32, p = 0.007). Knowledge level (crude OR = 1.11, 95% CI: 0.68–1.81, p = 0.674) and practice level (crude OR = 0.89, 95% CI: 0.66–1.19, p = 0.426) were not significant. Other socio-demographic variables, lifestyle behaviors such as sleeping habits, physical activity, smoking, and alcohol consumption, or skin condition status were also non-significant.

Multivariable Logistic Regression

Two variables were left independent after simultaneously adjusting for knowledge,

attitude, and practice and water intake. There was a negative association between good perceived skin health and higher attitude level (AOR = 0.74, 95% CI: 0.57–0.96, p = 0.023), while there was a positive association between good perceived skin health and higher water intake (AOR = 1.21, 95% CI: 1.07–1.36, p = 0.002). Knowledge (AOR = 1.07, 95% CI: 0.64–1.79, p = 0.781) and practice (AOR = 0.99, 95% CI: 0.71–1.38, p = 0.955) were non-significant in the adjusted model (Table 4).

Table 4 Multivariable binary logistic regression: factors associated with good perceived skin health (N = 100)

Variable	Category	AOR	95% CI	p-value
Knowledge level	Per unit increase (Poor→Moderate→Good)	1.07	0.64–1.79	0.781
Attitude level	Per unit increase (Poor→Moderate→Good)	**0.74***	**0.57–0.96**	**0.023***
Practice level	Per unit increase (Poor→Moderate→Good)	0.99	0.71–1.38	0.955
Water intake (daily)	Per category increase (<1 L–>3 L/day)	**1.21****	**1.07–1.36**	**0.002****

*Dependent variable: Good perceived skin health (very good/good = 1; average/could be better/poor = 0). AOR = adjusted odds ratio; CI = confidence interval. * p < 0.05; ** p < 0.01.*

DISCUSSION

The findings of this study indicate a prevalence of current skin conditions of 55.0% on the face and 46.0% on the body among 100 international students at a university in Thailand, which are not directly comparable to other reported prevalence estimates in the peer-reviewed skin condition literature. The prevalence of these disorders is slightly lower than that reported in a representative study of Chinese college students (60.1% clinical prevalence), possibly reflecting differences between self-report and face-to-face diagnosis, as well as differences in age and nationality composition. In the current study, psoriasis was the most common skin condition of the face (14.5%), which was higher than the clinically diagnosed prevalence rate reported by Xiao et al. (10) (0.23%) and than the five-year period prevalence of clinically diagnosed psoriasis in a Thai primary care population (approximately 0.18%) (5). This difference should not be construed as absolute, given differences in the studied population, diagnostic approaches, and the small sample size of the current study. Further, the small sample size (N = 100) may have led to greater sampling variability, thus offering less precision for the prevalence estimates. The prevalence estimates should therefore be interpreted with caution, as they may not be fully representative of the wider population of international university students in Thailand. Larger and more representative samples should be recruited in future studies to provide more precise and generalizable estimates of the prevalence of skin conditions in this population.

The inverse association between higher skincare attitude and good perceived skin health remained significant even after multivariable adjustment (AOR = 0.74, p = 0.023). In this cross-sectional design, the finding that positive attitudes are not protective for skin health more likely reflects the reverse case: students who are currently experiencing skin conditions may be more concerned about their skin and consequently more likely to develop positive attitudes towards skin care, as they recognize the need to address an active problem (11, 12).

Attitude is the most experientially flexible of the KAP components and hence is the most susceptible to confounding from this source. This cross-sectional association should not be interpreted as evidence of a protective causal effect, although it is supported by independent experimental evidence (13, 14).

Daily water intake was the most straightforwardly interpretable finding, with each increment in intake category significantly associated with greater odds of good perceived skin health (AOR = 1.21, p = 0.002). This aligns with experimental evidence that additional water intake can increase skin hydration, particularly in individuals with low habitual intake (15, 16), although a systematic review rated the overall evidence as weak in quantity and methodological quality (16). Increasing daily water intake nonetheless represents a low-cost, actionable public health recommendation for this population, pending confirmation in longitudinal or interventional studies.

In both unadjusted and adjusted analyses, there was no significant association between skin care knowledge and skin health, consistent with findings in the health behavior literature reporting a knowledge–behavior gap, including among university students whose awareness of sun-protection risks did not translate into protective behavior (17, 18), although this is not uniform across studies (9); this may reflect a statistical floor effect, whereby the more uniform a variable's distribution, the more difficult it becomes to detect an association. Skincare practice was also not significantly associated with skin health, possibly because self-reported frequency of practice does not adequately capture qualitative aspects such as the technique, thoroughness, and consistency of application, which may have a mechanistic protective effect on skin barrier integrity (1, 3). Socio-demographic factors, such as nationality, field of study, and period of stay, did not independently explain the KAP scores, which agrees with findings from other studies documenting the difference between predicting KAP level and predicting downstream health outcomes (19). A dedicated examination of nationality-specific skincare behaviors and attitudes was beyond the scope of the present analysis, as the sample of 100 participants was distributed across only three nationality groups (Chinese, Japanese, and Myanmar); such comparisons would require a larger and more evenly distributed sample to be adequately powered and are recommended for future research.

In addition, the pre-existing skin condition burden identified in this sample (72% face and 70% body) distinct from the current, active conditions reported above highlights the climatic and environmental factors that may place international students at risk in the humid environment of Thailand and is consistent with the broader literature on dry and sensitive skin types and their association with increased dermatologic risk in humid climates (20) and with evidence that climate-related exposures can exacerbate inflammatory skin conditions (4). Targeted skincare support, improved treatment-seeking pathways that address documented access barriers (6), and dedicated skin health education integrated into university orientation programs are the principal practical implications of these findings.

CONCLUSION

Knowledge of skin care among the students was very low, with poor knowledge being almost universal among the 100 international university students in Thailand while their attitudes and practices were comparatively good. Current skin conditions were prevalent on both the face (55%) and body (46%). Higher daily water intake independently predicted good perceived skin health (AOR = 1.21, p = 0.002), whereas higher attitude scores were inversely associated with good skin health (AOR = 0.74, p = 0.023), most plausibly reflecting reverse causality. As this study relied on convenience sampling and a modest sample size (N = 100), these findings may have limited generalizability to the broader population of international university students in Thailand. Future studies

using larger, more representative samples and longitudinal designs are recommended to obtain more precise prevalence estimates and a better understanding of the links between skincare knowledge, attitudes, practices, and skin health among international university students.

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ASSOCIATION BETWEEN SOCIAL MEDIA–RELATED APPEARANCE CONSCIOUSNESS AND APPEARANCE ANXIETY AMONG UNIVERSITY STUDENTS IN PHUKET PROVINCE, THAILAND

Yarong Wang[1], Nuchanad Hounnaklang[1]*, Onuma Zongram[1]

[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

** **Corresponding Author**: Nuchanad Hounnaklang, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: nuchanad.h@chula.ac.th*

ABSTRACT

Introduction: Social media use has become increasingly common among university students and is an important component of daily social interaction and self-presentation. Previous studies have suggested that social media use may contribute to appearance-related concerns and appearance anxiety. Young adults may be particularly affected due to increased exposure to appearance-focused content and concerns about others' evaluations. However, such concerns may be heightened in Phuket Province, a major international tourist destination where exposure to diverse beauty standards.

Objective: This study aimed to examine the association between social media-related appearance consciousness and appearance anxiety among university students in Phuket.

Methodology: A cross-sectional study was conducted among 740 university students in Phuket Province, Thailand. A structured self-administered online questionnaire was used to collect information on sociodemographic characteristics and psychological factors related to social media use, body image, social evaluation, self-esteem, social support, and appearance anxiety. Descriptive statistics were used to summarize participant characteristics. Multiple linear regression analysis was performed to identify factors associated with appearance anxiety.

Results: Among the 740 participants included in the study, the mean appearance anxiety score was 21.41 ± 5.95. In the multiple linear regression analysis, fear of negative evaluation ($\beta = .434$, $p < .001$), self-esteem ($\beta = .132$, $p < .001$), perceived social support ($\beta = -.143$, $p < .001$), objectified body consciousness ($\beta = .116$, $p < .001$), and study year ($\beta = -.075$, $p = .014$) were significantly associated with appearance anxiety. The final model explained 31.6% of the variance in appearance anxiety ($R^2 = .316$).

Conclusion: These findings highlight the potential value of educational policies and institutional support measures aimed at reducing appearance anxiety, including interventions targeting fear of negative evaluation and peer-support initiatives that strengthen perceived social support within student counseling services.

Keywords:

Appearance Anxiety; Social Media; Fear of Negative Evaluation; Body Image; Students; Thailand

INTRODUCTION

Social media has become an important part of communication, social interaction, and self-presentation among university students. The growing use of visually oriented platforms provides opportunities to present and evaluate physical appearance online. Previous research has linked social-media use, appearance comparison, and exposure to appearance-focused content with body-image concerns among adolescents and young adults (1-3).

Appearance-related social media consciousness (ASMC) refers to the extent to which individuals monitor their appearance in relation to how they may be perceived by a social-media audience (1,2,5). Concerns about photographs, social responses, and appearance standards may be heightened in environments where likes, comments, and followers provide visible forms of social evaluation (4,6).

Appearance anxiety may also be influenced by psychological factors. Fear of negative evaluation may increase concerns about others' judgments, while objectified body consciousness may encourage appearance monitoring. In contrast, perceived social support may provide resources for coping with appearance-related concerns. Self-esteem may also influence how individuals evaluate themselves and respond to social feedback (7,8).

The Thai context is particularly relevant because Phuket is a major international tourism destination with strong beach culture and visually oriented social environments. University students may therefore encounter diverse appearance standards through both online and offline environments (2,4,6,9).

Students aged 18–25 years were selected because university students in this age group commonly experience important academic, social, and interpersonal changes. (10-11).

Therefore, this study examined the associations among ASMC, objectified body consciousness, fear of negative evaluation, self-esteem, perceived social support, and appearance anxiety among university students in Phuket Province, Thailand.

METHODOLOGY

Research Design and Participants

A quantitative cross-sectional research design was used. The study was conducted in Phuket Province, Thailand, from January to July 2026. Participants were undergraduate students aged 18–25 years enrolled in higher-education institutions in Phuket. Participants were required to be able to read and understand Thai, actively use at least one social media platform, and voluntarily provide informed consent. Individuals with a self-reported diagnosis of a psychological disorder related to body dysmorphia or severe mental illness were excluded. Incomplete questionnaires were also excluded from the analysis. Participants were recruited using convenience sampling through online recruitment.

Sample Size

The minimum sample size was calculated using Cochran's formula for cross-sectional surveys and was estimated at 384 participants. Assuming a 10% non-response rate, the target sample size was increased to 422 participants. Although the minimum required sample size was 422, a total of 740 eligible questionnaires were obtained and included in the final analysis. The larger final sample increased the statistical power and precision of the analyses. The final sample size of 740 was therefore used consistently throughout the present study.

Measurement Instruments

Data were collected using a structured, self-administered online questionnaire. The questionnaire consisted of screening questions and the main questionnaire. The main questionnaire contained 91 items covering demographic information, social media use, and standardized psychological instruments.

Appearance-Related Social Media Consciousness Scale (ASMC)

ASMC was measured using the Appearance-Related Social Media Consciousness Scale (7). The scale contains 13 items and uses a 7-point Likert response format ranging from 1 = Never to 7 = Always. Higher scores indicate greater appearance-related social media consciousness. The scale demonstrated good internal consistency, with Cronbach's α reported as 0.91–0.94.

Objectified Body Consciousness Scale (OBCS)

Appearance visibility and body surveillance were assessed using the Surveillance Subscale of the Objectified Body Consciousness Scale (12). The questionnaire used 24 items with a 7-point response format. Reverse-scored items were recoded before analysis. Higher scores indicate greater body surveillance and appearance monitoring. Reported reliability ranged from Cronbach's α = 0.75–0.89.

Fear of Negative Evaluation (FNE)

Fear of negative evaluation was assessed using the Fear of Negative Evaluation Scale (13). The scale contains 12 items using a 5-point response format. Higher scores indicate greater concern about negative evaluation by others. Reported reliability ranged from Cronbach's α = 0.90–0.97.

Rosenberg Self-Esteem Scale (RSES)

Self-esteem was assessed using the Rosenberg Self-Esteem Scale (14). The scale contains 10 items rated on a 4-point Likert scale. Negatively worded items were reverse coded before calculating the total score. Higher total scores indicate higher self-esteem. Reported reliability ranged from Cronbach's α = 0.77–0.88.

Multidimensional Scale of Perceived Social Support (MSPSS)

Perceived social support was measured using the Multidimensional Scale of Perceived Social Support (15). The scale contains 12 items assessing perceived support from family, friends, and significant others. Responses were recorded using a 7-point Likert scale, with higher scores indicating greater perceived social support.

Appearance Anxiety Inventory (AAI)

Appearance anxiety was assessed using the Appearance Anxiety Inventory (16). The instrument contains 10 items and produces a total score ranging from 0 to 40, with higher scores indicating greater appearance anxiety.

Questionnaire Translation and Pretesting

The questionnaire was translated from English into Thai using a forward-translation and back-translation procedure. The Thai version was reviewed by experts for clarity, relevance, and cultural suitability. A pretest was conducted with 30 students with characteristics like the target population. The pretest participants were not included in the final study sample.

The internal consistency of the standardized instruments was assessed using Cronbach's alpha. A Cronbach's alpha value of 0.70 or above was considered acceptable.

Measurement of Height, Weight, and BMI

Height and weight were self-reported by participants. BMI was calculated using weight in kilograms divided by height in meters squared (kg/m²). BMI was summarized descriptively according to standard BMI categories and was also examined as a candidate variable in the preliminary regression analysis.

BMI was not significantly associated with appearance anxiety in the simple regression analysis ($\beta = -.012$, $p = .733$) and was therefore not retained in the final multiple regression model.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics Version 29. Descriptive statistics were used to summarize participant characteristics and study variables. Means and standard deviations were calculated for continuous variables, while frequencies and percentages were reported for categorical variables. Pearson correlation analysis was conducted to examine associations among the psychological variables. Simple linear regression analyses were conducted to examine the individual associations between demographic, social-media-related, and psychological variables and appearance anxiety. Multiple linear regression analysis using the Enter method was subsequently conducted to identify independent associations with appearance anxiety. Variables were considered for the final model based on theoretical considerations and findings from the preliminary analyses. Gender, study year, monthly living expenses, RSES, MSPSS, FNE, OBCS, and ASMC were entered simultaneously into the final model. BMI and GPA were examined in preliminary analyses but were not retained in the final model because they did not demonstrate statistically significant associations with appearance anxiety. Statistical significance was determined using a two-tailed p-value of $< .05$. Because the study used a cross-sectional design, regression findings were interpreted as associations rather than causal effects.

RESULTS

Demographic and Social Media Use Characteristics

A total of 740 university students were included in the final analysis. The sample consisted predominantly of male students (77.7%), while female students accounted for 22.3%. Fourth-year students represented the largest proportion of participants (30.0%), followed by third-year students (23.9%), first-year students (23.1%), and second-year students (23.0%). The mean height was 164.8 ± 7.6 cm, the mean weight was 62.4 ± 10.7 kg, the mean GPA was 3.11 ± 0.69, and the mean BMI was 23.00 ± 3.72 kg/m². Based on BMI classification, 65.5% were classified as normal weight, 23.1% as overweight, 7.6% as underweight, and 3.8% as obese. Regarding social media use, 38.6% reported using social media for more than four hours per day, while 37.7% reported three to four hours per day. TikTok was the most frequently used platform (27.3%), followed by Instagram (27.0%), Snapchat (24.5%), and Facebook (20.7%).

Regarding self-image posting, 24.7% reported posting photographs or videos of themselves at least once per week, while 26.5% posted one to three times per month. Regarding photo editing or filter use, 32.7% reported using such tools sometimes, 24.9% often, and 23.2% always. These demographic and social-media-use characteristics are based on the final Thesis dataset of 740 participants.

Descriptive Statistics of Psychological Variables

The descriptive statistics were as follows:

Table 1 Descriptive statistic

Variable	Possible Range	Actual Range	Mean	SD
Appearance-Related Social Media Consciousness (ASMC)	11–77	11–77	36.92	10.38
Objectified Body Consciousness (OBCS)	24–168	59–124	95.06	8.76
Fear of Negative Evaluation (FNE)	12–60	12–60	38.58	6.62
Self-Esteem (RSES)	10–40	14–36	24.66	3.49
Perceived Social Support (MSPSS)	12–84	12–84	50.09	10.07
Appearance Anxiety (AAI)	0–40	0–40	21.41	5.95

The mean appearance anxiety score was 21.41 ± 5.95. The mean ASMC score was 36.92 ± 10.38, OBCS was 95.06 ± 8.76, FNE was 38.58 ± 6.62, RSES was 24.66 ± 3.49, and MSPSS was 50.09 ± 10.07.

Simple Linear Regression Analysis

Simple linear regression analyses identified several variables significantly associated with appearance anxiety. Gender was significantly associated with appearance anxiety ($\beta = -.211$, $p < .001$). Study year was also significantly associated with appearance anxiety ($\beta = -.129$, $p < .001$), while monthly living expenses showed a small positive association ($\beta = .092$, $p = .011$). BMI was not significantly associated with appearance anxiety ($\beta = -.012$, $p = .733$), and GPA was also not statistically significant ($\beta = -.069$, $p = .058$). Among the psychological variables, FNE demonstrated the strongest association with appearance anxiety ($\beta = .493$, $p < .001$). MSPSS was negatively associated with appearance anxiety ($\beta = -.271$, $p < .001$), while RSES ($\beta = .251$, $p < .001$) and OBCS ($\beta = .177$, $p < .001$) showed positive associations. ASMC demonstrated a small negative association with appearance anxiety in the simple regression analysis ($\beta = -.102$, $p = .005$).

Multiple Linear Regression Analysis

The final multiple regression model included gender, study year, monthly living expenses, RSES, MSPSS, FNE, OBCS, and ASMC.

Table 2 Multiple linear regression analysis predicting appearance anxiety

Predictor	B	SE	β	t	p
Gender	−0.529	0.458	−0.038	−1.156	.248
Study Year	−0.377	0.153	−0.075	−2.462	.014
Monthly Living Expenses	0.264	0.162	0.049	1.626	.104
Self-Esteem (RSES)	0.224	0.053	0.132	4.194	<.001
Perceived Social Support (MSPSS)	−0.085	0.019	−0.143	−4.510	<.001
Fear of Negative Evaluation (FNE)	0.390	0.028	0.434	14.039	<.001
Objectified Body Consciousness (OBCS)	0.079	0.021	0.116	3.812	<.001
Appearance-Related Social Media Consciousness (ASMC)	0.011	0.020	0.019	0.537	.591

Model statistics: $R = .562$; $R^2 = .316$; Adjusted $R^2 = .312$; $p < .001$. The final model explained 31.6% of the variance in appearance anxiety. FNE demonstrated the strongest positive association with appearance anxiety ($\beta = .434$, $p < .001$). RSES ($\beta = .132$, $p < .001$) and OBCS ($\beta = .116$, $p < .001$) were also positively associated with appearance anxiety. MSPSS was negatively associated with appearance anxiety ($\beta = -.143$, $p < .001$), while study year was negatively associated with appearance anxiety ($\beta = -.075$, $p = .014$). Gender, monthly living expenses, and ASMC were not statistically significant predictors in the adjusted model. The final regression results are consistent with the final Thesis.

DISCUSSION

This study examined the associations among appearance-related social media consciousness, objectified body consciousness, fear of negative evaluation, self-esteem, perceived social support, and appearance anxiety among university students in Phuket Province, Thailand. The final multiple regression model explained 31.6% of the variance in appearance anxiety, indicating that appearance anxiety was associated with multiple psychological and academic factors rather than a single aspect of social-media use.

Fear of Negative Evaluation

Fear of negative evaluation was the strongest independent predictor of appearance anxiety ($\beta = .434$, $p < .001$). This finding highlights the importance of social-evaluative concerns in understanding appearance-related distress. Students who are more concerned about how others evaluate them may be more attentive to their physical appearance and more likely to experience anxiety regarding their appearance.

Social-media environments may intensify this process because photographs, comments, likes, and follower counts can provide visible forms of scial evaluation. Previous research has also suggested that social comparison and appearance-related self-presentation on social media may increase awareness of perceived appearance shortcomings (1,9).

Perceived Social Support

Perceived social support was negatively associated with appearance anxiety ($\beta = -.143$, $p < .001$). This finding suggests that students who perceive greater support from family, friends, and significant others tend to report lower levels of appearance anxiety. Supportive interpersonal relationships may provide reassurance and alternative sources of self-worth, potentially reducing dependence on appearance-based social evaluation. However, because this study was cross-sectional, the finding should be interpreted as an association rather than evidence that social support directly reduces appearance anxiety.

Objectified Body Consciousness

OBCS was positively associated with appearance anxiety (β = .116, $p < .001$). This finding is consistent with Objectification Theory, which proposes that repeated monitoring of one's physical appearance may increase attention to appearance-related concerns and perceived evaluation by others (17).

Students who frequently monitor their physical appearance may become more aware of perceived imperfections and more concerned about how their bodies are viewed by others. This may be particularly relevant in visually oriented social-media environments.

Self-Esteem

Self-esteem was positively associated with appearance anxiety in the final regression model (β = .132, $p < .001$). The positive direction differs from findings in some previous research and represents an unexpected finding in the present study. One possible explanation is that global self-esteem does not necessarily reflect appearance-specific self-evaluation. Individuals with relatively positive general self-evaluations may still place substantial importance on physical appearance or social approval. However, this interpretation remains tentative, and longitudinal research is needed to clarify the direction and mechanisms of this relationship.

Study Year

Study year was negatively associated with appearance anxiety (β = −.075, p = .014). Students in higher academic years tended to report lower levels of appearance anxiety after adjustment for the other variables. This finding may reflect differences in coping strategies, social experience, or psychological development across academic years. However, because the current study is cross-sectional, differences between study years cannot be interpreted as evidence of developmental change.

Appearance-Related Social Media Consciousness

An important finding was that ASMC was significant in the simple regression analysis (β = −.102, p = .005) but was no longer statistically significant in the final multiple regression model (β = .019, p = .591). This suggests that the bivariate association between ASMC and appearance anxiety did not remain independently significant after adjustment for the other psychological and demographic variables. The finding may indicate that appearance-related social-media consciousness overlaps with broader psychological processes such as fear of negative evaluation, body surveillance, self-esteem, and perceived social support. However, the present study did not conduct mediation analysis. Therefore, ASMC should not be described as a mediator, and the current findings cannot establish an indirect pathway or causal mechanism. Future longitudinal studies using formal mediation or path analysis may help clarify whether appearance-related social-media consciousness is associated with appearance anxiety through other psychological processes.

Social-Media Feedback and Engagement Context

The present study also needs to consider the broader nature of social-media engagement. The questionnaire assessed daily social-media use, platform use, self-image posting, and photo-editing behavior. However, it did not distinguish between public/open engagement and private/closed interactions, such as group chats or private communication. Similarly, the study did not directly measure the number of likes, comments, followers, or whether social feedback was positive or negative. Positive feedback may have different psychological effects from negative evaluation. Likes, supportive comments, reactions, emojis, and gaining followers may provide social validation and positive emotional experiences. At the same time, repeated reliance on appearance-related feedback may reinforce attention to physical appearance and increase the perceived importance of social approval.

Therefore, positive feedback should not automatically be interpreted as either protective or harmful. Future research should examine the type, frequency, and perceived meaning of social-media feedback and distinguish public from private engagement contexts.

CONCLUSION

The present study examined factors associated with appearance anxiety among university students in Phuket Province, Thailand. The findings demonstrated that fear of negative evaluation was the strongest independent predictor of appearance anxiety. Perceived social support was negatively associated with appearance anxiety, while self-esteem and objectified body consciousness showed positive associations. Study year was negatively associated with appearance anxiety.

Although appearance-related social media consciousness was associated with appearance anxiety in the simple regression analysis, it was not independently associated with appearance anxiety after adjustment for the other variables.

These findings suggest that university-based approaches to appearance anxiety should consider broader psychological and interpersonal factors rather than focusing only on social-media use. Counseling services addressing fear of negative evaluation, strengthening of social support, body-image education, and social-media literacy may be useful components of university health-promotion programs. However, because the study was cross-sectional, these findings should be interpreted as associations rather than causal relationships.

LIMITATIONS AND FUTURE RESEARCH

Several limitations should be considered when interpreting the findings. First, the cross-sectional design does not allow causal relationships or temporal ordering to be established. Therefore, the findings should be interpreted as associations rather than causal effects. Second, convenience sampling and the predominantly male sample (77.7% male, 22.3% female) may limit generalizability. Future studies should use more representative and gender-balanced samples. Third, sexual orientation, gender identity, nationality, cultural background, and religion were not collected. Therefore, LGBTQI+ differences and potential cultural influences on appearance anxiety could not be examined. Future research should include more inclusive and culturally diverse measures. Fourth, height and weight were self-reported, which may introduce reporting errors. Future studies could use objectively measured anthropometric data where feasible. Fifth, the study did not distinguish between public/open and private/closed social-media engagement or directly measure likes, comments, followers, and positive or negative feedback. Future research should examine how different types of online interaction and social feedback relate to appearance anxiety. Finally, the regression model explained 31.6% of the variance in appearance anxiety, indicating that other psychological, interpersonal, social-media-related, and environmental factors may also contribute. Future longitudinal and mediation studies could further clarify these relationships.

DECLARATION OF AI ASSISTANCE

Generative AI tools were used to assist with language editing, organization, and revision of this manuscript in response to peer-review comments. The authors provided the study content and data, verified the statistical results against the final thesis, and took full responsibility for the accuracy, interpretation, and final submitted version.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (Approval No. 162/69). Before participating in the study, all participants were provided with information about the study purpose and procedures and provided informed consent. Participation was voluntary, and participants were informed that they could

withdraw from the study at any time without any consequences. All information collected was kept confidential and used solely for research purposes.

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ASSOCIATION OF PERCEIVED MEDIA FRAMING AND TONE WITH ANXIETY AMONG WOMEN IN NEW DELHI, INDIA

Deepali Sharma[1]*, Montakarn Chuemchit[1]
[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, E-mail: 6774024653@student.chula.ac.th
***Corresponding Author**: Montakarn Chuemchit,*
College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand. E-mail: montakarn.ch@chula.ac.th

ABSTRACT

Introduction: Digital media is an important source of information about sexual violence, and the way such content is presented may be associated with psychological responses. Limited evidence has examined perceived media framing and tone in relation to anxiety among women exposed to sexual violence-related digital content in India.

Objectives: To examine the association between perceived media framing and tone of sexual violence-related digital media content and anxiety among women in New Delhi, India.

Methodology: A cross-sectional study was conducted among women aged 18–49 years. Of 390 responses, 15 were excluded for ineligibility, leaving 375 participants. Data were collected using a structured online questionnaire assessing digital-media exposure, perceived framing and tone, and anxiety using a modified 10-item DASS-21 anxiety measure. Analyses used SPSS version 29.0, descriptive statistics, chi-square/Fisher–Freeman–Halton exact tests, and binary logistic regression.

Results: Media framing was significantly associated with anxiety (Fisher–Freeman–Halton Exact Test, $p < .001$), as was media tone ($\chi^2 = 30.145$, $p < .001$). Binary exposure level was also associated with anxiety ($p = .021$). In multivariable analysis, occupation showed higher adjusted odds of high anxiety among participants who were not working/unemployed or students compared with those who were working, although the association was not statistically significant (AOR = 3.311, 95% CI: 0.985–11.111, $p = .053$).

Conclusion: Perceived media framing and tone were significantly associated with anxiety. Responsible, contextual, and survivor-sensitive reporting may support appropriate communication of sexual violence-related content.

Keywords:
Media Framing; Media Tone; Sexual Violence; Anxiety; Digital Media; Women

INTRODUCTION

Violence against women is a major public health and human rights concern with substantial physical, social, and psychological consequences (1). Violence against women remains widespread globally (2), and national data indicate a substantial burden of crimes against women in India (3). Delhi is an important urban context for understanding this burden (4). Exposure to violence has been associated with psychological outcomes including anxiety, depression, and post-traumatic stress (5), while anxiety contributes substantially to the mental health burden in India (6).

The growth of digital media has changed how information about sexual violence is encountered and consumed. Social media and online platforms provide repeated opportunities to encounter news, commentary, images, and other content concerning sexual violence (7). The psychological relevance of such exposure may depend not only on frequency of exposure but also on how the content is presented.

Media framing refers to the selection and emphasis of particular aspects of an issue, shaping the context through which audiences interpret an event or social problem. Sexual violence may be framed as an individual problem, a broader societal issue, or both. Entman's framing theory provides a basis for examining this process through selection and salience (8). Media tone represents another dimension of

presentation and may be perceived as balanced, sensationalized, critical toward survivors, sympathetic toward survivors, or unclear. Previous research has linked affective media tone with psychological responses to mass violence-related content (9), while research on representations of violence against women highlights the importance of contextual presentation and survivors' perspectives (10).

Despite growing interest in media exposure and mental health, limited research has examined whether perceived framing and tone of sexual violence-related digital media content are associated with anxiety among women in urban India. This study therefore examined these associations among women in New Delhi.

METHODOLOGY

Study Design, Study Area and Study Population

A quantitative cross-sectional study was conducted among women aged 18–49 years in New Delhi, India. Participants were recruited through non-probability purposive sampling using online networks, including WhatsApp groups, class representatives, personal contacts, and community networks. Of 390 responses received, 15 were excluded because participants were outside the eligible age range, resulting in a final analytical sample of 375.

Sampling and Sample Size

The minimum required sample size was calculated using Cochran's formula (11), assuming a 95% confidence level (Z = 1.96), p = 0.50, q = 0.50, and a 5% margin of error. The calculated minimum was 384.16, rounded to 385 participants. A total of 390 responses were received; 15 were excluded because participants did not meet the eligibility criteria, resulting in 375 participants for the final analysis.

Data Collection Instruments and Measurement

A structured self-administered questionnaire assessed socio-demographic characteristics, digital media use, exposure to sexual violence-related content, perceived media tone and framing, and anxiety.

Exposure to sexual violence-related digital media content was assessed using items Q15–Q29. Q15 directly assessed the frequency with which participants encountered news regarding sexual violence against women, with five response options: Always, Often, Sometimes, Rarely, and Never. The remaining items assessed characteristics of exposure, including accessibility of information, incidental exposure through social media, victim-blaming headlines or images, emotional effects, stereotyped portrayals and harmful myths, gender stereotypes, normalization of violence, survivor-supportive reporting, misleading or inaccurate reporting, vague or passive language, disrespectful language, violence portrayed in entertainment media, and protection of survivors' personal information. All 15 items were rated on a five-point Likert scale from 1 (Never) to 5 (Always), and their scores were summed to obtain the overall exposure score.

Perceived media tone was assessed using Q12 and categorized as sensationalized, balanced, sympathetic towards survivors, critical towards survivors, or unsure. Perceived media framing was assessed using Q13 and categorized as a societal issue, individual problem, both equally, or unsure. Q14 additionally assessed participants' perceived effect of media reporting on their awareness and concern regarding sexual violence. These measures reflected participants' perceptions of the media content they encountered rather than objective coding of individual media reports.

Anxiety was assessed using a modified 10-item instrument (Q30–Q39), comprising the seven original DASS-21 anxiety items and three researcher-developed items. Participants responded on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), and scores were summed across the ten items, giving a theoretical range of 10–50, with higher scores indicating higher anxiety.

The anxiety measure was adapted from the Depression Anxiety Stress Scales (DASS-21). The original DASS-21 anxiety subscale consists of seven items, all of which were retained in this

study. To better assess anxiety related to exposure to sexual violence-related content through digital media, three additional items were developed by the researcher and incorporated into the scale. Thus, the modified instrument contained ten items, with a theoretical total score ranging from 10 to 50. The modified instrument was subjected to expert content review and pilot testing, with its content validity and internal consistency assessed as described in Section 2.5.

Because the instrument was modified, established DASS-21 clinical cut-offs were not applied. Based on the sample mean (37.56) and SD (6.466), anxiety was classified as low (≤31), moderate (32–44), or high (≥45). For inferential analysis, moderate and high anxiety were combined into the high-anxiety category.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0. Categorical variables were summarized using frequencies and percentages; continuous variables were summarized using mean, standard deviation, median, minimum and maximum values, range, skewness, and kurtosis. Study-specific exposure and anxiety categories were based on mean ± SD because validated cut-offs were unavailable for the modified measures.

For inferential analysis, age was dichotomized into ≤35 and ≥36 years; education into ≤High School and ≥Graduate; occupation into not working/unemployed + student and working; living arrangement into living alone and not living alone; exposure into low exposure (negative + neutral) and high exposure (positive); and anxiety into low and high anxiety, with moderate and high combined into the high-anxiety category.

Pearson's chi-square test was used for categorical associations; Fisher–Freeman–Halton Exact Test was used for sparse tables (12). Variables with $p < .20$ in bivariate analysis were considered for logistic regression, while conceptually important variables such as occupation were retained. Crude and adjusted odds ratios with 95% confidence intervals were reported, with $p < .05$ considered statistically significant (13).

Reliability and Validity

Content validity was assessed by three public health experts using the Item-Objective Congruence Index; the overall IOC was 0.85 (14). A pilot test of approximately 30 participants assessed clarity, comprehensibility, and internal reliability. Internal consistency was acceptable for the exposure scale ($\alpha = 0.823$) and high for the modified anxiety scale ($\alpha = 0.868$). (15, 16).

RESULTS

Participant Characteristics and Digital Media Use

Among 375 participants, the mean age was 26.88 years (SD = 7.17). Participants aged 18–25 years comprised 55.7%, followed by 26–35 years (25.9%) and 36–49 years (18.4%). Graduate or postgraduate education was reported by 83.2%. Nearly half reported 4–7 hours of daily internet use (44.8%), followed by 1–3 hours (41.1%) and more than 7 hours (14.1%). Smartphones/mobile phones were the predominant device (84.3%), while WhatsApp (85.6%), Instagram (82.4%), and YouTube (80.5%) were the most frequently used platforms.

Table 1 Selected participant and digital media characteristics (n = 375).

Characteristic	Category	Frequency (n)	Percentage (%)
Age	18–25 years	209	55.7
	26–35 years	97	25.9
	36–49 years	69	18.4

Characteristic	Category	Frequency (n)	Percentage (%)
Education	≤High School	63	16.8
	≥Graduate	312	83.2
Daily internet use	1–3 hours	154	41.1
	4–7 hours	168	44.8
	>7 hours	53	14.1
Primary device	Smartphone/mobile phone	316	84.3
	PC/Laptop	35	9.3
	Other devices	24	6.4

Exposure to Sexual Violence-Related Digital Media Content

The 15-item exposure scale had observed scores of 29–74, with a mean of 53.80 (SD = 7.54) and median of 55.00. Using mean ± SD classification, 79.7% had neutral exposure, 12.8% had negative exposure, and 7.5% had positive exposure. For inferential analysis, negative and neutral exposure were combined as low exposure (92.5%), while positive exposure was classified as high exposure (7.5%).

Table 2 Distribution of sexual violence-related digital media exposure (n = 375).

Exposure measure	Category	Frequency (n)	Percentage (%)
Exposure score	Mean ± SD	53.80 ± 7.54	—
	Median	55.00	—
	Minimum–Maximum	29–74	—
Exposure level	Negative (≤46)	48	12.8
	Neutral (47–61)	299	79.7
	Positive (≥62)	28	7.5
Binary exposure	Low (negative + neutral)	347	92.5
	High (positive)	28	7.5

Note: Negative, neutral, and positive indicate relatively lower, moderate, and higher exposure levels and do not imply beneficial or harmful effects.

Perceived Media Framing and Tone of Sexual Violence-Related Content

Sexual violence-related content was most frequently encountered through social networking platforms (50.4%), followed by YouTube (19.2%) and online news channels (14.7%). Sensationalized reporting was the most commonly perceived tone (30.9%), followed by balanced (23.2%) and sympathetic reporting (21.1%). For framing, 43.2% perceived sexual violence as both a societal issue and an individual problem, while 38.4% perceived it primarily as a societal issue.

Table 3 Perceived media framing and tone of sexual violence-related content (n = 375).

Variable	Category	Frequency (n)	Percentage (%)
Media tone	Sensationalized	116	30.9
	Balanced	87	23.2
	Sympathetic toward survivors	79	21.1
	Critical toward survivors	44	11.7
	Unsure	49	13.1
Media framing	Both equally	162	43.2
	Societal issue	144	38.4
	Individual problem	41	10.9
	Unsure	28	7.5

Anxiety Levels

Among 375 participants, 52 (13.9%) were classified as having low anxiety, 279 (74.4%) moderate anxiety, and 44 (11.7%) high anxiety using study-specific mean ± SD categories. For inferential analysis, moderate and high anxiety were combined into high anxiety, resulting in 323 participants (86.1%) in the high-anxiety group. These categories should not be interpreted as clinical diagnoses.

Table 4 Distribution of anxiety levels among participants (n = 375).

Anxiety classification	Frequency (n)	Percentage (%)
Low	52	13.9
Moderate	279	74.4
High	44	11.7
Binary: Low	52	13.9
Binary: High (moderate + high)	323	86.1

Association Between Media Framing and Anxiety

Perceived media framing was significantly associated with anxiety (Fisher–Freeman–Halton Exact Test, $p < .001$). High anxiety was reported by 100.0% of participants perceiving an individual-problem framing, 91.0% perceiving a societal framing, 83.3% perceiving both equally, and 57.1% who were unsure.

Table 5 Association between perceived media framing and anxiety (n = 375).

Media framing	Low anxiety n (%)	High anxiety n (%)
Both equally	27 (16.7)	135 (83.3)
Individual problem	0 (0.0)	41 (100.0)
Societal issue	13 (9.0)	131 (91.0)
Unsure	12 (42.9)	16 (57.1)
Total	52 (13.9)	323 (86.1)

Note: Fisher–Freeman–Halton Exact Test: $p < .001$.

Association Between Media Tone and Anxiety

Perceived media tone was significantly associated with anxiety (χ^2 = 30.145, p < .001). High anxiety was reported by 100.0% of participants perceiving critical and sympathetic tones, compared with 80.2% for sensationalized, 77.0% for balanced, and 81.6% for unsure tone.

Table 6 Association between perceived media tone and anxiety (n = 375).

Media tone	Low anxiety n (%)	High anxiety n (%)
Balanced	20 (23.0)	67 (77.0)
Critical toward survivors	0 (0.0)	44 (100.0)
Sensationalized	23 (19.8)	93 (80.2)
Sympathetic toward survivors	0 (0.0)	79 (100.0)
Unsure	9 (18.4)	40 (81.6)
Total	52 (13.9)	323 (86.1)

Note: Pearson χ^2 = 30.145, p < .001.

Other Bivariate Associations with Anxiety

Occupation, living arrangement, and binary exposure were significantly associated with anxiety, whereas age and education were not. High anxiety was reported by 96.1% of participants classified as not working/ unemployed + student versus 83.6% of working participants (χ^2 = 7.852, p = .005). Living arrangement was also significant (χ^2 = 10.821, p = .001), and all participants living alone had high anxiety. Binary exposure was significant (Fisher–Freeman–Halton Exact Test, p = .021), with all participants in the high-exposure group classified as having high anxiety.

Table 7 Selected recoded variables associated with anxiety (n = 375).

Variable	Category	Low anxiety n (%)	High anxiety n (%)	Test	p
Age	≤35 years	39 (12.7)	267 (87.3)	χ^2 = 1.752	.186
	≥36 years	13 (18.8)	56 (81.2)		
Education	≤High School	9 (14.3)	54 (85.7)	χ^2 = 0.011	.916
	≥Graduate	43 (13.8)	269 (86.2)		
Occupation	Not working/unemployed + student	3 (3.9)	73 (96.1)	χ^2 = 7.852	.005*
	Working	49 (16.4)	250 (83.6)		
Living arrangement	Living alone	0 (0.0)	57 (100.0)	χ^2 = 10.821	.001*
	Not living alone	52 (16.4)	266 (83.6)		
Exposure	Low	52 (15.0)	295 (85.0)	Fisher–Freeman–Halton	.021*
	High	0 (0.0)	28 (100.0)		

Note: *p < .05.

Logistic Regression Analysis

In univariate logistic regression, occupation was significantly associated with anxiety. Participants classified as not working/unemployed or students had higher crude odds of high anxiety than working participants (COR = 4.762, 95% CI: 1.445–15.873, p = .010). Age was not significantly associated with anxiety (COR = 0.629, 95% CI: 0.315–1.255, p = .189). Crude odds ratios for living arrangement and binary exposure were not estimable because of complete separation.

In the multivariable model, age, occupation, living arrangement, and binary exposure were included. No individual predictor reached statistical significance at p < .05. Participants who were not working/unemployed or students had higher adjusted odds of high anxiety than working participants, although the association was not statistically significant (AOR = 3.311, 95% CI: 0.985–11.111, p = .053). Age was not significantly associated with anxiety (AOR = 0.901, 95% CI: 0.448–1.816, p = .771). Adjusted estimates for living arrangement and binary exposure were not estimable because of complete separation.

Table 8 Multivariable logistic regression analysis for predictors of anxiety (N = 375).

Variable	Comparison	AOR (Exp B)	95% CI	p-value
Age	≥36 vs ≤35	0.901	0.448–1.816	.771
Occupation	Not working/unemployed + student vs working	3.311	0.985–11.111	.053
Living arrangement	Living alone vs not living alone	NE	—	—
Exposure	High vs low	NE	—	—

Note: NE = not estimable because of complete separation.

DISCUSSION

This study examined the associations between sexual violence-related digital media exposure, perceived media framing and tone, and anxiety among 375 women aged 18–49 years in New Delhi. High anxiety was common after dichotomization, with 86.1% classified in the high-anxiety group. However, this category reflects the study-specific cut-off based on the sample mean and standard deviation and should not be interpreted as a clinical diagnosis.

The findings showed a significant association between perceived media framing and anxiety (p < .001). Participants who perceived sexual violence as a societal issue had a higher proportion of high anxiety than those who perceived it primarily as an individual problem or were unsure of the framing. This finding is consistent with the conceptual basis of framing theory, which emphasizes that media presentation can make particular aspects of an issue more salient. However, the cross-sectional design and reliance on participants' perceptions prevent determination of temporal direction or causality. The observed association may also reflect differences in how participants interpreted the same media content.

Media tone was also significantly associated with anxiety (χ^2 = 30.145, p < .001). The distribution of anxiety differed across sensationalized, balanced, sympathetic, critical, and unsure tone categories. The relatively high proportions of high anxiety in some categories should be interpreted cautiously because several categories contained comparatively small numbers of participants. In particular, category-specific percentages should not be interpreted as evidence that a particular tone causes anxiety.

Binary exposure level was significantly associated with anxiety in the bivariate analysis (p = .021). Although the high-exposure group showed a greater proportion of high anxiety, the

high-exposure category was small and complete separation prevented reliable estimation of its adjusted odds ratio in logistic regression. Therefore, the bivariate association should not be interpreted as an independent adjusted effect.

The multivariable analysis provided a more cautious interpretation of the socio-demographic and exposure variables. Participants classified as not working/unemployed or students had higher adjusted odds of high anxiety than working participants, but the association was not statistically significant (AOR = 3.311, 95% CI: 0.985–11.111, p = .053). Age was also not significantly associated with anxiety after adjustment (AOR = 0.901, 95% CI: 0.448–1.816, p = .771). Adjusted estimates for living arrangement and binary exposure were not estimable because of complete separation. Thus, the multivariable findings do not establish an independent predictor of anxiety among the variables included in the final model.

Taken together, the results suggest that how sexual violence-related content is perceived and presented may be relevant to anxiety, but the findings should be interpreted as associations rather than causal relationships. The findings support the importance of contextual, balanced, and survivor-sensitive communication when sexual violence is discussed in digital media, while recognizing that anxiety responses may also reflect individual and contextual factors not captured in the study.

CONCLUSION

Among women aged 18–49 years in New Delhi, perceived media framing and media tone of sexual violence-related digital content were significantly associated with anxiety. Binary exposure level was also associated with anxiety in the bivariate analysis, while the final multivariable model did not identify a statistically significant independent predictor among the variables included. The findings highlight the relevance of how sexual violence-related content is presented and perceived, while the cross-sectional design does not permit causal conclusions. Media communication should therefore emphasize contextual, balanced, and survivor-sensitive reporting.

RECOMMENDATIONS

Based on the findings, the following recommendations are proposed: Responsible media reporting: Media organizations and digital-content creators should use contextual, balanced, and survivor-sensitive approaches when reporting sexual violence. Public-health communication: Public-health and media-literacy initiatives should help audiences critically interpret sexual violence-related digital content and recognize potentially distressing presentation styles. Supportive digital environments: Platforms and relevant organizations should consider accessible information on psychological support when disseminating sensitive sexual violence-related content. Future research: Future studies should use larger probability-based or more diverse samples, longitudinal designs, and objective content analysis to examine media framing and tone alongside individual psychological and contextual factors. Measurement research: Further studies should validate the modified anxiety instrument and examine whether the observed associations remain consistent using established clinical anxiety measures.

ETHICAL DECLARATION

Ethical clearance was granted by the Research Ethics Review Committee for Research Involving Human Participants, Group I, Chulalongkorn University. Participation was voluntary and informed consent was obtained from all respondents. Confidentiality and anonymity were maintained throughout the study.

LIMITATIONS

The cross-sectional design prevents temporal or causal inference. Non-probability purposive sampling and online recruitment may introduce selection bias and limit generalizability beyond women represented in the New Delhi study population. Self-reported data may be

affected by recall or response bias, and media framing and tone reflected participants' perceptions rather than objective content analysis. Residual confounding cannot be excluded because not all potentially relevant factors were measured or included in the final model. The final sample was also slightly below the calculated minimum after eligibility screening. Anxiety was measured using a modified 10-item instrument, so established DASS-21 clinical cut-offs were not applicable, and the study-specific categories should not be interpreted as clinical diagnoses. Finally, outcome imbalance and sparse cells produced complete separation for living arrangement and binary exposure, preventing reliable, adjusted estimates for these variables.

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DETERMINANTS OF PSYCHOLOGICAL RESILIENCE AND ITS ASSOCIATIONS WITH PROFESSIONAL QUALITY OF LIFE AMONG HEALTH WORKERS OF ETHNIC HEALTH ORGANIZATIONS ON THE THAI-MYANMAR BORDER

Si Thu Naing*, Piyapong Janmaimool, Cheerawit Rattanapan, Orapin Laosee

ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhonpathom, 73710, Thailand.

****Corresponding author**: Piyapong Janmaimool, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73710, Thailand. Email: piyapong.jan@mahidol.ac.th*

ABSTRACT

Introduction: Ethnic Health Organizations (EHOs) play a critical role in delivering healthcare services to displaced and marginalized populations along the Thai-Myanmar border. EHOs' health workers face multiple stressors. Psychological resilience may help health workers cope with these challenges and maintain a positive quality of work life. However, resilience and its associated factors among EHO health workers remain largely unexplored. Furthermore, the relationship between psychological resilience and Professional Quality of Life (ProQOL) has not been examined in this context.

Objectives: This study aimed to assess the levels of psychological resilience and ProQOL among EHO health workers, identify factors associated with psychological resilience, and examine the association between resilience and ProQOL.

Methodology: A cross-sectional study was conducted among EHO health workers. A total of 150 health workers of EHOs were invited to participate in the survey, and 127 participants responded to the questionnaires. Psychological resilience was measured using the 10-item Connor-Davidson Resilience Scale (CD-RISC-10), while Professional Quality of Life was assessed using the ProQOL scale. Descriptive analyses were first performed to reveal characteristics of participants, psychological resilience level, and ProQOL. Chi-square tests and crude analyses were performed to identify factors associated with resilience. Variables with p-values ≤ 0.25 in crude analysis were included in a multiple logistic regression model. Chi-square tests were used to examine the association between psychological resilience and ProQOL.

Results: 22% of participants reported high psychological resilience. Based on the results of multiple logistic regression analysis, receiving stronger support from significant others and organizational support, and reporting higher optimism were significantly more likely to have high psychological resilience. Among the three ProQOL dimensions, compassion satisfaction and burnout were significantly associated with psychological resilience, whereas secondary traumatic stress was not.

Conclusion: Psychological resilience among EHO health workers is shaped by both individual and social factors. Enhancing social and organizational support can enable health workers to be more resistant to work-related stressors. The positive association between resilience and compassion satisfaction highlights the importance of fostering supportive work environments in conflict-affected settings. In addition, burnout among health workers can be prevented by resilience. Resilience-building interventions, including peer support, staff recognition, and psychosocial support mechanisms, should be integrated into workforce development strategies to strengthen health worker well-being and sustainability.

Keywords

Psychological resilience; Professional Quality of Life; Health workers; Ethnic Health Organizations; Thai-Myanmar border

INTRODUCTION

Myanmar has experienced widespread instability following the COVID-19 pandemic and political crisis, including armed conflict, population displacement, and disruption of essential public services. In conflict-affected areas, health facilities have become less functional and access to government health services has been limited (1). Consequently, communities in ethnic-controlled areas face significant barriers to essential healthcare.

In this context, Ethnic Health Organizations (EHOs) play a critical role in providing healthcare to displaced and marginalized populations along the Thai-Myanmar border, particularly where government services cannot adequately reach (2). Ethnic communities also face a double burden of infectious and non-communicable diseases, with higher mortality indicators than national and regional benchmarks (3). These pressures may increase workload and emotional strain among health workers working with limited resources.

Psychological resilience is important for health workers because it helps buffer stress and burnout while supporting psychological well-being and work performance (4). Resilience is shaped by personal and social factors, including optimism and social support (5). Professional Quality of Life (ProQOL) includes compassion satisfaction, burnout, and secondary traumatic stress (6). Therefore, this study aimed to examine psychological resilience, its associated factors, and its association with ProQOL among EHO health workers.

METHODOLOGY

A cross-sectional analytical study was conducted among health workers of Ethnic Health Organizations (EHOs) operating along the Thai-Myanmar border. EHOs provide essential primary healthcare services to conflict-affected, displaced, and underserved populations in areas where access to government health services is limited.

Study Population and Sampling

The study population was the health workers currently employed by the EHOs. The participants were recruited with the eligibility criteria of currently working in EHOs and agreeing to participate in the study.

The 10% of health workers were invited from approximately eligible 1000 of KDHW health workers according to (7) (8). Among them, 127 health workers responded during data collection.

This cross-sectional analytical study was conducted among health workers from the Karen Department of Health and Welfare (KDHW), an Ethnic Health Organization (EHO) operating on the Myanmar side of the Thai-Myanmar border. The KDHW headquarters is based in Mae Sot, Tak Province, Thailand. However, the study participants were recruited from KDHW-operated clinics located across multiple sites inside Myanmar near the Thai-Myanmar border. The specific clinic locations are not disclosed because of the sensitive security context in the study area. The study population included different categories of KDHW health workers, including Clinic In-Charge, Medics, Maternal and Child Health (MCH) Workers, Community Health Workers (CHWs), and other health-related personnel, such as referral assistants in a few areas.

A list of KDHW health workers who met the study inclusion criteria was requested from the KDHW focal person. To protect the confidentiality of health workers, eligible individuals were represented by unique ID codes, and only the focal person held the information linking the codes to individual identities. The list of eligible identification codes served as the sampling frame. Participants were selected using simple random sampling, and 150 codes were selected for participation. The selected codes were provided to the KDHW focal person, who disseminated the online questionnaire to the corresponding health workers. This procedure enabled random selection of participants while maintaining the confidentiality of individual identities.

Study Instruments, Validity and Reliability Tests

Psychological resilience was measured using the 10-item Connor-Davidson Resilience Scale (CD-RISC-10) (9), a validated instrument assessing adaptation to stress and adversity. Each item uses a five-point Likert scale, with total scores ranging from 0 to 40; higher scores indicate greater resilience. Professional Quality of Life was assessed using the ProQOL, comprising Compassion Satisfaction (CS), Burnout (BO), and Secondary Traumatic Stress (STS) (10). Additional sections assessed socio-demographic characteristics, optimism (11), perceived social support (12), organizational support, professional acknowledgement, and professional training (13).

The questionnaire was assessed for content validity by three experts in relevant fields. The Index of Item-Objective Congruence (IOC) was calculated for each item. Items with IOC values greater than 0.50 were considered acceptable, while items with lower IOC values were revised according to the experts' recommendations.

A pre-test was conducted with 30 EHO health workers to assess the internal consistency of the questionnaire. Cronbach's alpha coefficients were 0.95 for the psychological resilience scale, 0.80 for the ProQOL scale, 0.90 for the social and personal factors section, and 0.90 for the organizational factors section. A Cronbach's alpha coefficient of 0.70 or higher was considered acceptable.

Data Collection

Data were collected between May and June 2026 using an anonymous online self-administered questionnaire developed in Google Forms. Before data collection, advocacy to EHO leaders was conducted to get the approval for data collection. Participation in the survey was voluntary, and electronic informed consent was obtained officially.

Completed questionnaires were stored in a secure password-protected database accessible only to the principal investigator and academic supervisors.

Statistical Analysis

Data was exported from Google Forms to Microsoft Excel for coding and cleaning. Then, this dataset was imported into IBM SPSS Statistics for analysis.

The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Psychological resilience scores were normally distributed ($p > 0.05$) and were summarized using the mean and standard deviation (SD). However, the ProQOL dimensions were not normally distributed ($p < 0.05$) and were summarized using the median and QD. After that, frequencies and percentages for categorical variables were used to summarize participants' characteristics and study variables.

Bivariate analyses were conducted to identify the association of variables. It includes Chi-square tests and crude logistic regression analyses to identify variables potentially associated with psychological resilience. Variables with a p-value ≤0.25 were entered into a multiple logistic regression model to identify independent factors associated with psychological resilience. Adjusted odds ratios (AORs) with 95% confidence intervals were reported. For multivariable analysis, psychological resilience was dichotomized into high and low resilience categories, and multiple logistic regression was performed to identify independent factors associated with high psychological resilience. Statistical significance was set at $p < 0.05$. Finally, the Chi-square tests were performed to justify the associations between Psychological Resilience and each dimension of ProQOL.

RESULTS

Characteristics of Participants

A total of 127 EHO health workers participated in the study. As shown in Table 1, most were female (78.0%), aged >25 years (52.8%), single (65.4%), and had education below a bachelor's degree (78.0%). Regarding socioeconomic characteristics, 63.8% reported monthly income ≤3,300 THB, and 53.5% lived in households with ≤5 members. More than half (54.3%) had >3 years of EHO work experience.

Community health workers were the largest occupational group (26.0%), followed by medics (20.5%), MCH workers (11.8%), and other health-related personnel (41.7%).

Table 1. Socio-demographic and professional characteristics of study participants (n = 127)

Characteristics		n (%)
Sex	Male	28 (22.0)
	Female	99 (78.0)
Age group (years)	≤ 25	60 (47.2)
	> 25	67 (52.8)
Marital status	Single	83 (65.4)
	Married	44 (34.6)
Educational level	Below Bachelor's degree	99 (78.0)
	Bachelor's degree or higher	28 (22.0)
Monthly income (THB)	≤ 3,300	81 (63.8)
	> 3,300	46 (36.2)
Household members	≤ 5	68 (53.5)
	> 5	59 (46.5)
Years of working experience	≤ 3 years	58 (45.7)
	> 3 years	69 (54.3)
Job title	Medic	26 (20.5)
	Community Health Worker (CHW)	33 (26.0)
	Maternal and Child Health (MCH) workers	15 (11.8)
	Others	53 (41.7)

Psychological Resilience and Professional Quality of Life

The levels of psychological resilience and Professional Quality of Life (ProQOL) among EHO health workers are presented in Table 2. Based on CD-RISC-10 scores, 78.0% had low resilience (0-29), while 22.0% had high resilience (30-40). The mean psychological resilience score was 23.36 (SD = 8.275). For ProQOL, 38.6% had high Compassion Satisfaction, 67.7% had high Burnout, and 73.2% had high Secondary Traumatic Stress. Median scores were 11, 8, and 8, respectively.

Table 2. Level of psychological resilience and professional quality of life among EHO health workers (n = 127)

Psychological Resilience		n	%
PS	Low (0-29)	99	78.0
	High (30-40)	28	22.0
	(Mean = 23.36, SD=8.275)		
ProQOL			
CS	Low (≤11)	78	61.4
	High (>11)	49	38.6
	Median = 11, QD = 1.5, Max = 12, Min =5		

Psychological Resilience		n	%
BO	Low (≤6)	41	32.3
	High (>6)	86	67.7
	Median = 8, QD = 1.5, Max = 12, Min =3		
STS	Low (≤6)	34	26.8
	High (>6)	93	73.2
	Median = 8, QD = 1.5, Max = 12, Min =3		

Note: PS = Psychological resilience, CS = Compassion Satisfaction, BO= Burnout, STS=Secondary Traumatic Stress

Factors Associated with Psychological Resilience

Bivariate analyses were initially performed to identify variables associated with psychological resilience. Variables with a p-value of ≤0.25 were subsequently included in the multiple logistic regression model. The results of the final multiple logistic regression analysis are presented in Table 3.

In the final model, optimism, support from significant others, and perceived organizational support were significantly associated with high psychological resilience ($p < 0.05$). Marital status showed a borderline association at the 10% significance level ($p = 0.058$). Health workers who reported stronger support from significant others were significantly more likely to have high psychological resilience than those with lower social support. Similarly, participants with higher perceived organizational support had greater odds of reporting high psychological resilience. In addition, higher optimism was independently associated with high psychological resilience. No other variables remained statistically significant after adjustment in the final model.

Table 3. Results of multiple logistic regression analyses

Variables	Full Model (Step 1)				Final Model (Step 5)			
	AOR	95% C.I. Lower	95% C.I. Upper	P-value	AOR	95% C.I. Lower	95% C.I. Upper	P-value
Marital status								
Single	Reference							
Married	2.243	0.835	6.026	0.109	2.525	0.97	6.571	0.058
Optimism								
Negative	Reference							
Positive	3.451	1.202	9.913	0.021	3.87	1.442	10.388	0.007
Family support								
Low	Reference							
High	0.881	0.221	3.509	0.857				
Friend support								
Low	Reference							
High	2.205	0.609	7.986	0.229				
Others' support								
Low	Reference							
High	2.136	0.538	8.487	0.281	3.027	1.158	7.907	0.024

Variables	Full Model (Step 1)				Final Model (Step 5)			
	AOR	95% C.I. Lower	Upper	P-value	AOR	95% C.I. Lower	Upper	P-value
Professional training								
Low	Reference							
High	1.201	0.375	3.844	0.757				
Perceived organizational support								
Low	Reference							
High	3.099	0.906	10.6	0.071	2.759	1.026	7.422	0.044
Professional acknowledgement								
Low	Reference							
High	0.715	0.212	2.409	0.588				

Association between Psychological Resilience and Professional Quality of Life

The associations between psychological resilience and the three dimensions of Professional Quality of Life (ProQOL) are presented in Table 4. Chi-square analysis showed that psychological resilience was significantly associated with Compassion Satisfaction (χ^2 = 8.671, p = 0.003) and Burnout (χ^2 = 4.170, p = 0.041). Participants with high psychological resilience were more likely to report high Compassion Satisfaction and low Burnout than those with low psychological resilience. However, no statistically significant association was observed between psychological resilience and Secondary Traumatic Stress (χ^2 = 0.938, p = 0.333).

Table 4. Associations between psychological resilience and ProQOL

PS	CS		Chi-square		BO		Chi-square		STS		Chi-square	
	Low	High	X^2	P-value	Low	High	X^2	P-value	Low	High	X^2	P-value
Low	68 (68.7%)	31 (31.3%)	8.671	0.003	27 (27.3%)	72 (72.7%)	4.170	0.041	24 (21.2%)	75 (75.8%)	0.938	0.333
High	10 (35.7%)	18 (64.3%)			14 (50.0%)	14 (50.0%)			10 (35.7%)	18 (64.3%)		

Note: PS = Psychological Resilience, CS = Compassion Satisfaction, BO= Burnout, STS=Secondary Traumatic Stress, χ^2 = chi-square statistic.

DISCUSSION

Principal Findings

This study aimed to examine psychological resilience and its association with Professional Quality of Life (ProQOL) among health workers from Ethnic Health Organizations (EHOs) operating along the Thai-Myanmar border. The findings showed that only 22% of participants had high psychological resilience. It was described that many health workers may have limited capacity to cope effectively with several stresses in conflict-affected settings. Furthermore, the multiple logistic regression analysis showed that optimism, support from significant others, and perceived organizational support are associated with higher psychological resilience. Finally,

psychological resilience was significantly associated with compassion satisfaction and burnout, but not with secondary traumatic stress, as the association with Professional Quality of Life (ProQOL).

Factors Associated with Psychological Resilience

One significant finding of this study is that optimism was significantly associated with higher psychological resilience. Health workers who are with a positive mindset were more likely to have higher resilience. This finding is consistent with resilience theory, and previous studies among healthcare workers and humanitarian personnel have similarly reported that optimism enhances adaptive coping, emotional regulation, and recovery from occupational stress (14, 15).

Support from significant others was significantly associated with higher psychological resilience among health workers. Emotional encouragement, practical assistance, peer support, and opportunities to share stressful experiences may reduce stress and strengthen coping capacity, well-being, and motivation in challenging working environments. The present finding is consistent with previous studies demonstrating the important role of social support in enhancing psychological resilience among health workers (16, 17)

Marital status was also associated with psychological resilience at the p-value ≤ 0.1. Married participants had higher odds of high psychological resilience compared with single participants (AOR = 2.525, 95% CI: 0.970-6.571, p = 0.058).

Perceived organizational support was also positively associated with psychological resilience, which is consistent with previous studies among nurses and healthcare workers (18)

Psychological Resilience and Professional Quality of Life (ProQOL)

Psychological resilience was significantly associated with higher compassion satisfaction and lower burnout, suggesting greater professional fulfillment and a potential protective effect against occupational stress. However, no significant association was found with secondary traumatic stress, which may reflect repeated exposure to traumatic and conflict-related experiences beyond individual resilience.

CONCLUSION

Psychological resilience among EHO health workers was associated with individual and organizational factors, particularly optimism, support from significant others, and perceived organizational support. Psychological resilience was also significantly associated with compassion satisfaction and burnout, but not secondary traumatic stress. These findings highlight the importance of strengthening individual resilience and supportive work environments to promote health worker well-being in conflict-affected settings.

RECOMMENDATIONS

The findings provide key insights for strengthening psychological resilience and improving the Professional Quality of Life of EHO health workers in conflict-affected settings. First, EHOs should strengthen organizational support through supportive supervision, effective communication, staff recognition, fair workload management, and professional development opportunities. Second, social support should be prioritized through peer support, team-based problem-solving, mentoring, and opportunities to share experiences and provide emotional support. Third, resilience-building interventions should promote optimism, adaptive coping, stress management, and regular training on resilience, psychosocial well-being, and self-care. Given the association of resilience with higher compassion satisfaction and lower burnout, staff well-being programmes should be integrated into routine human resource management, addressing physical, mental, social, and financial well-being. Finally, longitudinal and intervention studies are recommended to examine causal relationships

and evaluate organizational and psychosocial interventions for strengthening resilience among health workers in humanitarian and conflict-affected settings.

ETHICAL DECLARATION

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB Approval No. 2026/157.2003) and the Community Ethics Advisory Board (CEAB Reference No. CEAB-2026-013). Participation was voluntary, with informed consent obtained electronically. Data were anonymized, securely stored, and reported in aggregate to protect participants' confidentiality and privacy.

LIMITATIONS

However, several limitations should be considered. First, the cross-sectional design limits the ability to establish the causal relationships between psychological resilience and associated factors. Second, all information was self-reported, which may introduce reporting and social desirability bias. Third, the study was conducted only in one EHO operating along the Thai-Myanmar border. So, the findings may not be generalizable to other health systems. Future longitudinal studies and qualitative studies should be conducted in the future.

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FEAR OF MISSING OUT, SOCIAL COMPARISON, LONELINESS, AND SOCIAL MEDIA CHECKING AMONG MYANMAR MIGRANTS IN THE BANGKOK METROPOLITAN AREA, THAILAND: A PRELIMINARY FINDING

Aung Min Tun[1*], Htet Zaw Shein[1], Wandee Sirichokchatchawan[1]
[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.
****Corresponding Author:** Aung Min Tun, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, E-mail: 6874025353@student.chula.ac.th, dr.agmintun@gmail.com*

ABSTRACT

Introduction: Fear of Missing Out (FoMO), the anxiety that others are having rewarding experiences from which one is absent, is an emerging public health concern linked to psychosocial distress, problematic social media use, sleep problems, and reduced well-being. While it is widely studied among youth and students, little is known about its correlates among migrants. Myanmar migrants in Thailand may experience migration-related circumstances, including separation from family, disruption of social networks, adaptation to a new environment, and reliance on digital communication to maintain transnational relationships. This preliminary study examined psychosocial, demographic, and digital factors associated with FoMO among Myanmar migrants residing in the Bangkok Metropolitan Area (BMA), Thailand.

Methodology: A preliminary cross-sectional study was conducted among 160 Myanmar migrants aged 18–60 years living in the BMA. Participant recruitment was through convenience sampling and snowball sampling among Myanmar migrant community networks and social media platforms. Data were collected via an online self-administered questionnaire. FoMO, loneliness, self-esteem, and social comparison were assessed using validated scales. General characteristics (age, gender, monthly income, duration of stay in the BMA, etc.) and social media usage patterns (daily duration and checking frequency, etc.) were also recorded. Spearman's rank correlation coefficient was used to examine bivariate associations between FoMO and selected psychosocial, demographic, and digital factors ($p < 0.05$), and to visualize the direction and magnitude via a heatmap.

Results: FoMO was positively correlated with social comparison ($\rho = 0.384$, $p < 0.001$), loneliness ($\rho = 0.300$, $p < 0.001$), and daily frequency of checking social media ($\rho = 0.167$, $p = 0.035$). Age was negatively correlated with FoMO ($\rho = -0.244$, $p = 0.002$), indicating higher FoMO among younger participants. No significant associations were observed between FoMO and self-esteem, monthly income, duration of stay in the BMA, or daily duration of social media use.

Conclusion: Social comparison was the strongest correlate of FoMO among Myanmar migrants, followed by loneliness and frequent social media checking. Interventions, such as Burmese-language digital wellbeing education and youth-focused peer-support programs, targeting social comparison and social isolation, may help reduce FoMO. However, causal inference is limited by the cross-sectional design, and online recruitment may have underrepresented migrants with limited digital access; future multivariable and longitudinal studies are needed.

Keywords:
Fear of Missing Out (FoMO); Myanmar Migrants; Social Comparison; Loneliness; Correlation

INTRODUCTION

Background

Fear of Missing Out (FoMO) refers to a persistent worry that others may be having rewarding experiences from which one is absent, accompanied by a desire to remain continuously connected with what others are doing (1). FoMO has emerged as an important public health

concern because it is associated with negative affect, stress, physical symptoms, reduced sleep, greater social media use over time, and more compulsive social media engagement (2-4).

Thailand hosts one of the largest Myanmar migrants in Southeast Asia, with the BMA serving as a major destination for migrant workers and students (5-7). Migration may involve separation from family, disruption of established social networks, economic insecurity, language barriers, and difficulties accessing health services. Previous research among Myanmar migrants in Thailand has documented depression, anxiety, stress, frustration, and panic symptoms, although the experiences and levels of psychological distress vary across migrant groups and settings (8, 9). Broader ASEAN evidence also shows a high prevalence of mental disorders among migrant workers, with pooled estimates of 34.77% for depression and 37.72% for anxiety (10). Similarly, among Myanmar migrants in Thailand, reported problems include depression, anxiety, stress, frustration, and panic symptoms, with contributing factors including social stigma, lack of healthcare access, and economic insecurity (9).

Across Asia, problematic social media use and smartphone overuse have become increasingly common, especially among people in Thailand experiencing social media addiction and FoMO (11). Many Myanmar migrants also reported mental health and behavioral problems associated with social media use, particularly through exposure to violent images, videos, and political news on platforms such as Facebook, Messenger, and Telegram (9, 12). Although these platforms provide important sources of social support for migrants, they may also increase exposure to social comparison and compulsive social media checking, which have been linked to higher FoMO (13-15).

Although FoMO has been widely studied among adolescents and university students, little is known about its psychosocial and digital correlates among Myanmar migrants in Thailand. Understanding these associations may provide preliminary evidence to inform future digital well-being education, migrant mental health services, and culturally appropriate community-based support. Therefore, this study examined associations between FoMO and selected demographic, psychosocial, and digital factors among Myanmar migrants residing in the BMA.

This study is informed by Self-Determination Theory (SDT) and the Interaction of Person–Affect–Cognition–Execution (I-PACE) model, which are widely used to explain the development of FoMO and its relationship with problematic social media use (14, 16, 17). SDT suggests that FoMO develops when individuals experience unmet psychological needs for relatedness, autonomy, and competence (18). The I-PACE model proposes that FoMO mediates the relationship between personal vulnerabilities and affective-cognitive responses. Social Comparison Theory further suggests that social media users evaluate themselves through comparison with others, and repeated exposure to idealized online content may foster upward social comparison that heightens FoMO (19). Guided by these frameworks, this study examined the relationships between FoMO and psychosocial factors and digital factors (14, 20, 21).

METHODOLOGY

Participants

This preliminary cross-sectional study was conducted among Myanmar migrants residing in the Bangkok Metropolitan Area (BMA), Thailand, including Bangkok, Nonthaburi, Pathum Thani, Samut Prakan, Samut Sakhon, and Nakhon Pathom. Eligible participants were Myanmar migrants aged 18–60 years who had lived in the BMA for at least six months and had used social media within the previous 30 days.

Participants were recruited using convenience and snowball sampling because a comprehensive sampling frame of Myanmar migrants in the study area was unavailable. The online survey link was disseminated through Myanmar migrant community networks, Facebook, Messenger, LINE, Telegram,

workplaces, educational institutions, and community organizations. Participants were also invited to share the survey link with eligible individuals in their personal networks. This recruitment approach was intended to reach migrants across different community settings but did not produce a probability-based or population-representative sample.

As no previous studies involving Myanmar migrants have reported an effect size for the proposed regression model, a sensitivity analysis was conducted using G*Power version 3.1.9.7 (22). Assuming $\alpha = 0.05$, power = 0.80, and 12 predictors, a sample size of 386 participants was sufficient to detect a small effect size ($f^2 = 0.046$) (23). At the time of conference abstract submission, recruitment and data collection were ongoing. Therefore, the accepted abstract and this conference proceeding report exploratory bivariate analyses based on the first 160 participants. Multivariable analysis using the complete sample was planned to examine factors independently associated with FoMO while accounting for potential confounding; however, that analysis is outside the scope of this preliminary proceeding.

Measures

Data were collected using an anonymous self-administered online questionnaire developed in Google Forms. Before accessing the questionnaire, participants received an electronic study information sheet and provided informed consent. The questionnaire was translated into Burmese using a forward–backward translation process. Expert review yielded an overall mean Index of Item–Objective Congruence score of 0.90. Pilot testing among Myanmar migrants in Chiang Mai produced Cronbach's alpha coefficients ranging from 0.72 to 0.88 across the study scales.

The questionnaire included general characteristics, digital factors, and psychosocial factors. FoMO was measured using the 10-item FoMO Scale (1), social comparison orientation using the Iowa–Netherlands Comparison Orientation Measure (INCOM) (24), loneliness using the UCLA Three-Item Loneliness Scale (25), and self-esteem using the Rosenberg Self-Esteem Scale (RSES) (26). General characteristics were collected to describe the study population. Among them, age, monthly income, and duration of stay were further examined in the correlation analyses because previous literature suggests that demographic and migration-related characteristics may influence psychosocial well-being and FoMO.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0.2.0. Descriptive statistics summarized participant characteristics. Because several variables were not normally distributed, Spearman's rank correlation coefficient (ρ) was used to examine associations between FoMO and psychosocial factors, selected general characteristics, and social media use. Spearman's rank correlation coefficient was calculated as:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

where:

- ρ= Spearman's rank correlation coefficient,
- d_i= difference between the ranks of the two variables for the *i*th participant,
- n= number of paired observations.

Statistical significance was set at $p < 0.05$. A correlation heatmap was generated to visualize the relationships among study variables.

RESULTS

Table 1 summarizes the categorical characteristics of the participants. Most were aged 18–30 years (76.9%), female (59.4%), single (81.3%), and Buddhist (72.5%). About half identified as Bamar ethnicity (51.2%) and had completed college, university, or vocational education (50.6%). The largest occupational groups were students or unemployed (30.6%) and professional or remote workers (30.0%). Most participants reported a monthly income below 10,000 THB (40.0%), had lived in the BMA for 1–4 years (51.9%), and reported basic Thai

language proficiency (46.3%). Facebook was the primary social media platform (56.3%), and passive social media use was the most common pattern (48.1%).

Table 1 Distribution of categorical variables (N = 160)

Variables	Frequency	Percentage
General Characteristics		
Age Group		
18-30 years	123	76.9
31-45 years	33	20.6
46-60 years	4	2.5
Gender		
Male	65	40.6
Female	95	59.4
Marital status		
Others (Widowed, Separated or Divorced)	6	3.8
Married	24	15.0
Single	130	81.3
Ethnicity		
Others (Kachin, Kayah, Chin, Mon, Rakhine, Shan, etc)	78	48.8
Bamar	82	51.2
Religion		
Others (Christianity, Islam, Hinduism, and No religion)	44	27.5
Buddhism	116	72.5
Level of education		
Below high school	38	23.8
High school	41	25.6
College/University or vocational education	81	50.6
Occupation		
Manual labour	45	28.1
Professional and remote workers	48	30.0
Service & informal employment	18	11.3
Student or unemployed	49	30.6
Monthly income		
Less than 10,000 THB	64	40.0
10,000–14,999 THB	39	24.4
15,000–19,999 THB	32	20.0
20,000 THB or more	25	15.6
Living arrangement		
Living alone	49	30.6
With friends	60	37.5
With family	51	31.9
Duration of stay in the BMA (years)		
Less than 1 year	60	37.5
1–4 years	83	51.9
5–9 years	8	5.0
10 years and over	9	5.6

Variables	Frequency	Percentage
Thai language proficiency		
None	47	29.4
Basic	74	46.3
Conversational and fluent	39	24.4
Digital factors		
Primary social media platform		
Others (Instagram, Youtube, Line, X(twitter), Telegram, Snapchat)	26	16.3
TikTok	44	27.5
Facebook	90	56.3
Mode of social media use		
Passive	77	48.1
Active	27	16.9
Mixed	56	35.0

Table 2 summarizes the descriptive statistics for the continuous variables. Participants had a median age of 27 years (IQR: 22.25–30), a median monthly income of 12,000 THB (IQR: 0–15,000), and a median duration of stay in the BMA of 2 years (IQR: 0.58–2.61). The median scores for social comparison, loneliness, self-esteem, and FoMO were 35, 5, 29, and 18, respectively. Participants reported a median social media use of 5 hours/day and checked social media 13.5 times/day.

Table 2 Distribution of continuous variables (N = 160)

Variables	Median (IQR)	Min-Max	Possible score range
1. General Characteristics			
Age (years)	27 (22.25- 30)	18-56	
Monthly income	12000 (0-15000)	0-110000	
Duration of stay in the BMA(years)	2 (0.58-2.61)	0.5 - 20	
2. Psychosocial factors			
Social Comparison	35 (29-38)	16-50	11 - 55
Loneliness	5 (4-6)	3-9	3-9
Self-esteem	29 (26.25- 32)	19-40	10 - 40
3. Digital factors			
Daily duration of social media use (hours)	5 (3-6.5)	0.05-20	
Daily frequency of checking social media	13.5 (6-30)	1-250	
4. Fear of missing out	18 (14.25-23)	10-38	10-50

As shown in Table 3, Spearman's rank correlation analysis demonstrated that social comparison showed the strongest positive significant association with FoMO, although the magnitude of the association was weak (ρ = 0.384, $p < 0.001$). This was followed by a weak positive significant correlation between loneliness and FoMO (ρ = 0.300, $p < 0.001$). Daily frequency of checking social media showed a very weak positive significant correlation with FoMO (ρ = 0.167, p = 0.035). In contrast, age demonstrated a weak negative significant correlation with FoMO (ρ = −0.244, p = 0.002), indicating that younger participants tended to report higher FoMO. Although statistically significant, these correlations were generally

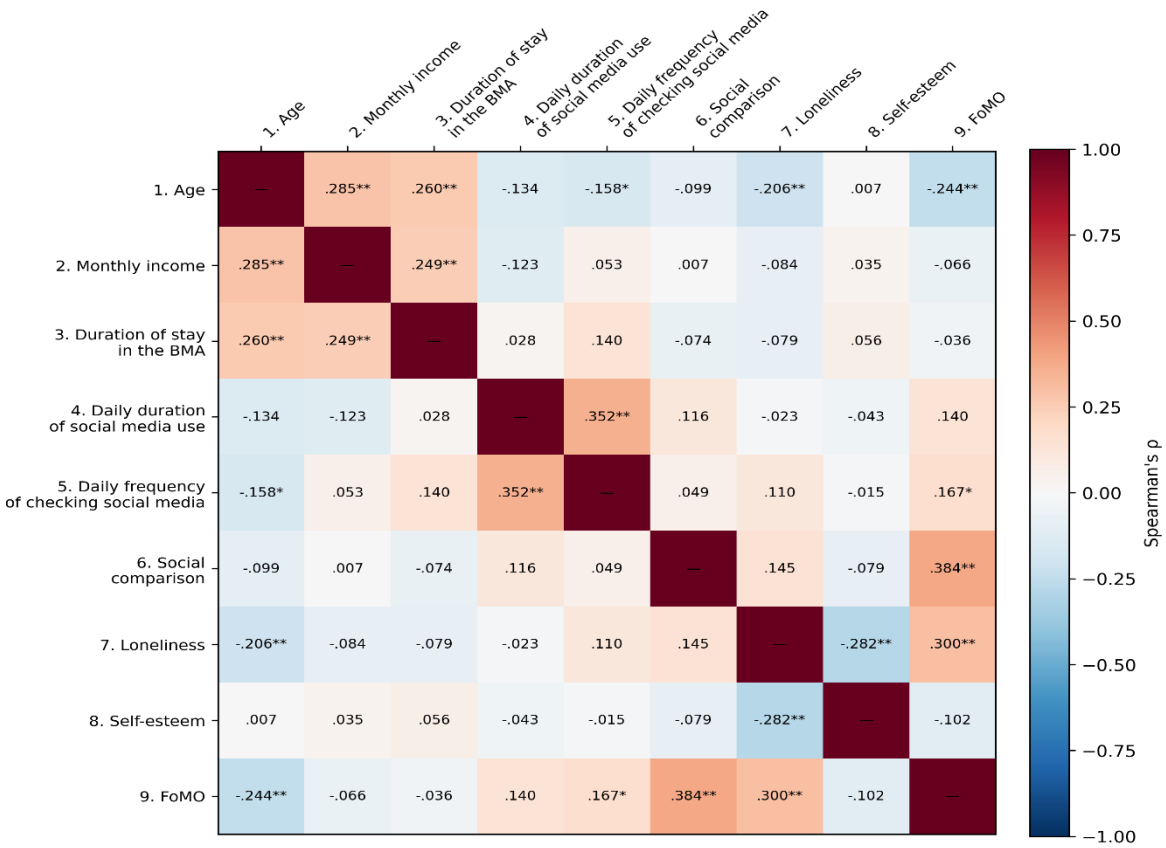
small in magnitude, suggesting that FoMO is associated with multiple psychosocial and behavioral factors rather than any single variable alone. No statistically significant correlations were observed between FoMO and monthly income (p = 0.406), duration of stay in the BMA (p = 0.650), daily duration of social media use (p = 0.078), or self-esteem (p = 0.200).

Table 3 Spearman's rank correlation coefficients (ρ) between FoMO and study variables (N = 160)

Variables	Spearman's ρ	*p*-value
1. Age (years)	-0.244	**0.002***
2. Monthly income	-0.066	0.406
3. Duration of stay in the BMA (years)	-0.036	0.650
4. Daily duration of social media use (hours)	0.140	0.078
5. Daily frequency of checking social media	0.167	**0.035***
6. Social comparison	0.384	**<0.001****
7. Loneliness	0.300	**<0.001****
8. Self-esteem	-0.102	0.200

Spearman's rank correlation coefficients (ρ). **p* <0.05, ***p <0 .001.*

Figure 1 illustrates the correlation matrix among the study variables. Loneliness was negatively associated with self-esteem (ρ = −0.282, p < 0.001), indicating that participants reporting greater loneliness tended to report lower self-esteem. Age was negatively associated with daily frequency of social media checking (ρ = −0.158, p = 0.046), indicating that older participants tended to report slightly less frequent checking. These associations were small and should be interpreted cautiously.



Spearman's rank correlation coefficients (ρ). *p <0.05, **p <0 .001.

Figure 1 Spearman's rank correlation heat map illustrating the relationships between study variables and FoMO

DISCUSSION

This preliminary study examined factors associated with FoMO among Myanmar migrants living in the BMA. Findings are based on the first 160 participants recruited during an ongoing study, and they should be interpreted as exploratory and hypothesis-generating rather than as definitive estimates or evidence of causal relationships. The correlations were limited in magnitude, and the analysis did not adjust for potential confounding.

Younger age was associated with higher FoMO scores, which is consistent with previous studies reporting lower FoMO among older age groups (27, 28). One possible explanation is that younger adults may engage more frequently with social networking platforms and may place greater importance on peer interaction, social inclusion, and online feedback. Younger Myanmar migrants may also use social media to connect with family and friends, follow events in Myanmar, and develop social networks in Thailand. These explanations are plausible interpretations based on previous literature, but the present study did not directly measure motives for social media use or age-specific migration experiences.

Monthly income and duration of stay in the BMA were not statistically associated with FoMO. Monthly income was examined because socioeconomic circumstances may be related to psychological well-being, access to digital resources, and patterns of online engagement, and some previous studies have reported associations between income and FoMO (29). Duration of residence was examined because post-migration experiences and social integration may change over time and have been associated with migrant mental health outcomes (30, 31). Nevertheless, the absence of statistically significant correlations in this sample should not be interpreted as evidence that socioeconomic or

migration-related circumstances are unimportant. The limited sample size, restricted distributions, unmeasured confounding, and use of bivariate analysis may have affected the findings.

Social comparison orientation showed the largest significant association with FoMO. This finding is consistent with Social Comparison Theory and previous studies identifying social comparison as a correlate of FoMO (32, 33). Individuals who frequently compare themselves with others may be more attentive to information suggesting that other people are participating in rewarding social, educational, occupational, or family experiences. Among Myanmar migrants, social media may provide updates about family and friends in Myanmar as well as information about peers with different employment opportunities, migration pathways, or living conditions. Exposure to such information may be associated with concerns about being excluded or missing valued experiences. However, it is also possible that individuals with higher FoMO engage more frequently in social comparison, as the study was cross-sectional.

Loneliness was positively associated with FoMO, consistent with previous research linking loneliness with greater FoMO and problematic social media use (34). Migration may involve separation from family, disruption of social networks, language barriers, adaptation to unfamiliar environments, and limited opportunities for social participation (35, 36). Under these circumstances, migrants may rely on social media to maintain transnational relationships and obtain emotional or informational support (37). At the same time, repeated exposure to other people's online activities may be associated with increased awareness of social events or relationships from which an individual feels absent (33, 38). These factors provide a plausible migrant-specific interpretation of the observed association. Nevertheless, the study did not include a non-migrant comparison group and therefore cannot conclude that Myanmar migrants experience greater loneliness or social comparison than other populations.

Self-esteem was not statistically associated with FoMO in this preliminary analysis. Although previous studies have reported an inverse association between self-esteem and FoMO, other evidence suggests that self-esteem may be related to FoMO indirectly through variables such as social comparison orientation or loneliness (39, 40). The absence of a significant bivariate association in the present sample may also reflect limited statistical power, restricted variability, cultural differences in scale interpretation, or confounding by other psychosocial factors. Multivariable and mediation analyses would be required to investigate these possibilities.

A modest, significant positive association was observed between FoMO and the frequency of daily social media checking, whereas total time spent on social media was not. Prior literature describes FoMO as a state of persistent concern about missing rewarding social experiences that motivate individuals to continually monitor social media for updates (41, 42). This interpretation is supported by evidence that FoMO predicts platform use frequency and compulsive social media use across different platforms (43, 44), while problematic smartphone use has been linked to FoMO but not to screen time (45). Together, these findings suggest that FoMO may be linked to a compulsive behavioral loop, in which anxiety about missing out is associated with repeated social media checking, while repeated checking may reinforce dependence on social media (46, 47).

The findings may inform future digital well-being research and intervention development for Myanmar migrants. Culturally appropriate programs could promote healthy social media use, reduce maladaptive social comparison and frequent checking behaviors, and strengthen offline social connectedness through migrant organizations, workplaces, educational institutions, and community-based organizations. However, the present findings do not establish that these approaches would

reduce FoMO and should be evaluated in future intervention studies.

CONCLUSION

This preliminary study found that FoMO among Myanmar migrants in the BMA was associated with social comparison orientation, loneliness, frequent social media checking, and younger age, although all statistically significant associations were limited in magnitude. Self-esteem, monthly income, duration of stay, and daily duration of social media use were not statistically associated with FoMO. These findings identify candidate psychosocial and digital factors for further investigation when developing culturally appropriate digital well-being and migrant mental health initiatives. They should not be interpreted as evidence that these factors cause FoMO or that modifying them will necessarily reduce FoMO. Future studies should use probability-based or more diverse recruitment strategies, adequately powered multivariable analysis, longitudinal designs, and intervention evaluations.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University (COA No. 176/69). Electronic informed consent was obtained from all participants before participation. Participation was voluntary, and all survey responses were anonymous and confidential.

LIMITATIONS

This study is among the first to examine FoMO among Myanmar migrants in Thailand. It considered demographic, psychosocial, and digital factors using established instruments that underwent Burmese translation, expert content review, and pilot reliability testing. The findings provide preliminary evidence to inform future research on migrant digital well-being.

Several limitations should be considered. First, the cross-sectional design cannot establish causal relationships. Second, this proceeding reports exploratory bivariate analyses of the first 160 participants, so potential confounding was not controlled and categorical demographic variables were not examined inferentially. Third, online convenience and snowball sampling may have introduced selection bias and limited representativeness by underrepresenting migrants with limited internet access, lower digital or Burmese literacy, or weaker community networks. Fourth, self-reported measures may be affected by recall and social desirability bias. Finally, migration status, work conditions, reasons for social media use, and online content exposure) were not assessed.

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SPATIAL EDUCATIONAL GRADIENTS, EDUCATIONAL MIGRATION AND ADOLESCENT MENTAL HEALTH: PRELIMINARY FINDINGS AND A CONCEPTUAL RESEARCH PROTOCOL FROM CHINA'S SICHUAN–CHONGQING BORDER REGION

Zanyun Huang*
Cuiying Honors College, Lanzhou University, Lanzhou, China
***Corresponding author:** Zanyun Huang, Cuiying Honors College, Lanzhou University, Lanzhou, China.*
Email: hzanyun2023@lzu.edu.cn

ABSTRACT

Introduction: Spatial inequalities in educational opportunity represent an important yet underexplored determinant of adolescent mental health. The Sichuan–Chongqing border region provides a distinctive setting: neighbouring communities share similar cultural backgrounds but differ in educational resources, admission systems, and access to metropolitan Chongqing, offering insights that may inform other border and migration-related contexts.

Objectives: To report preliminary evidence of a spatial educational migration gradient and develop a conceptual research protocol linking origin-place educational conditions, educational migration experiences and adolescent psychological distress.

Methodology: A pilot mixed-methods study was conducted in four towns along the Eastern Sichuan Ridge–Valley corridor. Questionnaires from 210 graduates or family members in the 2020–2025 cohorts retrospectively recorded origin, senior-secondary school location, and educational destination. Seventeen interviews with students and parents explored educational choices, perceived inequalities, belonging and future expectations. Descriptive analyses compared migration and destination patterns, while interviews identified recurring psychosocial themes. Spatial patterns, qualitative themes and contextual evidence were integrated abductively to develop the Spatial Educational Gradient Index (SEGI), the four-category Educational Migration Status (EMS) framework, and three proposed mediators. The protocol positions SEGI as an origin-place exposure, EMS as a descriptive classification, and the mediators as parallel pathways to psychological distress measured by the ten-item Kessler Psychological Distress Scale (K10).

Results: The pilot findings suggest three preliminary patterns: 1.) A clear north–south gradient in migration towards metropolitan Chongqing was observed, with high-school attendance there rising across the four towns (6.0%, 16.3%, 20.3%, 29.3%), 2.) More complex trajectories than a simple stayers–migrants dichotomy, including return migrants and constrained aspirants, 3.) Three recurring psychosocial processes: perceived educational disadvantage, disruption of belonging, and uncertainty about future prospects.

These observations informed a protocol centred on SEGI as the primary contextual exposure, a four-category EMS framework for heterogeneous trajectories, and three parallel psychosocial mediators—Perceived Educational Disadvantage, Belonging Disruption and Future Life Uncertainty—linking educational conditions to distress.

Conclusion: Educational migration appears embedded in a spatial combination of educational push and mobility constraint. SEGI, EMS and the proposed mediators offer a testable framework for investigating spatial educational gradients as a contextual determinant of adolescent mental health.

Keywords:
Spatial Educational Gradients; Educational Migration; Adolescent Mental Health; Psychological Distress; Health Geography.

INTRODUCTION

Adolescent mental health is shaped by individual circumstances and the social organisation of place. Educational opportunities influence academic pressure, peer relationships, mobility expectations and confidence in the future, yet are organised through administrative systems, regional development, transport and policy. Neighbouring communities may therefore offer markedly different prospects. (1-6)

Educational migration is one family response to these inequalities. In China, children may attend school outside their home county or province for stronger teaching or more favourable routes to higher education. Beyond household resources, competition and registration restrictions, migration should be understood within a wider geographical opportunity structure. Adolescents may migrate, remain, return or be unable to realise an intention to migrate, with potentially different mental-health experiences. (7-10)

Spatial educational gradient describes geographical differences in educational resources, admission systems, accessibility and elite university opportunities. It is a regional structural pattern, distinct from individual migration decisions, distress or a numerical index. (3,4)

The Sichuan–Chongqing border region provides a useful quasi-natural setting. Before Chongqing became a centrally administered municipality in 1997, the two areas formed one provincial system and retained closely related histories, language and culture. Administrative separation subsequently produced differences in educational governance, resources and higher-education admission. A north–south corridor in the Eastern Sichuan Ridge–Valley Region connects several Sichuan counties to metropolitan Chongqing, creating progressive variation in proximity with limited cultural discontinuity. (7,8)

This paper reports an exploratory mixed-methods pilot and develops a protocol comprising SEGI, four-category EMS and three potential psychosocial mediators.

METHODOLOGY

Pilot study design and participants

A pilot study was conducted in summer 2025 in the western corridor of the Eastern Sichuan Ridge–Valley Region. The quantitative component surveyed students and families from four towns arranged north to south: Miaoba and Oujia in Dazhu County, followed by Ganzi and Guanyinqiao in Linshui County. It retrospectively recorded secondary-school location and postsecondary destination for graduates from the 2020–2025 cohorts. Of the 223 questionnaires collected, 210 met the eligibility and data-completeness requirements and were included in the analysis. Eligibility required that the student concerned had lived in the study region since primary school or earlier. Seventeen semi-structured interviews involved students and parents with different mobility experiences. The exploratory study aimed to identify patterned mobility and generate concepts, not to test mental-health pathways or causal effects.

Pilot analysis and framework development

Descriptive analyses summarised senior secondary school location by town of origin and postsecondary destination by school location, using counts and within-group percentages. Interviews explored educational choices, perceived inequalities, belonging and future expectations and identified recurring psychosocial themes. Spatial patterns, qualitative themes and contextual evidence were integrated abductively to develop the proposed SEGI, EMS and psychosocial framework. These analyses were exploratory and did not test mental-health pathways or causal effects.

RESULTS

Preliminary findings

Educational migration towards Chongqing increased along the corridor (Table 1). Metropolitan Chongqing attendance rose from 6.0% in Miaoba to 16.3% in Oujia, 20.3% in Ganzi and 29.3% in Guanyinqiao, while retention within the origin county fell from 77.6% to 46.3%. This spatial outflow pattern should not be read as a

gradient in psychological distress. Together with the interviews, it suggested that places nearer Chongqing could lose more students because metropolitan schools were easier to reach, while direct comparison could heighten perceived inequality. More distant places could show lower outflow because transport and institutional barriers blocked migration. Observed migration therefore reflects both incentives and constraints; low migration may indicate blocked mobility rather than weak structural strain. This tension became a theoretical basis for SEGI.

Table 1 Senior secondary school location by town of origin

Town of origin (north to south)	n	High school in metropolitan Chongqing, n (%)	Retained within origin county, n (%)
Miaoba	67	4 (6.0)	52 (77.6)
Oujia	43	7 (16.3)	30 (69.8)
Ganzi	59	12 (20.3)	41 (69.5)
Guanyinqiao	41	12 (29.3)	19 (46.3)
Total	210	35 (16.7)	142 (67.6)

Note: Retention within the origin county is the sum of township and county-seat high school attendance.

Other destinations are omitted from this condensed table. The observed migration proportion is an outcome of both incentives and constraints and is not used as a proxy for SEGI or psychological distress.

Postsecondary destinations also differed by school location (Table 2). Elite or overseas university entry was 68.6% among students educated in metropolitan Chongqing, compared with 18.1% in county-seat schools and 6.8% in township schools; no bachelor's-degree entry occurred among 8.6%, 34.9% and 64.4%, respectively. This ordered contrast is descriptive and unadjusted. Students entering Chongqing schools may already have differed in achievement, family resources, aspirations, or networks, so migration cannot be interpreted as causal. (9)

Table 2 Postsecondary destination by senior secondary school location

Senior secondary school location	n	Elite or overseas university, n (%)	No bachelor's-degree entry, n (%)
Township within origin county	59	4 (6.8)	38 (64.4)
County seat within origin county	83	15 (18.1)	29 (34.9)
Home prefecture-level city centre	12	5 (41.7)	3 (25.0)
Metropolitan Chongqing	35	24 (68.6)	3 (8.6)
Chengdu or Mianyang	6	3 (50.0)	1 (16.7)
Other locations	15	1 (6.7)	9 (60.0)
Total	210	52 (24.8)	83 (39.5)

Note: Elite university refers to a nationally highly selective university. 'No bachelor's-degree entry' denotes entry into junior college or employment rather than a bachelor's-degree programme. Percentages are within school-location categories; results are descriptive and unadjusted.

Interviews helped explain why migration propensity could not be equated with distress. Participants nearer Chongqing could compare educational systems directly and described stronger awareness of unequal resources, admission rules and university opportunities.

Those farther away often faced greater practical barriers despite lower visible outflow. These accounts informed Perceived Educational Disadvantage (PED). Migrants also described difficulty entering established peer networks and detachment from hometown relationships, while some stayers felt excluded as classmates left; these experiences informed Belonging Disruption (BD). Students and parents linked school location to employment, independence and social mobility, generating Future Life Uncertainty (FLU): doubt that present effort would lead to a stable and desired future. (5,6)

Because the interviews were not designed to validate psychological constructs, these themes are concept-generating. Together, the pilot suggests that the gradient appears in mobility and destinations; migration rate alone cannot measure a predicament that may both encourage and obstruct departure; and PED, BD and FLU are plausible psychological expressions requiring prospective testing.

Conceptual research protocol

Drawing on the preliminary findings reported above, together with relevant literature and contextual evidence, we developed the following conceptual research protocol. It constitutes a concept-generating output of the pilot investigation; the proposed index, migration classification and psychosocial pathways remain to be empirically validated.

From the Spatial Educational Gradient to the Spatial Educational Gradient Index

The Spatial Educational Gradient Index (SEGI) is a proposed composite origin-place measure of the structural strain generated by geographically unequal educational conditions. It quantifies the conditions underlying the regional gradient rather than individual migration or subjective distress. (3,4)

SEGI is intended to represent education-related structural strain: the extent to which an origin place makes education elsewhere appear necessary while making that movement difficult to realise. It therefore combines two forces. Migration-promoting factors include limited local educational resources and weaker access to elite higher-education opportunities. Migration-constraining factors include administrative discontinuities and poor accessibility to metropolitan Chongqing. A high SEGI score represents a place where the pressure to seek education elsewhere is strong but the practical or institutional capacity to do so is restricted. This formulation explains why observed outflow need not increase linearly with SEGI: high migration may reflect strong incentives with relatively low barriers, whereas low migration may reflect severe constraints. (7-10)

Four domains are proposed. The Educational Resource Gradient may include teacher qualifications, student–teacher ratios, expenditure per student and the diversity of recognised admission pathways. The Elite Higher-Education Opportunity Gradient may represent geographical differences in access to highly selective universities, admission opportunities and the proportion entering high-quality bachelor's programmes. These two domains primarily capture forces promoting migration. The Administrative Boundary Gradient may capture differences in school eligibility, registration requirements, curricular governance and higher-education admission between Sichuan and Chongqing. The Mobility and Accessibility Gradient may include travel time, transport cost, direct transport availability and other practical barriers; greater accessibility should be reverse-coded. These latter domains primarily capture forces obstructing migration.

Indicators should be selected for conceptual relevance, comparability and data availability, then standardised so that higher values consistently indicate greater structural strain. Domain scores can be calculated by averaging their component indicators, followed initially by an equal-weighted average of the four domains. Equal weighting is transparent for an early-stage index, although sensitivity analyses should compare alternative specifications and examine the two force dimensions separately. SEGI should be linked to the student's origin

township or urban subdistrict rather than current school, allowing within-county variation in school provision, institutional position and metropolitan accessibility to be represented.

SEGI measures contextual conditions, PED their subjective interpretation, and K10 non-specific psychological distress. Adolescents sharing an origin-place score may differ in perceptions and distress through family resources, achievement, expectations or support. Validation should assess indicator coverage, weighting, geographical stability and associations with external educational and mental-health outcomes. (2-5)

Educational Migration Status

EMS replaces a migrant–non-migrant dichotomy with four mutually exclusive categories. Stayers continue within their county of origin or neighbouring local system. Migrants move from the Sichuan border region to metropolitan Chongqing primarily for education. Return Migrants previously studied in Chongqing but later returned to the local system. Constrained Aspirants express a strong intention to study in Chongqing but remain locally because of academic, financial, family, administrative, or other barriers.

EMS describes an adolescent's observed position within the migration process; it is neither a structural exposure nor a necessary mediator. Its purpose is to make heterogeneous experiences visible. Migrants may gain educational resources but lose belonging; return migrants may experience interrupted trajectories; constrained aspirants may perceive particularly severe restrictions; and stayers may experience either continuity or involuntary immobility. These possibilities should be tested rather than assumed. (6,9,10)

Psychosocial mechanisms and outcome

Three parallel mechanisms are proposed. PED is the perception that geographical origin, administrative jurisdiction or unequal regional provision restricts access to desirable education. BD is the weakening or instability of connections with school, peers, community or place of origin; it may affect both movers and those left behind. FLU is uncertainty about whether educational choices and personal effort will lead to employment, independence, social mobility, and a desired life. The constructs are conceptually distinct but may be correlated. (1,2,5,6)

Psychological distress would be measured using the ten-item Kessler Psychological Distress Scale (K10), producing a score from 10 to 50, with higher scores indicating greater non-specific distress. (11,12) The basic framework is: SEGI → PED, BD and FLU → K10, while retaining a direct SEGI–K10 path. Because an initial survey is likely to be cross-sectional, mediation language must remain cautious. Indirect associations may be consistent with the proposed mechanisms but cannot establish temporal or causal transmission. (13)

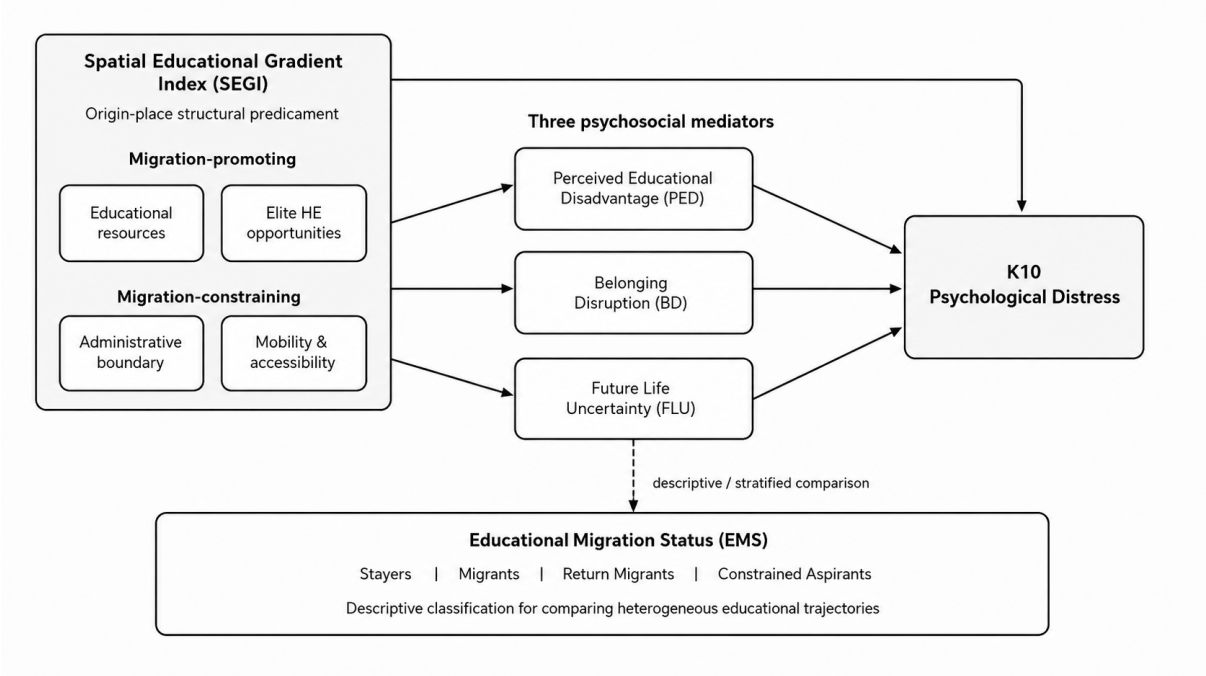

Figure 1 Proposed conceptual framework linking SEGI, EMS, the three psychosocial mediators and K10 psychological distress.

Spatial Educational Gradient Index (SEGI)

A multidimensional contextual exposure framework that quantifies geographically structured educational opportunity environments at the county level.

Conceptualisation

- Quantifies geographically structured educational opportunity environments at the county level.
- Treats educational opportunities as contextual characteristics embedded in geographical space.
- Integrates administrative systems, educational resources, transportation accessibility, and elite higher-education opportunities.
- Higher SEGI values indicate stronger spatial educational gradients and greater structural educational eisadvantage relative to metropolitan Chongqing.

1. Administrative Boundary Gradient (AG)

Institutional separation generated by administrative boundaries.

Indicators

- **AG1:** Boundary crossings to metropolitan Chongqing

$$= 1 \times N_{\text{county}} + 2 \times N_{\text{provincial}}$$

county boundary = 1 point; provincial-level boundary = 2 points.

- **AG2:** Undergraduate admission rate gap (%) between local county and metropolitan Chongqing.

2. Educational Resource Gradient (RG)

Inequalities in educational resources.

Indicators

- **RG1:** Teacher Qualification Index (TQI)

$$\text{TQI} = \text{P(master-only)} + 2 \times \text{P(doctoral)}$$

P(master-only) = proportion of teachers whose highest qualification is a master's degree;
P(doctoral) = proportion of teachers holding a doctoral degree.
This specification prevents teachers with doctoral degrees from being counted twice.

- **RG2:** Student–teacher ratio.
- **RG3:** Educational expenditure per student.
- **RG4:** Educational Pathway Diversity Index (EPDI)

Five mutually exclusive final admission pathways

1. the conventional National College Entrance Examination
2. academic competition-based admission
3. overseas higher education
4. foreign-language recommendation admission
5. elite sports or arts admission

The proportions assigned to the five pathways sum to 1.

$$\text{EPDI} = -\left[\sum_{i=1}^{5} p_i \times \ln(p_i)\right] / \ln(5)$$

p_i represents the proportion of students entering higher education through pathway i.

Values approaching 1 indicate greater pathway diversity, whereas values approaching 0 indicate concentration in a single pathway.

$$\text{RG4} = 1 - \text{EPDI}$$

This ensures higher SEGI values indicate greater educational disadvantage.

3. Accessibility Gradient (AC)

Temporal, financial and service-related barriers to travelling to metropolitan Chongqing.

$$\text{GTC}_m = C_m + \lambda \times T_m$$

C_m = one-way monetary cost; T_m = one-way travel time (hours); λ = monetary value of one hour.

Indicators

- **AC1:** Car generalised travel cost.
- **AC2:** Coach generalised travel cost.
- **AC3:** Railway generalised travel cost.
- **AC4:** Daily coach frequency.
- **AC5:** Railway accessibility.

direct high-speed rail	= 0
direct conventional rail only	= 0.5
no direct rail	= 1

- **AC6:** Daily railway frequency.

Only direct coach and railway services between 06:00 and 23:00 are counted.

4. Elite Higher-Education Opportunity Gradient (OG)

Inequalities in access to elite universities.

Indicators

- **OG1:** Double First-Class university admission rate.
- **OG2:** Project 211 university admission rate.
- **OG3:** Project 985 university admission rate.

Represents county-level opportunities for admission to China's highest-tier universities.

Indicators → Domain scores → Standardisation / harmonisation → Overall county-level SEGI score

Higher SEGI = greater structural educational disadvantage.

Figure 2 Proposed domains and indicator structure of the Spatial Educational Gradient Index (SEGI).

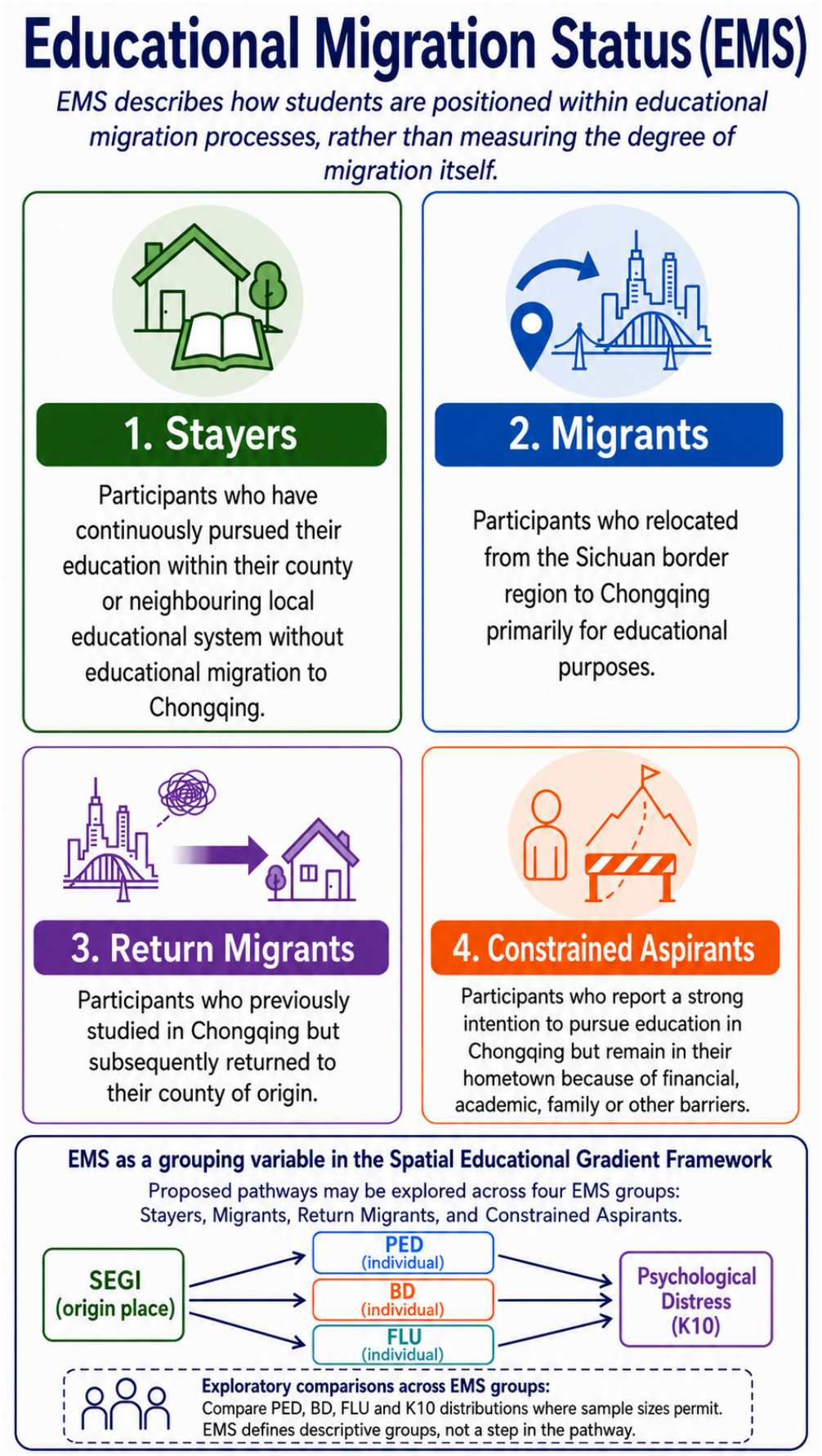

Figure 3 Four-category Educational Migration Status (EMS) framework.

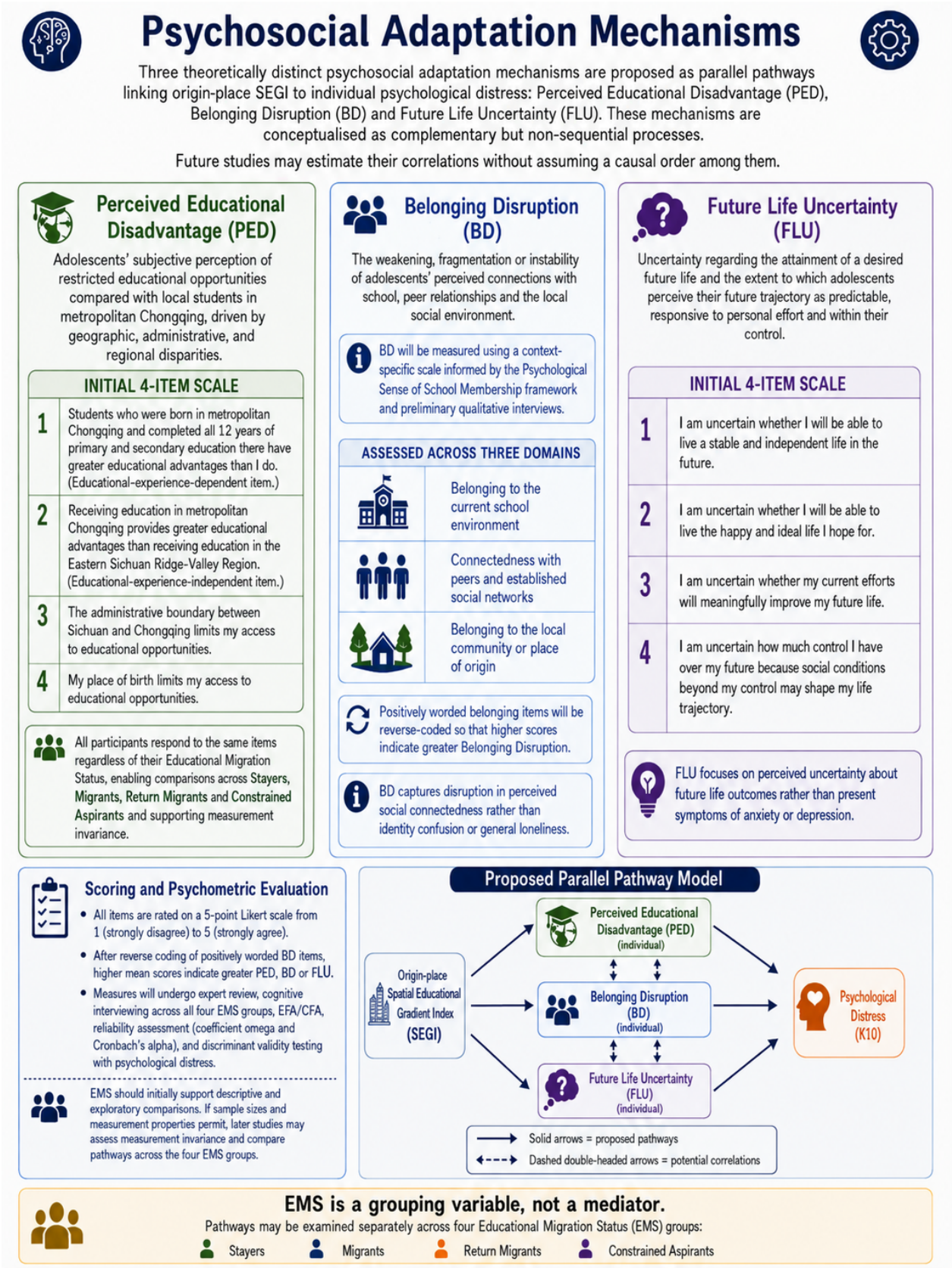

Figure 4 Conceptual definitions and preliminary measurement design for PED, BD and FLU as parallel psychosocial mediators of psychological distress.

Participants, measures and analysis

A subsequent questionnaire study could recruit adolescents from schools in selected Sichuan border counties and Chongqing schools enrolling students from those areas. Recruitment at origins and destinations would improve coverage of the four EMS groups. The questionnaire should record origin, present and previous schools, migration intentions and barriers; PED, BD and FLU items; K10; and limited covariates such as age, sex, parental education, household income and living arrangements. SEGI data may come from statistical yearbooks, education reports, school records, transport schedules and admission information.

Scale development should begin with expert review and cognitive interviews across EMS groups. Internal consistency and factor structure can then be assessed if sample size permits. Analyses should summarise SEGI, psychosocial scores and K10; estimate theory-led multivariable associations; and use bootstrap confidence intervals for simultaneous indirect associations. Covariate selection should remain limited and conceptually justified.

EMS should initially be analysed descriptively and exploratorily rather than embedded in an unnecessarily complex multigroup model. Adjusted means or distributions of PED, BD, FLU and K10 can be compared across Stayers, Migrants, Return Migrants and Constrained Aspirants. Where group sizes permit, stratified associations may be shown. This staged approach first asks whether the proposed concepts can be measured coherently and whether predicted relationships are observable.

If data cover enough geographical and institutional clusters, later extensions may include geographic mapping, spatial autocorrelation, multilevel regression or multilevel structural equation modelling. Longitudinal follow-up would be the strongest extension because it could determine whether changes in educational context precede changes in psychosocial adaptation and distress. These methods should be driven by the data structure rather than added solely for technical sophistication. (13)

Future data collection requires ethical approval, consent, and guardian consent for minors where applicable. Because K10 may identify substantial distress, referral and support procedures are necessary. Geographical privacy also requires care because combinations of origin, migration history and school may identify participants in small communities.

DISCUSSION

The pilot findings and protocol support a conceptual shift from educational migration to the spatial distribution of educational opportunity. Table 1 identified a geographical gradient in student outflow, but the interviews showed why this gradient cannot be read as a direct gradient in psychological distress. Proximity to Chongqing may facilitate migration and heighten comparison with metropolitan opportunities; distance may reduce observed migration by intensifying transport and institutional constraints. Table 2, meanwhile, showed an ordered descriptive association between school location and entry into elite or overseas universities, or conversely failure to enter a bachelor's-degree programme. Together, these findings support the existence of a spatial educational gradient while demonstrating the need for an index that combines the forces encouraging migration with those preventing it.

This distinction clarifies the roles of the study's principal concepts. The spatial educational gradient is the observed regional pattern in administrative systems, resources, mobility and elite higher-education opportunity. SEGI is the proposed numerical representation of the structural predicament produced by that pattern. EMS captures how an individual is positioned within the migration process, while PED, BD and FLU specify plausible ways in which structural conditions become psychologically meaningful. Migration is therefore neither the principal exposure nor a direct proxy for distress; it is one possible outcome of the interaction

between educational aspiration and mobility constraint.

Its principal contribution is integrative. Conventional school-quality measures often ignore administrative boundaries and mobility barriers, while migration studies may treat a low outflow rate as an absence of aspiration or disadvantage. The proposed framework instead separates the observable spatial gradient from its composite structural index, and combines contextual conditions, mobility heterogeneity and psychosocial adaptation within a single design. If future studies support the framework, policy responses may need to address both sides of the predicament: reducing the pressure created by weak local educational provision and reducing avoidable barriers to mobility, while supporting social integration and mental health among migrants, stayers, returnees and constrained aspirants. (3,4,9,10)

Implications for research on youth mental health in other border and cross-border settings

The distinction between a spatial educational gradient and SEGI offers a transferable framework for studying youth mental health in border settings. Borders affect adolescents not only through conflict or displacement, but also through less visible discontinuities in governance, school resources, qualification recognition, mobility and access to higher education. Researchers can map how these conditions vary across space and construct locally adapted SEGI measures that effectively capture the tension between pressures to seek opportunities elsewhere and the barriers that prevent young people from doing so.

This perspective also cautions against treating mobility rates as direct indicators of disadvantage. High mobility may reflect pronounced opportunity gaps but relatively permeable borders, whereas low mobility may indicate that aspirations are constrained by documentation requirements, transport costs, security restrictions or institutional exclusion. EMS, together with PED, BD and FLU, can therefore help examine how movement, immobility and blocked aspiration shape adolescents' perceptions of inequality, belonging and future possibility. (3,4,6-8,10)

These concepts require cultural adaptation and local validation. Nevertheless, their broader ethical implication is clear: administrative borders may organise governance, but they should not become barriers to the shared right to health. Young people should not be made to suffer for inequalities produced by lines they did not draw.

CONCLUSION

The pilot identified spatial differences in educational migration and postsecondary destinations across the Sichuan–Chongqing border corridor. These findings informed a framework distinguishing contextual educational conditions (SEGI), migration trajectories (EMS), and three proposed psychosocial pathways (PED, BD and FLU). Observed migration reflects both incentives and constraints and should not be treated as a proxy for psychological distress. The framework requires prospective empirical validation.

RECOMMENDATIONS

Future research should validate SEGI and the proposed psychosocial measures. Potential policy applications should address local educational provision, avoidable mobility barriers and social integration, subject to further evidence.

ETHICAL DECLARATION

The pilot investigation originated as an undergraduate course-based fieldwork assignment at Lanzhou University in summer 2025. Formal research ethics approval or an exemption determination was not obtained for the original activity. The questionnaire introduction explained the investigation's purpose, specified that responses would be used for academic research, and stated that personal information would be kept confidential. Respondents interested in follow-up interviews

could voluntarily provide contact details. The questionnaire described the interview format and expected duration, and further information was provided when arranging participation.

All students represented in the analysed questionnaire data were aged 18 years or older at the time of data collection, and all student interview participants were adults at the time of interview. Quantitative findings are presented in aggregate form, and no personally identifying information is disclosed in this manuscript. The pilot questionnaire addressed educational experiences, choices, and opportunities. The proposed future study involving K10 psychological distress assessment will undergo institutional ethics review before recruitment and data collection.

LIMITATIONS

The pilot provides empirical motivation, not definitive evidence. Its sample was small and non-probability-based, outcomes were retrospective, and contrasts were unadjusted for selection into metropolitan schools. Interviews were not designed to validate the constructs, and no migration–distress association was tested. SEGI remains a working index whose domains, directionality and weighting require evaluation. The framework is a testable research programme, not a confirmed causal model. (9,13)

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During the revision of this manuscript, I was encouraged to learn that residence permit mutual recognition with Chongqing had been extended to additional areas in Sichuan, expanding coverage in and around the Eastern Sichuan Ridge–Valley Region. (14) This development resonates with the protocol's emphasis on reducing administrative barriers to mobility and strengthens my hope for more equitable access to educational opportunities in my home region.

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THE ASSOCIATION BETWEEN WEEKLY EXERCISE, ALLERGIC RHINITIS SYMPTOM FREQUENCY, AND SLEEP DEPRIVATION AMONG SECONDARY SCHOOL STUDENTS

Pen-eck Phattharawimoltham1*, Yossawin Pintavirooj1, Pobpech Naowaddee1, Punnapat Jiratravonkul1, Chayawat Siripantasak1

1 Srinakharinwirot University Prasarnmit Demonstration School (secondary), 176 Soi Sukhumvit 23, Khlong Toei Nuea, Watthana, Bangkok 10110

**** Corresponding Author**: Pen-eck Phattharawimoltham,*
Srinakharinwirot University Prasarnmit Demonstration School (Secondary), Bangkok 10110, Email: peneckpath8@gmail.com

ABSTRACT

Introduction: Sleep deprivation is a significant public health hazard linked to diabetes, hypertension, and obesity, with adolescents especially vulnerable during this critical developmental period. Weekly exercise and allergic rhinitis symptoms have each been associated with sleep deprivation, but prior studies have largely examined them separately, leaving their combined association in adolescents unexamined. This study addresses that gap.

Objective: This cross-sectional study aimed to 1) describe weekly exercise, allergic rhinitis symptom frequency, and sleep deprivation among secondary school students, 2) analyze the relationship among weekly exercise, allergic rhinitis symptom frequency, and sleep deprivation among secondary school students, and 3) examine the association between weekly exercise and frequency of allergic rhinitis symptoms with sleep deprivation

Methodology: This study was conducted in Bangkok, Thailand, in March 2026. A sample of 110 secondary school students from grades 7 to 12 was recruited through purposive sampling and completed self-administered Google Forms questionnaires distributed via social media channels, consisting of a sleep deprivation scale, an allergic rhinitis symptoms frequency scale, and a weekly exercise measure. Reliability was assessed using Cronbach's alpha coefficient, yielding values of .81 for the sleep deprivation scale and .85 for the allergic rhinitis symptoms frequency scale. Data were analyzed using descriptive statistics, Pearson's correlation coefficient, and multiple regression analysis.

Results: The results were as follows. Weekly exercise was at an inadequate level (M = 2.09, SD = 1.10), AR symptom frequency was intermittent (M = 2.75, SD = 0.96), and sleep deprivation was mild (M = 3.04, SD = 0.86). AR symptom frequency was significantly and positively associated with sleep deprivation ($p < .05$), while weekly exercise showed no significant association. Together, the two variables explained 7% of the variance in sleep deprivation, with AR symptom frequency emerging as the only significant predictor.

Conclusion: These findings suggest that screening and management of allergic rhinitis symptoms in school health programs could serve as a practical strategy for reducing sleep deprivation among secondary school students. From a public health perspective, addressing this factor at the school level could inform more effective interventions and policies aimed at safeguarding adolescent well-being and preventing long-term chronic disease burdens.

Keywords:
Sleep Deprivation, Allergic Rhinitis, Weekly Exercise

INTRODUCTION

Sleep deprivation is one of the most recognized health concerns from a public health perspective, with potentially far-reaching consequences. A cross-sectional study of senior high school students in Thailand shows that 56.24% have poor sleep quality (1); this shows sleep deprivation is a common problem among

Thai adolescents. This is also partly caused by adolescents' natural tendency that leads to fall asleep later than usual, which conflicts with early school schedule studies, which lead to many students experiencing sleep deprivation (2). According to the American Academy of Sleep Medicine and Sleep Research Society, adults require a minimum of seven hours of sleep to sustain stable health (3). Adequate sleep is essential for maintaining the well-being of various human system functions, such as memory consolidation, emotional stability, and metabolic regulation. Having sleep deprivation or inadequate sleep duration could likely lead to the development of hypertension, diabetes, and obesity (4). This statistic indicates that sleep deprivation is a systemic threat to the majority of secondary schools worldwide.

Among the physical factors implicated in adolescent sleep disruption, AR is one of the most consistently identified factors. AR is a chronic inflammatory condition that affects the nasal mucosa, stimulated by allergen exposure, and the symptoms of AR are rhinorrhea, sneezing, and persistent congestion (5). A meta-analysis of 27 studies shows that over 240 million patients confirm that AR has significantly increased their sleep deprivation and increased sleep latency compared to the control group (4). These studies proved a positive correlation between nasal symptom severity and sleep deprivation in approximately 250 thousand shift workers (6). This shows that AR may increase sleep deprivation through inflammatory factors.

On the other hand, physical activity has gained attention as a behavior that may solve sleep deprivation problems. A meta-analysis shows evidence that cycling and walking have significantly lowered adolescents' sleep deprivation (7). These findings were also supported by a meta-analysis of 22 randomized controlled trials. The evidence shows that doing Mind-Body (Yoga) and regular physical activity could decrease sleep deprivation issues (8). However, an analysis of 7 million nights shows that doing vigorous exercise within 4 hours of bedtime could disrupt sleep quality (9). Meanwhile, some adolescent athletes have significantly increased sleep deprivation due to overtraining compared to other well-being athletes (10). Taken all together, this all indicates that physical activity could have a positive correlation with sleep quality if managed correctly in time and dose. If not properly controlled, it may increase sleep deprivation.

Based on the concepts mentioned above, it can be observed that AR and weekly exercise appear to shape sleep deprivation through distinct but potentially associated pathways. The independent burden of AR on sleep is substantial: 73.5% of AR patients have been reported to have a concurrent sleep disorder, with insomnia identified as the most prevalent (11); AR patients have been found to be nearly three times more likely to suffer from sleep deprivation relative to non-AR individuals (12). At the same time, the sleep-protective effect of exercise has been documented in recent literature (7). Raises the possibility that adequate physical activity may change how strongly AR symptoms affect sleep deprivation. In other words, doing weekly exercise might reduce the effect of AR on sleep, while less weekly exercise might leave this effect unchanged or make it even stronger. However, this relationship has limited research. In populations where both variables are simultaneously present, such as secondary school students who carry a high prevalence of atopic conditions while also facing competing pressures on time available for physical activity, the combined influence of these two factors on sleep deprivation warrants systematic investigation.

Findings from studies on weekly exercise and AR suggest that these factors may be related to sleep deprivation, although the current evidence is still limited, and further research is needed. Much of the existing work has examined these factors separately or in different populations. For example, Bin Eid et al. (13) compared sleep deprivation between adolescents in Saudi Arabia and the UK. However, their focus

was on sleep itself rather than on weekly exercise or AR as predictors. Similarly, Yan et al. (7) and Leota et al. (9) explored the relationship between exercise and sleep deprivation but did not include AR alongside exercise in their analyses. In contrast, Liu et al. (4) investigated the link between AR and sleep deprivation without considering weekly exercise as a related factor. This has shown that most of the experiments have examined these factors separately or in different populations. Differences in study populations also make direct comparisons difficult, as some samples focused on adults (6) rather than adolescents. Taken together, while these studies provide useful background, few have examined weekly exercise and AR within the same group, and most of the research did not examine these factors' relationship to sleep deprivation together.

Crucially, research on this factor remains limited to date, despite its widespread impact on global public health. Therefore, we investigated weekly physical activity levels alongside the frequency of AR symptoms as joint predictors of sleep deprivation within the same cohort of high school students. This study aims to bridge this gap by using validated scales to examine both the independent and combined effects of these two factors on sleep deprivation. Ultimately, these findings may provide valuable insights for managing insufficient sleep, which remains a chronic societal challenge for public health. The objectives in this research are to describe weekly exercise, AR symptom frequency, and sleep deprivation among secondary school students, to analyze the relationship between weekly exercise and AR symptom frequency with sleep deprivation among secondary school students, and to examine the effects of weekly exercise and AR symptom frequency on sleep deprivation among secondary school students.

METHODOLOGY

Study Design

This research uses a cross-sectional design to study the relationship between various variables by collecting data over the same period. This allowed for a comprehensive overview of the relationship between sleep deprivation, AR, and weekly exercise.

Study Setting

This research was conducted at Prasarnmit Demonstration School (Secondary), located in the Watthana District of Bangkok, Thailand (176 Soi Sukhumvit 23, 10110) in March 2026, identifying the school environment and students' daily social media usage as an appropriate context for investigating the relationship between sleep deprivation, weekly exercise, and AR.

Study Population and Study Sample

This section lacks detailed information in several parts, including the study area (specific schools at the district/province level in Thailand), sampling technique, inclusion and exclusion criteria, and participant recruitment.

The research population comprised secondary school students aged 13-18 years, currently enrolled in grades 7-12 at Srinakharinwirot University Prasarnmit Demonstration School (Secondary) in Bangkok, Thailand. Purposive sampling was implemented to select this specific cohort, as they were capable of providing detailed information on adolescent sleep behavior within a school environment. This target group selection ensured that the sample was representative of secondary school students, with eligibility criteria requiring participants to be currently studying in grades 7 to 12 and aged between 13 and 18 years. The final research sample consisted of 110 participants obtained through purposive sampling questionnaires via Google Forms, which were distributed through both social media channels and a field survey conducted among secondary school students throughout the school. The minimum required sample size was determined to be 65 participants, calculated using Soper's (14) statistical analysis based on the following parameters: an effect size Cohen's f^2 of 0.25

derived from Liu et al. (4), a significance level of .05, a statistical power of 0.95, and 2 independent variables.

Data Collection

Data were collected using self-administered questionnaires, with informed consent obtained prior to the completion of each questionnaire. These included a sleep deprivation scale, weekly exercise, and frequency of AR symptoms.

Instrument

The research instruments used in this study included a sleep deprivation scale, a weekly exercise scale, and a scale measuring the frequency of AR symptom manifestations. The details are as follows.

Sleep deprivation was assessed using an eight-item instrument covering three dimensions: insufficient sleep duration, disturbed sleep, and circadian misalignment. The duration and disturbance items were translated and adapted from the Pittsburgh Sleep Quality Index developed by Buysse et al. (15). The two circadian items were adapted from the Bedtime Procrastination Scale (16). Example items are "I often wake up in the middle of the night" and "I get less than 7 hours of actual sleep per night". The PSQI's mixed open-ended and four-point frequency format was replaced by a uniform five-point Likert agreement scale, and PSQI items on sleeping medication, breathing difficulty, snoring, pain, and bad dreams were excluded as they fall outside the three dimensions defined here. Results: The reliability analysis indicated good internal consistency, with a Cronbach's alpha coefficient of .81. Furthermore, construct validity testing demonstrated that the measurement instrument exhibited satisfactory construct validity (X^2/df = .871, p = .615, *RMSEA* = .000, *SRMR* = .037).

Weekly exercise was assessed using a four-item instrument capturing both the frequency and intensity of exercise in the usual week. It was translated and adapted from the short form of the International Physical Activity Questionnaire (IPAQ) (17). Respondents were instructed to count only exercise sessions lasting at least 30 minutes. Example items are "I do vigorous exercise, such as running, serious swimming, competitive sports, or weightlifting, during which I breathe hard and sweat a great deal" and "I do moderate exercise, such as brisk walking or cycling, during which I breathe slightly faster, but I can still talk". Each item was rated on a five-point frequency scale (1 = never, 2 = 1-2 times per week, 3 = 3-4 times per week, 4 = 5-6 times per week and 5 = 7 or more times), which was converted to the midpoint number of weekly sessions (0, 1.5, 3.5, 5.5, and 7, respectively). To account for intensity, each session was weighted by the metabolic equivalent of task (MET) value assigned to the corresponding IPAQ short-form activity category: 3.3 for the general activity item, 2.5 for light activity, 4.0 for moderate activity, and 8.0 for vigorous activity. The weighted values were then summed and divided by 24.92, so the final score ranges from 0 to 5. Results: The reliability analysis indicated acceptable internal consistency, with a Cronbach's alpha coefficient of .67. Furthermore, construct validity testing demonstrated that the measurement instrument exhibited satisfactory construct validity (X^2/df = .903, p = .439, *RMSEA* = .000, *SRMR* = .030).

AR symptom frequency was assessed using a four-item instrument, capturing how often each cardinal nasal symptom occurred during the past week. It was translated and adapted from the Rhinitis Control Assessment Test developed by Schatz et al. (18). Three modifications were made: the original six items were reduced to four, retaining only the nasal symptom items and excluding ocular, sleep-interference, activity avoidance, and global-control items, because the construct of interest was symptom frequency rather than overall symptom control. The scoring direction was also reversed so that higher scores indicate more frequent symptoms (1 = never to 5 = always). Example items are "I often have a blocked nose during the day" and "I often have a clear runny

nose when I do not have a cold". Results: The reliability analysis indicated good internal consistency, with a Cronbach's alpha coefficient of .85. Furthermore, construct validity testing demonstrated that the measurement instrument exhibited satisfactory construct validity (X^2/df = .835, p = .351, *RMSEA* = .000, *SRMR* = .010).

Data analysis

Data analysis, which was performed using R version 4.5.3 and RStudio, is presented according to the following aspects.

1) Weekly exercise, frequency of AR, and sleep deprivation were described using descriptive statistics, namely mean and standard deviation. The criteria for interpreting each level are presented in Table 1-3.

Table 1 Criteria for weekly exercise (adapted from World Health Organization (19)

Variables	Level
Less than 2.25	Inadequate
2.25 - 5.00	Adequate

This criterion was adapted from the World Health Organization's (19) physical activity guideline for children and adolescents aged 5 - 17 years, as applied in the Thai context by Katewongsa et al. (20). The guideline recommends at least 60 minutes of moderate- to vigorous-intensity physical activity daily, which equals 420 minutes per week. Because respondents counted only sessions lasting at least 30 minutes, this corresponds to 14 sessions per week. Using a MET value of 4.0 for moderate activity (17), the benchmark equals 14 × 4 = 56 MET × session × week. Dividing by 24.92 places the benchmark at 2.25 on the 0 to 5 index used in this study, and scores of 2.25 or above were classified as adequate.

Table 2 Criteria for AR symptoms frequency (adapted from Meltzer et al. (21)

Variables	Level
1.00 - 2.49	Intermittent
2.50 - 5.00	Persistent

The criterion was adapted from Meltzer et al. (21), which established a cut point of RCAT to be ≤ 21 for inadequate control. The scale used in this study was reversed, so that higher scores indicate more frequent symptoms. The cut point was therefore mirrored by subtracting 21 from the sum of the maximum and minimum possible RCAT score (30 + 6 = 36), giving ≥ 15. Because the present scale contains four items with a range of 4 to 20, proportional rescaling places the equivalent cut point at ≥ 10. Dividing by the number of items gave a mean item score of 2.50.

Table 3 Criteria for Sleep deprivation (adapted from Morin et al. (22)

Variables	Level
1.00 - 2.13	None or minimal
2.14 - 3.13	Mild
3.14 - 4.13	Moderate
4.14 - 5.00	Severe

This criterion was adapted from Morin et al. (22), who used the Insomnia Severity Index (ISI) to evaluate insomnia severity. The ISI consists of seven items rated on a five-point scale from 0 to 4, where higher scores indicate greater severity, giving a possible total of 0 to 28. Morin et al. (22) classified respondents into four levels: 0 - 7, 8 - 14, 15 - 21, and 22 - 28. The scale used in this study consists of eight items rated from 1 to 5 in the same direction, giving a possible total of 8 to 40. Each boundary of the original criteria was rescaled proportionally to this range and then divided by the number of items to obtain the equivalent mean item score, using the formula: mean item score = 1 + (ISI score ÷ 28) × 4. Because no established severity bands exist for sleep deprivation, the ISI bands were adopted as the closest available reference.

2) Relationship among weekly exercise, frequency of AR symptoms, and sleep deprivation was analyzed using Pearson's correlation coefficient, based on the interpretation criteria presented in Table 4.

Table 4 Criteria for interpreting the size of the correlation coefficient (23)

Variables	Level
.00 - .09	Negligible correlation
.10 - .39	Weak correlation
.40 - .69	Moderate correlation
.70 - .89	Strong correlation
.90 - 1.00	Very strong correlation

3)The independent associations of weekly exercise and allergic rhinitis symptoms frequency with sleep deprivation were examined using multiple linear regression analysis.

RESULTS

The demographic background of the sample used in this study is presented in Table 5.

Table 5 Demographic characteristics

Demographic characteristics of sample	%
Education Level	
(Ages: *M* = 16.59, *SD* = 1.03)	
Higher secondary school level	96.36
Lower secondary school level	3.64
Gender	
Female	55.5
Male	45.5
Currently on antihistamine therapy	
Yes	27.27
No	72.73

Considering Table 5, most of the samples were higher secondary school students, accounting for 96.36%, with a mean age of 16.59 years (*M* = 16.59, *SD* = 1.03). In terms of gender, more than half of the samples were female, accounting for 55.5%. Moreover, the majority were not currently on antihistamine therapy, accounting for 72.73%. Additionally, most

students participated in at least one type of sport, representing 93.64% of the samples.

The results of the study on sleep deprivation and related factors among secondary school students are presented in Table 6.

Table 6 Descriptive statistics for describing sleep deprivation and related factors

Variable	*M*	*SD*	Level
Weekly exercise	2.09	1.10	Inadequate
AR symptoms frequency	2.75	0.96	Persistent
Sleep deprivation	3.04	0.86	Mild

Considering Table 6, weekly exercise was at an inadequate level (M = 2.09, SD = 1.10), AR symptoms frequency was at a persistent level (M = 2.75, SD = 0.96), and sleep deprivation was at a mild level (M = 3.04, SD = 0.86).

The assumptions for multiple linear regression were examined before the analysis.

Linearity was supported by an insignificant Harvey-Collier test (*HC* (106) = 0.67, p = .504) with observations ordered by fitted values, and an insignificant Rainbow test (*Rain* (55,52) = 0.70, p = .904). Moreover, normality was evaluated using the Kolmogorov–Smirnov test, which demonstrated that the residuals did not significantly deviate from a normal distribution (D = .08, p = .134). Furthermore, homoscedasticity was supported by an insignificant Breusch–Pagan test (*BP* (2) = 1.53, p = .464), and an insignificant Goldfeld–Quandt test (*GQ* (41,41) = 1.24, p = .464), indicating constant variance of the residuals. Additionally, independence of observations was ensured by design, as each participant completed the questionnaire once, supported by the Durbin-Watson test (*DW* = 1.94, p = 814), which indicated no autocorrelation in the residuals. Lastly, Multicollinearity was not a concern, with variance inflation factors (VIF) of 1.00 for both independent variables, indicating no evidence of multicollinearity. Overall, the results indicated that the data met the assumptions for multiple linear regression analysis.

The results of the study on the relationship between sleep deprivation and related factors in secondary school students are presented in Table 7.

Table 7 Relationships between sleep deprivation and related factors

Variable	*r*	*p*
Weekly exercise	.12	.231
AR symptoms frequency	.22	.019*

*p < .05

Considering Table 7, weekly exercise had a statistically insignificant positive correlation with sleep deprivation at the .05 level (r = .12, p = .231). However, AR symptom frequency has a statistically significant positive correlation with sleep deprivation at the .05 level (r = .22, p = .019).

The results of the analysis of the influence of related factors on sleep deprivation among secondary school students are presented in Table 8.

Table 8 Multiple linear regression for studying influence of factors on sleep deprivation

Variables	*B*	*SE*	*Beta*	*t*	*p*
Weekly exercise	0.10	0.07	0.13	1.38	.171
AR symptoms frequency	0.21	0.08	0.23	2.45	.015*
R^2 = .07, $R^2_{Adjusted}$ = .05, F (2,107) = 3.834, p = .025					

*p < .05

Considering Table 8, weekly exercise and AR explained 7% of the variance in sleep deprivation, which was statistically significant at the .05 level. When controlling for other factors, it revealed that AR symptom frequency had a statistically significant positive influence on sleep deprivation at the .05 level (*Beta* = 0.23, p = .015), whereas weekly exercise had a statistically insignificant positive influence on sleep deprivation at the .05 level (*Beta* = 0.13, p = .171).

DISCUSSION

This study examined the effects of weekly exercise and AR symptom frequency on sleep deprivation among secondary school students. Weekly exercise was inadequate, AR symptom frequency was persistent, and sleep deprivation was mild. AR symptom frequency had a significant positive association with sleep deprivation, whereas weekly exercise had an insignificant positive association, together explaining only 7% of the variance.

The positive relationship between AR symptom frequency and sleep deprivation found in this study seems to match what earlier research has reported, as well as a common explanation for why this might happen. The result fits with studies suggesting that people with AR may sleep worse (4), and with research showing a connection between worse nasal symptoms and sleep problems in teenagers (24). It may also be related to findings that many people with AR report sleep problems, especially trouble sleeping, which tends to be worse when symptoms are more severe (11). Moreover, people with AR seem to be somewhat more likely to report poor sleep than those without it (12). One common explanation is that a blocked nose from AR may make it harder for air to pass through, which could disturb sleep and sometimes lead to problems such as sleep apnea (25). This may explain the significant association between AR symptom frequency and sleep deprivation.

The insignificant relationship between weekly exercise and sleep deprivation requires careful interpretation, as it may reflect the specific aspects of exercise that the present measure was designed to capture. Although several studies have found that regular exercise is linked to better sleep in teenagers (7,26), this benefit may depend on the timing and intensity of exercise. For instance, intense exercise in the evening has been said to occasionally worsen sleep quality instead of improving it (9), and adolescent athletes have shown increased sleep deprivation due to overtraining (10). This means that the positive and negative effects of exercise might cancel each other out, which may explain the insignificant association between weekly exercise and sleep deprivation.

The mild level of sleep deprivation found in this study also deserves closer attention. Although the mean score fell within the mild range (M = 3.04, SD = 0.86), this value was close to the upper boundary of the mild category (2.14–3.13) and bordered on the moderate range, suggesting that sleep deprivation in this sample, while classified as mild on average, may not be negligible. In addition, most participants (72.73%) were not currently receiving antihistamine therapy for AR, which may be worth noting given the significant association found between AR symptom frequency and sleep deprivation in this study.

Another point worth discussing is the imbalance between higher and lower secondary

school students in this sample, with higher secondary students accounting for 96.36% of participants and lower secondary students for only 3.64%. Because the sample consisted overwhelmingly of higher secondary school students, the associations found in this study may be more reflective of this group, and this imbalance limits how confidently the findings can be generalized across the full grades 7–12 range that the study intended to represent.

Beyond this, the study has a few other limitations that should be considered. Although the sample size of 110 met the minimum number required by the a priori power analysis, it is still relatively modest, which may have limited the ability to detect weaker associations. The use of purposive sampling and recruitment through social media may have also introduced some selection bias, since only students who saw and chose to respond to the questionnaire were included. Lastly, because this study used a cross-sectional design, it is not possible to determine the direction of these relationships or draw causal conclusions from the results. Future studies with larger and more balanced samples across school levels, along with longitudinal designs, would help confirm and extend these findings.

CONCLUSION

This study examined the effects of weekly exercise and AR symptom frequency on sleep deprivation among secondary school students. The findings showed that AR symptom frequency had a significant positive influence on sleep deprivation, while weekly exercise had only an insignificant positive influence. These results suggest that AR is a more consistent and meaningful contributor to sleep deprivation among adolescents than weekly exercise, at least as measured in this study. These findings carry important implications for adolescent health. They indicate that managing AR symptoms may be a practical and accessible strategy for reducing sleep deprivation among secondary school students, particularly given that AR often goes unrecognized or untreated in this population. In contrast, the limited influence of weekly exercise suggests that simply increasing physical activity frequency may not be sufficient to improve sleep outcomes, and that other aspects of exercise behavior, such as timing and intensity, may need to be considered. Overall, this study highlights AR management as a promising entry point for school-based interventions aimed at safeguarding adolescent sleep health and preventing associated long-term chronic diseases, such as hypertension and obesity, while improving adolescent well-being.

RECOMMENDATION

Given that AR symptom frequency was found to be a significant predictor of sleep deprivation in this study, schools should consider implementing routine AR symptom screening as part of existing school health programs to enable early identification and timely referral to healthcare professionals (11). Since the majority of students in this study were not currently on antihistamine therapy, raising awareness among students, parents, and school staff about the impact of unmanaged AR symptom frequency on sleep quality could serve as a practical and accessible first step toward reducing sleep deprivation in this population (12).

Future research should leverage the significant association between AR symptom frequency and sleep deprivation identified in this study by developing school-based AR screening and sleep promotion programs through a research and development (R&D) approach, with the ultimate goal of producing practical, scalable innovations such as screening toolkits or school health guidelines that can be systematically implemented across school settings. For weekly exercise, which showed an insignificant relationship in this study, in-depth qualitative research should be conducted to explore students' exercise behaviors, particularly the timing, intensity, and personal barriers that frequency-based measures alone cannot capture. Together, advancing both lines of inquiry is expected to contribute meaningfully to

addressing sleep deprivation as a broader public health challenge among adolescents in the future.

ETHICAL DECLARATION

This study did not obtain formal approval from an institutional ethics review board. However, informed consent was obtained directly from each adolescent participant prior to completing the questionnaire, and participation was entirely voluntary. Students who did not provide consent were not included in the study, and their responses were excluded from data collection and analysis. All data were collected anonymously through self-administered Google Forms, and no personally identifiable information was gathered from participants.

LIMITATIONS

Several limitations of this study should be noted. Given its cross-sectional design, the study cannot determine causality or the direction of the relationships between weekly exercise, AR symptom frequency, and sleep deprivation. The sample size of 110, while sufficient according to the a priori power analysis, remained relatively small, and reliance on purposive sampling and recruitment through social media may have introduced selection bias, as only students with access to and engagement on these platforms were reached. The sample was also disproportionately composed of higher secondary school students (96.36%), with lower secondary students comprising only 3.64% of participants; this imbalance restricts the extent to which the findings can be generalized across the full grades 7–12 range that the study aimed to represent. Finally, all variables in this study were assessed through self-report questionnaires rather than objective measurement tools, a method inherently susceptible to recall and social desirability bias. Future research incorporating larger and more demographically balanced samples, alongside objective measurement tools and longitudinal designs, would help clarify and extend the associations identified in this study.

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THE EFFECTS OF SOCIAL INFLUENCE, SELF-REGULATION, SEDENTARY BEHAVIOR, AND ESCAPISM ON FEAR OF MISSING OUT (FOMO) AMONG SECONDARY SCHOOL AND UNIVERSITY STUDENTS

Nataorn Thamasanong[1], Kornchanok Oranmatee[1], Pattharanan Sae-ngoy[1], Chuttanun Mitmuang[1]*, Chayawat Siripantasak[2]

[1] Student of Srinakharinwirot University Prasarnmit Demonstration School (Secondary)

[2] Teacher of Srinakharinwirot University Prasarnmit Demonstration School (Secondary)

****Corresponding Author:** Chuttanun Mitmuang,*

Srinakharinwirot University Prasarnmit Demonstration School (Secondary), Bangkok, Thailand, Email:chuttanunm@gmail.com

ABSTRACT

Introduction: Fear of Missing Out (FoMO) is one of the factors associated with various mental health problems such as obsessive-compulsive disorder, narcissistic personality disorder, and depression. Several studies have suggested that social influence, self-regulation, sedentary behavior, and escapism behavior may be associated with FoMO. However, research examining the combined effects of these factors remains limited, as previous research has investigated each factor independently. Accordingly, examining factors that influence FoMO may provide a basis for developing interventions to prevent mental health problems among secondary school and university students.

Objective: The objectives of this research were to 1) describe social influence, self-regulation, sedentary behavior, and escapism. 2) analyze relationships between social influence, self-regulation, sedentary behavior, and escapism with FoMO, and 3) analyze the effects of social influence, self-regulation, sedentary behavior, and escapism on FoMO among secondary school and university students.

Methodology: The sample consisted of 108 participants, including 88 secondary school students aged 12–19 years and 20 university students aged 20–23 years. The total sample size exceeded the minimum requirement of 86 participants for multiple regression analysis (1), which was calculated based on an effect size of $f^2 = 0.15$ (22), a significance level of .05, a statistical power of .85, and three independent variables. The research instruments included the FoMO Scale, Social Influence Scale, Sedentary Behavior Scale, Self-Regulation Scale, and Escapism Scale, with Cronbach's alpha coefficients indicating acceptable reliability and construct validity. Data were analyzed using descriptive statistics and multiple regression analysis to address the research objectives, with the level of statistical significance set at .05.

Results: The results were as follows. 1) Mean of Social influence, self-regulation, sedentary behavior, and escapism were 3.62, 3.08, 3.60, and 2.97, respectively. 2) Social influence, self-regulation, sedentary behavior, and escapism had significantly positive correlations with FoMO at the .05 level. 3) 40% of the variance in FoMO was explained by social influence, self-regulation, sedentary behavior, and escapism. Social influence, self-regulation, sedentary behavior, and escapism had significantly positive influences on FoMO at the .05 level. Among these predictors, sedentary behavior had the strongest influence on FoMO.

Conclusion: Sedentary behavior was found to have the strongest influence on FoMO. Relevant organizations and individuals, including schools, parents, healthcare professionals, and media producers, may use these findings to develop public health interventions aimed at helping secondary school and university students monitor, manage, and reduce sedentary behavior. Such interventions may focus on promoting healthier daily routines through various approaches, including encouraging physical activity, raising awareness of balanced social media use, and developing technological

innovations or media that support healthier online behaviors. In the long term, these may help reduce FoMO and support better mental health, further contributing to the prevention of future mental health problems among secondary school and university students.

Keywords:
Social Influence; Self-regulation; Sedentary Behavior; Escapism; Fear of Missing Out (FoMO)

INTRODUCTION

Fear of Missing Out (FoMO) has become an increasingly common issue with the widespread use of social media. FoMO refers to a persistent feeling of anxiety or discomfort caused by the belief that one may miss valuable opportunities or enjoyable experiences that others are having (2). Individuals with FoMO often believe that other people are engaging in more rewarding activities, receiving valuable information, or having experiences that they themselves do not have. Seeing regular updates on social media makes these experiences more visible and encourages people to stay informed about others' activities. As a result, many individuals frequently check social media to remain connected and avoid missing important information or events (2). Previous studies have also reported that FoMO is associated with several mental health problems, including obsessive-compulsive disorder, narcissistic traits, and depression (3). Therefore, understanding FoMO and its related factors is important, as it may contribute to the development of effective interventions to address FoMO while promoting mental well-being and preventing mental health problems.

Understanding the factors associated with FoMO may provide useful insights for preventing mental health problems among secondary school and university students. Social influence is one factor that may affect FoMO. Social influence refers to changes in an individual's thoughts, emotions, attitudes, or behaviors resulting from interactions with other people (4). Social influence develops through relationships within families, peer groups, organizations, and the broader social environment (5). Through these relationships, individuals may influence one another's decisions and behaviors. However, the effects of social influence may vary depending on each person's social relationships and personal characteristics (6). For this reason, previous research has suggested that social influence may increase the likelihood of experiencing FoMO (7).

Self-regulation has also been identified as a factor associated with FoMO. Self-regulation is defined as an individual's ability to monitor, control, and adjust thoughts, emotions, and behaviors in order to achieve personal goals (8-9). It also includes the ability to maintain self-control, persist in goal-directed behavior, and modify one's behavior when facing challenges or obstacles (9). Individuals with stronger self-regulation are generally better able to manage their emotions and behaviors, including their use of social media. As a result, they may be less likely to experience FoMO (10)

Sedentary behavior has also been linked to FoMO. It refers to waking activities that require very low energy expenditure, typically between 1.0 and 1.5 metabolic equivalents (METs) (11). Such activities include sitting, slow walking, reading, and writing (12). People who spend long periods engaging in sedentary behavior often spend more time using digital devices and social media (13). Frequent exposure to other people's activities through online platforms may increase the feeling of missing important experiences or events, which can eventually lead to higher levels of FoMO (14).

Escapism has also been suggested as a factor associated with FoMO. Escapism refers to the tendency to avoid real-life problems or stress by shifting attention away from reality (15). One

common way of escaping from reality is through the use of social media and other online activities (16). Spending excessive time in virtual environments may reduce individuals' awareness of their real-life responsibilities and negatively affect their relationships with others (17). Consequently, previous studies have found a positive relationship between escapism and FoMO (18).

Although these factors have been examined in previous research, studies investigating their combined effects on FoMO remain limited. (19) reported that social influence increases concerns about missing information and social participation. (7) found that self-regulation helps reduce uncontrolled social media use. (20) suggested that prolonged sedentary behavior may encourage greater use of online media, while (18) explained that excessive social media use as a form of escapism may increase dependence on social media and eventually lead to higher levels of FoMO. However, most previous studies have investigated these factors separately. As a result, the combined effects of social influence, self-regulation, sedentary behavior, and escapism on FoMO have not yet been clearly explained.

Based on the existing literature, further research is needed to examine the relationships among social influence, self-regulation, sedentary behavior, escapism, and FoMO, particularly among secondary school and university students. These groups spend a considerable amount of time using social media and may be more vulnerable to social and psychological influences. Therefore, this study aims to investigate the effects of social influence, self-regulation, sedentary behavior, and escapism on FoMO among secondary school and university students. It is expected that the findings of this study will improve understanding of the psychological and behavioral factors associated with FoMO and provide useful evidence for promoting mental well-being, encouraging healthier social media use, and preventing mental health problems among young people. Furthermore, this study supports Sustainable Development Goal (SDG) 3, which aims to ensure healthy lives and promote well-being for people of all ages (21). This research aims to describe social influence, self-regulation, sedentary behavior, and escapism, analyze relationships between social influence, self-regulation, sedentary behavior, and escapism with FoMO, and to analyze the effects of social influence, self-regulation, sedentary behavior, and escapism on FoMO among secondary school and university students.

Conceptual Framework

Based on the review of the relevant literature, social influence, self-regulation, sedentary behavior, and escapism have all been identified as factors related to FoMO. Social influence from people around an individual and from social media may increase the need for social acceptance and participation, leading to concerns about missing important information or experiences (2). At the same time, individuals with lower levels of self-regulation may have greater difficulty controlling their social media use, which can result in more frequent use (10). In addition, sedentary behavior and escapism may further encourage individuals to continuously engage in observing other people's activities online, increasing the likelihood of experiencing FoMO (23-24). Therefore, FoMO is expected to be influenced by these factors. The conceptual framework of this study is presented in Figure 1.

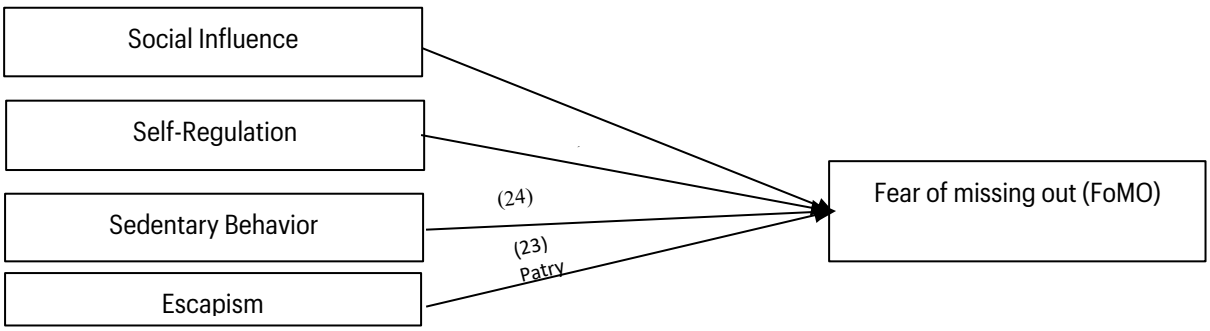


Figure 1 Conceptual Framework

METHODOLOGY

This study applied a cross-sectional study research design, and the procedures of the study were as follows.

Population & Sample

The population of this study consisted of secondary school and university students, and the sample comprised 108 participants, including 88 secondary school students aged 12–19 years and 20 university students aged 20–23 years who voluntarily agreed to participate and complete the research questionnaires. The total sample size exceeded the minimum requirement of 86 participants for multiple regression analysis, as suggested by (1), which was calculated based on an effect size of f^2 = 0.15 derived from (22), a significance level of .05, a statistical power of .85, and three independent variables, indicating that the obtained sample size was adequate for statistical testing.

Research instrument

The instruments used in this study consisted of five Likert-scale measuring FoMO, social influence, self-regulation, sedentary behavior, and escapism. Each scale used a 5-point rating system, ranging from strongly disagree to strongly agree.

The FoMO scale consisted of 8 items adapted and translated from (2). Cronbach's alpha was .90, while the construct validity was supported by (χ^2/df = 1.191, p = .265, *RMSEA* = .042 *SRMR* = .036).

The social influence scale consisted of 5 items adapted and translated from (25). Cronbach's alpha was .59, while the construct validity was supported by (χ^2/df = 0.062, p = .804, *RMSEA* = .000, *SRMR* = .005).

The self-regulation scale consisted of 6 items adapted and translated from (26). Cronbach's alpha was .86, while the construct validity was supported by (χ^2/df = 0.097, p = .756, *RMSEA* = .000, *SRMR* = .007).

The sedentary behavior scale consisted of 7 items adapted and translated from (27-28). Cronbach's alpha was .77, while the construct validity was supported by (χ^2/df = 0.961, p = .480, *RMSEA* = .000, *SRMR* = .044).

The escapism scale consisted of 6 items adapted and translated from (15). Cronbach's alpha was .88, while the construct validity was supported by (χ^2/df = 0.548, p = .701, *RMSEA* = .000, *SRMR* = .019).

Analysis

Data analysis was conducted using R 4.5.3 and R Studio which were conducted, as follows.

1. Descriptive statistics, including mean and standard deviation, were used to describe social influence, self-regulation, sedentary behavior, escapism, and FoMO.
2. Pearson's correlation coefficient was used to examine the relationships between social influence, self-regulation, sedentary behavior, and escapism with FoMO.
3. Multiple regression analysis was applied to investigate the predictive effects of social influence, self-regulation, sedentary behavior, and escapism on FoMO.

RESULTS

The study sample consisted of 108 participants, including secondary school and university students aged 12–23 years. The demographic characteristics of the participants are presented in Table 1.

Table 1 Demographic characteristics

Variable	*N*	%
Gender		
- Male	36	33.3
- Female	72	66.7
Education level		
- Secondary school	88	81.5
- University	20	18.5
Number of siblings		
- 0	25	23.1
- 1	49	45.4
- 2	23	21.3
- More than 2	11	10.2
Screen time per day		
- 1-3 hours	1	0.9
- 4-6 hours	31	28.7
- 7-9 hours	45	41.7
- More than 9	31	28.7
Daily-use apps		
- Line	102	94.4
- Instagram	106	98.1
- TikTok	100	92.6
- X	72	66.7
- Facebook	45	41.7
- YouTube	94	87.0
Device		
- 1	5	4.63
- 2	65	60.2
- 3	31	28.7
- More than 3	7	6.48

As shown in Table 1, a total of 108 participants were included in the study. Most participants were female (66.7%) and were secondary school students (81.5%). Regarding family characteristics, the largest proportion had one sibling (45.4%). The most common daily screen time was 7–9 hours (41.7%). Instagram (98.1%), Line (94.4%), TikTok (92.6%), and YouTube (87.0%) were the most frequently used social media applications. Most participants reported using two electronic devices (60.2%).

The descriptive statistics, including the means and standard deviations, as well as the correlations among the study variables, are presented in Table 2.

Table 2 Means, standard deviations, and correlations among the study variables

Variables	*M*	*SD*	1	2	3	4
1. FoMO	3.60	0.57				
2. Social Influence	3.62	0.57	.43* (*p*<.001)			
3. Self-regulation	3.08	0.76	.38* (*p*<.001)	.18 (*p*=.060)		
4. Sedentary behavior	3.60	0.69	.46* (*p*<.001)	.33* (*p*<.001)	.15 (*p*=.122)	
5. Escapism	2.97	0.99	.46* (*p*<.001)	.40* (*p*<.001)	.29* (*p*=.003)	.43* (*p*<.001)

*$p < .05$

Based on the results presented in Table 2, descriptive statistics revealed that means of FoMO, social influence, self-regulation, sedentary behavior, and escapism were 3.60, 3.62, 3.08, 3.60, and 2.97, respectively.

In addition, the relationships between FoMO among secondary school and university students and the study variables were examined. FoMO and social influence were positively correlated and were statistically significant at the .05 level (r = .43, p < .001). FoMO and self-regulation were positively correlated and were statistically significant at the .05 level (r = .38, p < .001). FoMO and sedentary behavior were positively correlated and were statistically significant at the .05 level (r = .46, p < .001). In addition, FoMO and escapism were positively correlated and were statistically significant at the .05 level (r = .46, p < .001).

The assumptions for multiple regression analysis were examined before the analysis. 1) The assumption of normality was evaluated using the Kolmogorov–Smirnov test, which showed that the residuals did not significantly deviate from a normal distribution (D = 0.07, p = .305). 2) Linearity was evaluated using the Harvey–Collier test (HC (102) = 0.03, p = .998) and the Rainbow test ($Rain$ (54,49) = 0.79, p = .801), and the results showed insignificant deviation from linearity. 3) Homoscedasticity was evaluated using the Breusch–Pagan test (BP (4) = 2.36, p = .669) and the Goldfeld–Quandt test (GQ (49,49) = 0.59, p = .967), indicating constant variance of the residuals. 4) The presence of autocorrelation was evaluated using the Durbin–Watson test, which showed insignificant autocorrelation among the residuals (DW = 2.03, p = .575). 5) Multicollinearity was evaluated using the variance inflation factor (VIF). The VIF values ranged from 1.10 to 1.41, indicating no evidence of multicollinearity. Overall, the results indicated that the data met the assumptions for multiple regression analysis.

The results of the analysis of the effects of various factors on FoMO among secondary school and university students are presented in Figures 2–3 and Table 3.

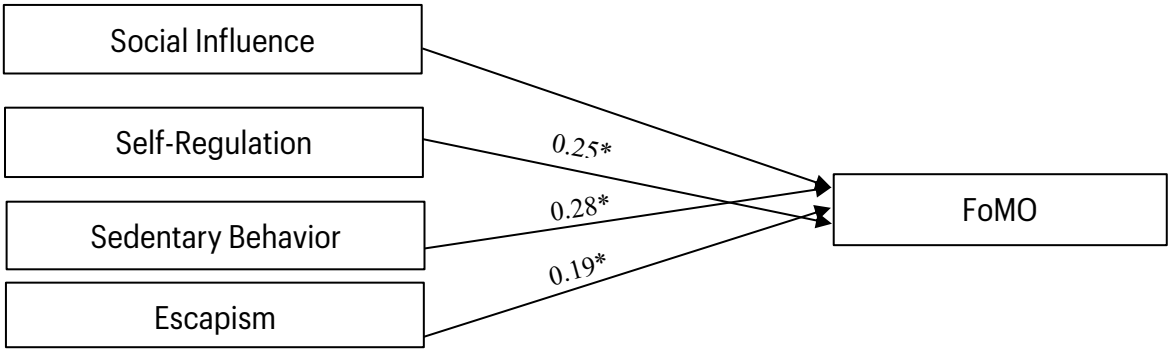
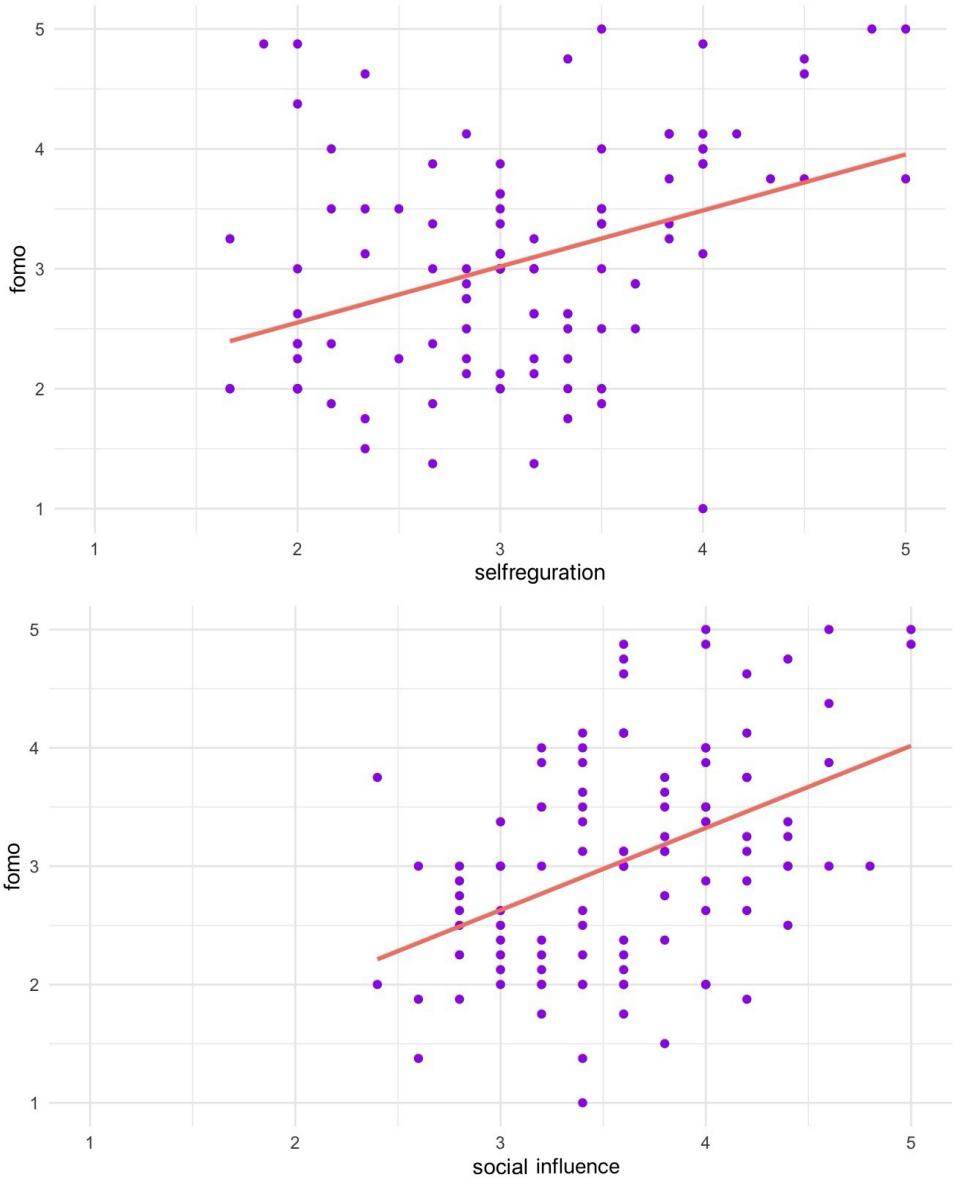


Figure 2 Results of the analysis of the effects of various factors on FoMO, with standardized regression coefficients reported (*p<.05)



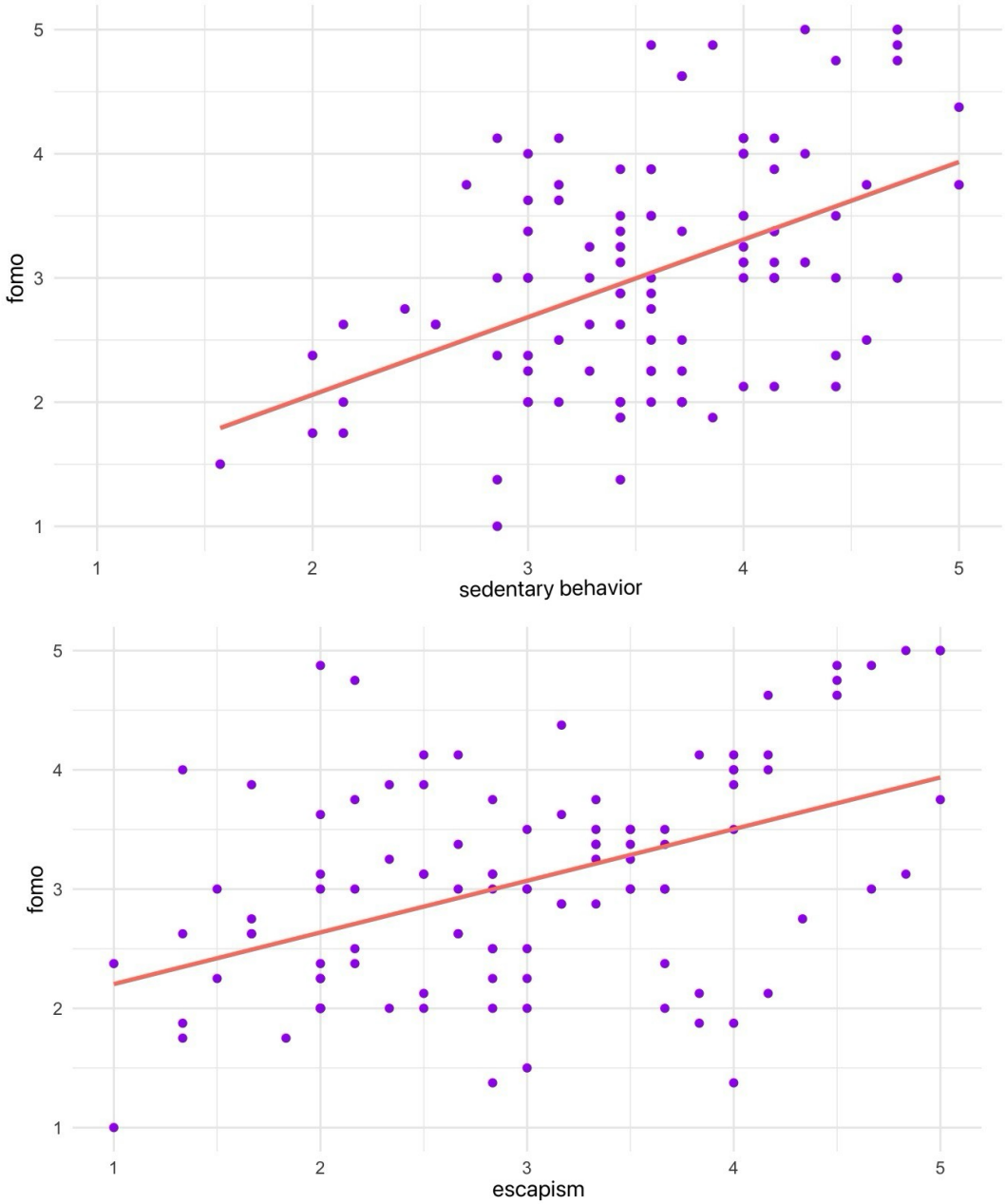


Figure 3 Scatter plots illustrating the relationships among social influence, self-regulation, sedentary behavior, and escapism among secondary school and university students.

Table 3 Results of the analysis of the effects of various factors on FoMO among secondary school and university students.

Variables	*B*	*β*	*SE*	*t*	*p*
Social Influence	0.35	0.22	0.14	2.56	< .001
Self-regulation	0.30	0.25	0.10	3.08	< .001
Sedentary behavior	0.37	0.28	0.16	3.21	< .001
Escapism	0.17	0.19	0.09	2.05	< .001

$R^2 = .40$, $R^2_{adjust} = .38$, $f^2 = 0.67$, $F(4, 103) = 17.16$, $p < .001$

As presented in Table 3, multiple regression analysis showed that social influence, self-regulation, sedentary behavior, and escapism jointly explained 40% of the variance in FoMO. The regression model was statistically significant at the .05 level ($R^2 = .40$, $p < .001$). All factors showed an effect on FoMO ($f^2 = 0.67$). Social influence had a statistically significant effect on FoMO at the .05 level ($\beta = 0.22$, $p < .001$). Self-regulation also had a statistically significant effect on FoMO at the .05 level ($\beta = 0.25$, $p < .001$). Sedentary behavior had a statistically significant effect on FoMO at the .05 level ($\beta = 0.28$, $p < .001$). In addition, escapism had a statistically significant effect on FoMO at the .05 level ($\beta = 0.19$, $p < .001$).

DISCUSSION

Sedentary behavior has the strongest positive statistically significant effect on FoMO among secondary school and university students. This finding may be explained by the association between sedentary behavior, lower levels of social connectedness (26), and greater smartphone use (13). These factors may increase feelings of loneliness or reduce individuals' sense of social connection. As a result, individuals may become more concerned about missing important experiences or events, leading to higher levels of FoMO (29).

Social influence has a positive, statistically significant effect on FoMO among secondary school and university students. Social media allows individuals to interact with others and maintain a sense of involvement in their social networks (2). When individuals perceive that they are not participating in activities or discussions that others consider important, they may become concerned about missing valuable experiences or opportunities. They may also worry that these missed experiences could negatively affect their relationships with others (19). Such concerns may strengthen their need to belong, leading to higher levels of FoMO (30).

Self-regulation was positively associated with FoMO, which was inconsistent with the proposed hypothesis and previous studies reporting that individuals with higher levels of self-regulation generally experience lower levels of FoMO (9). A possible explanation for this finding is that the participants in the present study were secondary school and university students, for whom social media serves not only as a platform for social interaction but also as an important source of academic communication and information. Individuals with higher self-regulation may intentionally monitor online information and social activities to avoid missing important updates or opportunities. Consequently, although they are able to regulate their behavior effectively, they may still experience higher levels of FoMO. However, because this study employed a cross-sectional design, the direction of this relationship cannot be determined. Therefore, further research is needed to investigate the underlying

mechanisms explaining the relationship between self-regulation and FoMO.

Escapism has a positive, statistically significant effect on FoMO among secondary school and university students. Individuals who use social media to escape from stress or real-life problems (16) tend to spend more time online. Greater exposure to other people's activities may increase concerns about missing valuable experiences or opportunities. In addition, relying on social media as a means of escaping reality may increase dependence on online platforms, which may further contribute to higher levels of FoMO. This finding is consistent with (18), who found that escapism through social media is associated with higher levels of FoMO.

The findings of this study highlighted that sedentary behavior had the strongest effect on FoMO among secondary school and university students. Future research may further investigate the mechanisms underlying this relationship and examine factors that may influence or explain it, such as through longitudinal research designs. In addition, future studies may develop and evaluate intervention programs aimed at reducing sedentary behavior, strengthening self-regulation, and promoting healthier social media use using Research and Development (R&D) approaches, with their effectiveness subsequently evaluated through randomized controlled trials (RCTs) or other experimental research designs. Such research may provide evidence for developing effective strategies to reduce FoMO and improve the mental health of secondary school and university students.

CONCLUSION

Main findings about factors affecting FoMO were as follows. Social influence, self-regulation, sedentary behavior, and escapism explained 40% of the variance in fear of missing out ($R^2 = .40$, $p < .001$). Out of the four predictors, sedentary behavior showed the strongest positive statistically significant effect on fear of missing out ($\beta = 0.28$, $p < .001$), followed by self-regulation ($\beta = 0.25$, $p < .001$), social influence ($\beta = 0.22$, $p < .001$),and escapism. ($\beta = 0.19$, $p < .001$).

RECOMMENDATION

The results of this study indicated that social influence, self-regulation, sedentary behavior, and escapism had statistically significant effects on FoMO among secondary school and university students. Relevant organizations and individuals, including schools, parents, mental health professionals, and media developers, may use these findings to develop strategies and interventions that promote healthier social media use and reduce FoMO. Particular attention should be given to reducing sedentary behavior, as it had the strongest effect on FoMO. Such interventions may focus on encouraging physical activity, strengthening self-regulation, promoting balanced social media use, and increasing opportunities for face-to-face social interaction. In the long term, these efforts may help reduce FoMO, support better mental health, and contribute to the prevention of future mental health problems among secondary school and university students.

ETHICAL DECLARATION

This study was conducted in accordance with the approved ethical procedures for research involving human participants. The questionnaire collected only non-sensitive information. Therefore, parental or guardian consent was not required for participants under 18 years of age, in accordance with the approved ethics procedures. Participation was voluntary, and the confidentiality of participants' information was maintained throughout the study.

LIMITATION

The study included both secondary school and university students, with a broad age range and an unequal distribution between the two groups. Differences in age and educational level may have influenced social media use and FoMO. Future studies may use more clearly defined age

groups and a more balanced sample. For participants under the age of 18 years, parental or guardian consent was not required in accordance with the approved ethical procedures, as the questionnaire did not collect sensitive information. Participation was voluntary, and participant confidentiality was maintained throughout the study.

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THE INFLUENCE OF LONELINESS AND JOY OF MISSING OUT (JOMO) ON DOOMSCROLLING AMONG ADOLESCENTS IN BANGKOK, THAILAND

Nicha Satayamana[1,*], Wipunwara Patpanitchote[1], and Chayawat Siripantasak[1]

[1]Srinakharinwirot University Demonstration School Prasarnmit (Secondary), Bangkok, Thailand

****Corresponding author**: Nicha Satayamana, Srinakharinwirot University Demonstration School Prasarnmit (Secondary), Bangkok, Thailand, Email: nicha.satayamana@gmail.com*

ABSTRACT

Introduction: In the modern digital era, adolescents increasingly encounter loneliness, which has emerged as a significant public health concern. This emotional distress often drives individuals to seek online support, leading to "doomscrolling"—the repetitive consumption of distressing online media. Thus, investigating the factors influencing this behavior is critical for developing effective public health interventions to mitigate its adverse effects on students.

Objectives: This study aimed to examine the levels and interrelationships of loneliness, JOMO, and doomscrolling behavior, while evaluating the combined predictive influence of loneliness and JOMO on adolescent doomscrolling.

Methodology: Samples consisted of 83 secondary school students from Bangkok who met the inclusion criteria for online data collection. The required sample size was determined via a priori power analysis for multiple regression. Based on a medium effect size (f^2 = 0.15), alpha level ($\propto$= 0.05), power of 0.80, and 2 predictors, the minimum sample required was 67 participants. Data were collected using 5-point Likert scales for loneliness and JOMO, alongside a doomscrolling scale. Data were analyzed using descriptive statistics, Pearson's correlation, and multiple regression.

Results: Results indicated that: 1) the mean values for JOMO, doomscrolling, and loneliness among students were 3.28, 2.64, and 2.60, respectively, which were at a moderate level. 2) Loneliness was significantly and positively correlated with doomscrolling at the .05 level, whereas JOMO showed an insignificant negative correlation. 3) Loneliness had a significant positive influence on doomscrolling behavior at the .05 level, while JOMO demonstrated no significant predictive influence.

Conclusion: While loneliness acts as the primary predictor of doomscrolling, JOMO demonstrates insignificant influence. Consequently, initiatives might prioritize addressing social isolation rather than solely promoting digital disconnection. Furthermore, future digital mental health innovations, such as support frameworks informed by Cognitive Behavioral Therapy (CBT) principles, could be explored as potential help for adolescents' negative emotional states associated with media consumption.

Keywords:

Doomscrolling; Loneliness; JOMO

INTRODUCTION

In the contemporary digital landscape, "doomscrolling" has emerged as a media habit, characterized by the compulsive, obsessive consumption of negative, crisis-driven information on online platforms (1). As a critical behavior, doomscrolling warrants urgent management due to its profound associations with adolescent well-being.

The adverse psychological outcomes are associated with doomscrolling. Research consistently demonstrates a strong positive correlation between doomscrolling and elevated anxiety levels(2). This behavior accelerates mental health challenges, extending beyond immediate emotional distress to long-term psychological impairments (Fazia et al., 2023, as cited in (3)Specifically, doomscrolling is linked to the worsening of depression and anxiety, and it can even trigger panic attacks in susceptible individuals(4). Furthermore, this reciprocal relationship between behavior and psychological

state has negative effects on overall well-being and life satisfaction, while simultaneously increasing the development of mental health problems and decreasing motivation (5).

Beyond individual health, doomscrolling is also linked to broader societal issues, including reduced productivity and altered risk perception (6). Moreover, the digital environment in which this behavior occurs presents additional concerns, such as a lack of algorithmic transparency and the proliferation of fake news, which can foster cynicism and heighten privacy concerns among young people (7).

In order to solve the problem of doomscrolling, it is important to study factors affecting doomscrolling. Beyond the immediate psychological toll of doomscrolling, it is imperative to examine the foundational drivers of this behavior, foremost among them being loneliness. Loneliness is defined as a subjective experience linked to the absence of meaningful, close relationships with people who could genuinely understand them and affirm their importance. The prevalence of this condition is globally alarming; recent estimates indicate that one in six individuals experiences loneliness, a state that disproportionately affects adolescents and young adults, with 20.9% of 13–17-year-olds reporting this state of disconnection (8).

While lonely individuals may initially turn to the internet in a search for social connection, they often fall into a trap of inhibited behavior, rumination, and negative social comparison (9, 10) observed that higher levels of smartphone access and internet usage among students are While addressing the role of loneliness, it is equally essential to consider whether other psychological constructs—specifically the 'Joy of Missing Out' (JOMO)—may also exert a significant influence on this behavior.

JOMO— a psychological orientation toward intentional, mindful disengagement from digital and social pressure (11) may also play a role in doomscrolling. Unlike the compulsive monitoring characteristic of FOMO (Fear of Missing Out), JOMO is rooted in the enjoyment of self-reflection and the pursuit of activities based on personal preference, rather than external validation(12). The psychological utility of JOMO lies in its ability to serve as a protective mechanism. Research indicates that JOMO is associated with higher levels of life satisfaction and mindfulness, suggesting that individuals who practice this orientation are better equipped to maintain psychological equilibrium (12). Thus, investigating the interplay between JOMO and doomscrolling is crucial, as it offers a potential pathway to mitigate the compulsive media habits that currently compromise adolescent well-being.

Despite the growing concern regarding digital well-being, the intersection of psychological drivers and compulsive digital behaviors remains poorly understood. Systematic reviews by O'Day and Heimberg (2021) highlight a clear nexus between social media use, social anxiety, and loneliness. However, leaving a significant gap in our understanding of how positive psychological buffers—such as the JOMO—might mitigate these behaviors.

This gap is particularly concerning within the context of Thai adolescents, where excessive social media consumption has become normalized. Recent evidence reveals that over 57% of Thai adolescents access social media more than 12 times daily, suggesting a chronic state of digital over-engagement that may predispose them to doomscrolling (13). Addressing this research gap is, therefore, essential; it provides the empirical foundation needed to transition from merely observing these digital risks to implementing evidence-based strategies that prioritize mental stability over crisis-driven consumption.

Given these concerns, this study aims to investigate the influence of loneliness and JOMO on doomscrolling behavior among Thai adolescents. By exploring these psychological dynamics, this research seeks to provide empirical evidence that is vital for public health initiatives aimed at digital wellness. This research aims to describe the levels of JOMO, doomscrolling, and loneliness, to analyze the

relationship of doomscrolling with loneliness and JOMO, and to evaluate the predictive influence of loneliness and JOMO on doomscrolling behavior.

METHODOLOGY

This study adopted a cross-sectional design. The research methodology is detailed in the sections below.

Population & sample

The target population consisted of secondary school students. The research sample comprised 83 secondary school students aged between 12 and 19 years residing in Bangkok. Data collection was conducted online via Google Forms over a period of 5 days. Prior to participation, the research objectives were explicitly clarified, and informed consent was obtained from all respondents. A purposive sampling technique was utilized. The inclusion criteria required participants to be currently enrolled in secondary school, aged 12 to 19 years, and willing to voluntarily complete the questionnaires. The exclusion criterion was the submission of incomplete questionnaire responses. The minimum sample size was determined considering a statistical significance level of .05, statistical power of .80, and the designated two predictor variables. The calculation indicated a minimum required sample size of 67 participants.

Research instruments

The research instruments consisted of three sets of 5-point Likert scales, ranging from 1 (not at all descriptive of the participant) to 5 (extremely descriptive of the participant). The instruments were developed and adapted as follows:

The loneliness scale was adapted from the UCLA Loneliness Scale (Version 3) by Russell (1996), consisting of 5 items. The scale demonstrated consistency with a Cronbach's alpha coefficient of .83. Confirmatory Factor Analysis (CFA) confirmed its construct validity ($X^2/df = 0.825$, $p = .480$, $RMSEA = .000$, $SRMR = .023$).

Doomscrolling was measured using an adapted scale based on Sharma et al. (2022), comprising 5 items. The scale demonstrated consistency with a Cronbach's alpha coefficient of .77. Confirmatory Factor Analysis (CFA) confirmed its construct validity ($X^2/df = 0.550$, $p = .648$, $RMSEA = .000$, $SRMR = .022$).

JOMO: Measured using an adapted 5-item scale based on Eitan and Gazit (2024), consisting of 5 items. The scale demonstrated consistency with a Cronbach's alpha coefficient of .77. Confirmatory Factor Analysis (CFA) confirmed its construct validity ($X^2/df = 0.666$, $p = .573$, $RMSEA = .000$, $SRMR = .024$).

Data analysis

Data analysis was conducted using R version 4.5.3 and RStudio, utilizing the following statistical methods:

1) Descriptive statistics, namely mean and standard deviation, were used to describe loneliness, JOMO, and doomscrolling behavior among secondary school students. The level of all variables was assessed using Boonchom Srisa-ard's (1999)(14) interpretation criteria for Likert scale scores.

2) Pearson's Correlation was used to analyze the relationship between loneliness and JOMO and the doomscrolling behavior of secondary school students.

3) Multiple Regression Analysis was used to analyze the predictive factors of loneliness and JOMO related to the doomscrolling behavior of secondary school students. The preliminary assumptions were verified as follows:

3.1) The absence of autocorrelation or independence was tested using the Durbin-Watson Test.

3.2) The normal distribution of residuals was tested using the Kolmogorov-Smirnov statistic.

3.3) The linear relationship was tested using the Harvey-Collier Test and the Rainbow Test.

3.4) The homoscedasticity of the residuals was tested using the Breusch-Pagan Test and the Goldfeld-Quandt Test.

3.5) The issue of multicollinearity was verified using the VIF statistic.

RESULTS

Demographic characteristics of the participants are presented in Table 1

Table 1 Demographic characteristics of the participants

Variable	*n*	%
Gender		
- Male	34	41.00
- Female	43	51.80
- LGBTQ+	5	6.02
- Not Specified	1	1.20
Resident type		
- Private House/Condo (Living with family/relatives)	58	69.90
- Dormitory/Condo (Living alone)	14	16.90
- Dormitory/Condo (Living with roommates/friends)	6	7.23
- Not Specified	5	6.02

The results presented in Table 1 show that the majority of the participants were female (51.80%). Most participants lived in a private house or condominium with their family or relatives (69.90%). The mean age of the participants was 16.55 years (*SD* = 1.37)

Descriptive statistics and Pearson's correlation coefficients among doomscrolling, loneliness, and JOMO are presented in Table 2.

Table 2 Descriptive statistics and Pearson's correlation coefficients (*$p < .05$)

Variables	*M*	*SD*	Level	1	2	3
Doomscrolling	2.64	0.82	Moderate	1		
Loneliness	2.60	0.83	Moderate	.329* (p = .002)	1	
JOMO	3.28	0.79	Moderate	-.191 (p = .084)	-.106 (p = .339)	1

Table 2 shows that the levels of doomscrolling, loneliness, and JOMO were 2.64, 2.60, and 3.28, respectively, which were at moderate levels. Loneliness was positively and significantly correlated with doomscrolling (r = .329, p = .002). In contrast, JOMO showed a negative, insignificant correlation with doomscrolling (r = -.191, p = .084).

The assumptions for multiple regression analysis were examined prior to model estimation. The Durbin-Watson test initially indicated positive, insignificant autocorrelation (*DW* = 2.13, p = .278). The Kolmogorov-Smirnov test confirmed that the residuals were normally distributed (D = 0.09, p = .123). The Harvey-Collier test ($HC(79)$ = 1.04, p = .304) and the Rainbow test ($Rain(42, 38)$ = 0.69, p = .883) indicated that the assumption of linearity was satisfied. Furthermore, the Breusch-Pagan test (BP (2) = 0.07, p = .966) and the Goldfeld-Quandt test ($GQ(39, 38)$ = 0.66, p = .899) confirmed homoscedasticity of the residuals. Finally, the Variance Inflation Factor (*VIF*) values for both predictors were 1.01, indicating no evidence of multicollinearity. Overall, all assumptions required for multiple regression analysis were satisfied. The results of the multiple regression analysis predicting doomscrolling are presented in Table 3.

Table 3 Multiple regression analysis for doomscrolling

Variables	*B*	β	SE	*p*
Constant	2.37	-	0.47	<.001
Loneliness	0.31	0.31	0.10	.004
JOMO	-0.16	-0.16	0.11	.136

R^2 = .13, $R^2_{Adjusted}$ = .11, $F(2,80)$ = 6.14, p = .003

Table 3 shows that loneliness and JOMO collectively explained 13% of the variance in doomscrolling (R^2 = .13, p = .003). Loneliness significantly and positively predicted doomscrolling (β = .31, p = .004), whereas JOMO showed a negative, insignificant effect on Doomscrolling (β = -.16, p = .136).

DISCUSSION

The present study examined the cross-sectional associations between loneliness, JOMO, and doomscrolling among Thai adolescents in Bangkok. In line with our initial hypothesis, loneliness emerged as a statistically significant positive predictor of doomscrolling.

Conversely, JOMO did not exhibit a statistically significant association with doomscrolling. This result contrasts with recent scale validation studies (11), which frame JOMO as a positive mindset that fosters digital well-being and reduces online distress. However, this contrast can be explained by Barry et al. (12), who found that high levels of JOMO are relatively rare in general populations and involve complex psychological traits rather than a simple protective effect. In the context of the present study, this divergence may be largely explained by limited statistical power resulting from our modest sample size (n = 83), which may have reduced the likelihood of detecting a subtle protective effect.

Crucially, given the cross-sectional observational design of this research, the observed empirical patterns reflect statistical associations rather than directional or causal pathways. The unadjusted regression model accounted for 13% of variance, indicating that adolescent doomscrolling may be associated with a broader range of unmeasured psychological and environmental factors.

From a practical perspective, intervention efforts targeting adolescent digital wellness might focus on addressing underlying social isolation rather than relying solely on promoting digital detachment. Because loneliness shares a clearer association with doomscrolling than JOMO in this sample, strategies aimed at enhancing interpersonal connectedness and social support may offer greater utility for adolescent mental well-being.

CONCLUSION

The findings revealed that secondary school students exhibited moderate levels of JOMO (M = 3.28, SD = 0.79), Doomscrolling (M = 2.64, SD = 0.82), and Loneliness (M = 2.60, SD = 0.83), based on Boonchom Srisa-ard's (1999) interpretation criteria. Correlation analysis indicated that Loneliness was significantly and positively associated with doomscrolling (r = .329, p = .002), whereas JOMO was not significantly associated with either doomscrolling (r = -.191, p = .084) or loneliness (r = -.106, p = .339). Multiple regression analysis revealed that loneliness and JOMO collectively explained 13% of the variance in doomscrolling (R^2 = .13, p = .003). Among the predictors, Loneliness had a positive significant effect on doomscrolling (β = 0.31, p = .004), whereas JOMO had a negative insignificant effect (β = -0.16, p = .136) on doomscrolling.

RECOMMENDATION

Interventions should target underlying social isolation rather than simply restricting screen time. Cognitive Behavioral Therapy (CBT) frameworks can be applied to help adolescents reframe cognitive distortions related to

loneliness. Furthermore, scalable digital interventions—such as fully automated conversational agents or app-based CBT programs—offer feasible and accessible tools to deliver cognitive-behavioral support to youth experiencing emotional distress (15).

ETHICAL DECLARATION

This study was conducted with the consent of participants and remained voluntary and anonymous. Due to logistical constraints in accessing participants' parents, parental consent was not obtained.

LIMITATION

Several methodological limitations of this study should be acknowledged. First, given the observational, cross-sectional design, the identified relationships reflect statistical associations rather than directional or causal pathways. Second, the sample size (n = 83) provided limited statistical power, which likely reduced the sensitivity to detect subtle or complex protective effects of JOMO. Third, data collection was limited to adolescents in urban Bangkok, limiting the generalizability of the findings to non-urban or rural Thai adolescent populations. Fourth, using self-report questionnaires may lead to inaccurate answers, so future studies should use direct screen-time tracking instead. Finally, the regression model explained only 13% of the variance, showing that doomscrolling is also influenced by other unmeasured factors.

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THE INFLUENCE OF WATER LITERACY, HYDRATION AWARENESS, DRINKING FREQUENCY, DRINKING BEHAVIORS, AND EXERCISE ON CONFIDENCE IN WATER QUALITY AMONG SECONDARY SCHOOL STUDENTS

Panthila Tanyakum[1,*], Praewpraewa Luangvutiwong[1], Pimpicha Luangvutiwong[1], Chanankorn Narakorn[1], Thachakotchaphon Puttarakunwisan[1], Phatnaree Kipairoj[1], Issariyapon Eaumnovilai[1], and Chayawat Siripantasak[1]

[1]Srinakharinwirot University Demonstration School Prasarnmit (Secondary), Bangkok, Thailand

***Corresponding author**: Panthila Tanyakum, Srinakharinwirot University Demonstration School Prasarnmit (Secondary), Bangkok, Thailand, Email: panthila1309@gmail.com*

ABSTRACT

Introduction: Heatstroke is an increasingly common health problem in hot weather. This may lead to serious conditions. Adequate water intake is a key factor in prevention. Confidence in water quality may influence students' drinking behaviors; therefore, examining factors associated with confidence in water quality among secondary school students may contribute to heatstroke prevention.

Objectives: This cross-sectional study aimed to 1) describe water literacy, hydration awareness, drinking frequency, drinking behaviors, exercise, and confidence in water quality among, 2) study the relationship between water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise with confidence in water quality, 3) identify factors independently associated with the impact of water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise on confidence in water quality among secondary school students.

Methodology: The minimum sample required was 80 secondary students, calculated using (10), calculator based on effect size $f^2 = 0.269$ reported by (11), with statistical power of .95, and five predictor variables. Total of 111 secondary school students were recruited through purposive sampling. Research instruments included confidence in water quality, water literacy, exercise, hydration awareness, drinking frequency with Cronbach's alpha of .92, .93, .91, .89, and .18, respectively and drinking behavior scales. Data were analyzed using descriptive statistics, Pearson's correlation, and multiple regression analysis. Statistical significance was set at .05.

Results: 1) Means for confidence in water literacy, hydration awareness, drinking frequency, drinking behaviors, exercise, and confidence in water quality were 3.85, 3.92, 3.72, 1.98, 3.30, and 4.13, respectively. 2) Confidence in water quality was positively correlated with water literacy, exercise, and drinking behavior, while it was negatively correlated with drinking frequency. 3) Water literacy, exercise, water consumption volume, drinking frequency, and drinking behavior jointly explained 41.74% of the variance in confidence in water quality. Drinking behavior, hydration awareness, and water literacy had a positive significant associated on confidence in water quality. Exercise, water intake volume, and drinking frequency had no significant association with confidence in water quality.

Conclusion: Hydration awareness and water health literacy were important factors associated with confidence in water quality. Schools and relevant organizations should provide education and activities that promote proper water consumption and heatstroke prevention. From a public health perspective, promoting these cognitive factors may help prevent dehydration and reduce heatstroke risk among adolescents. Future studies should employ qualitative methods to gain a deeper understanding of these factors. Enhancing water literacy and healthy drinking behaviors may improve confidence in water quality and contribute to heatstroke prevention among students.

Keywords:
Heatstroke; Water Quality Confidence; Water Literacy; Drinking Behavior

INTRODUCTION

Heat Stroke is a dangerous and increasingly common public health emergency that is caused by excessive body heat accumulation that overwhelms the body's thermoregulation and is compounded by dehydration from insufficient fluid consumption. Rising ambient temperatures are associated with increased heat stroke incidence and higher non-accidental mortality rates, highlighting the urgent need for effective preventive strategies(1). Furthermore, heat stroke fatalities are increasing with rising temperatures (2). Because heat stroke can result in severe complications and preventable deaths, effective preventive strategies targeting adequate hydration are essential.

Confidence in water quality is an important determinant of adequate water consumption, which is essential for preventing dehydration and heat stroke. Confidence in water quality refers to individuals' belief that available drinking water is safe and suitable for consumption. When individuals trust the quality of drinking water, they are more likely to consume sufficient fluids. Maintaining hydration not only helps prevent heat stroke but also supports overall health and physical performance (3). Therefore, promoting confidence in water quality may improve hydration behaviors and reduce the risk of heat stroke.

Identifying factors associated with confidence in water quality may facilitate the development of interventions that enhance confidence, promote adequate water intake, and ultimately prevent heat stroke. One potential factor is hydration awareness, which reflects an individual's awareness of thirst and recognition (4). This includes an awareness of inadequate water intake, such as dehydration, increased blood viscosity, and risk of heat stroke(5). Individuals with greater hydration awareness may be more motivated to maintain adequate hydration and have greater confidence in water quality.

Water literacy is another potential factor influencing confidence in water quality. It encompasses knowledge and understanding of hydration requirements, thirst recognition, and related behavior (6). Greater water literacy may increase awareness of heat-related risks and support appropriate hydration practices.

In addition to hydration awareness and water literacy, health-related behaviors may also influence confidence in water quality. Exercise increases fluid requirements and may encourage greater attention to hydration (7). Drinking behavior and drinking frequency reflect habitual hydration practices that may also be associated with confidence in water quality.

However, empirical evidence simultaneously examining hydration awareness, water literacy, exercise, drinking behavior, and drinking frequency in relation to confidence in water quality remains limited, particularly among secondary school students (8). Addressing this gap may provide evidence for interventions that strengthen confidence in water quality and promote adequate hydration.

Therefore, this study aimed to examine the influence of hydration awareness and water literacy on confidence in water quality among secondary school students. Increased temperatures are associated with a higher burden of heat-related illnesses, including dehydration, highlighting the importance of adequate hydration during hot weather (9). Secondary school students were selected because they spend substantial time in school and may be exposed to hot weather and outdoor physical activities, increasing their risk of dehydration. The findings are expected to inform public health and school-based interventions to promote healthy hydration behaviors and heat stroke prevention.

The objectives were to 1) describe water literacy, hydration awareness, drinking frequency, drinking behaviors, exercise, and confidence in water quality among, 2) study the relationship between water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise with confidence in water quality; 3) identify factors independently associated with the impact of water literacy, hydration awareness, drinking frequency,

drinking behaviors, and exercise on confidence in water quality among secondary school students.

METHODOLOGY

This is a cross-sectional study. The details of the research procedures are as follows.

Population and sample

The population of this study was Thai secondary school students under the Ministry of Higher Education, Science, Research and Innovation, the Ministry of Education, the Office of the Basic Education Commission, Office of the Private Education Commission.

The sample of this study used 111 secondary school students. The minimum sample size is 80 secondary students, calculated using (10), calculation based on the effect size f^2 = 0.269 reported by(11), with statistical power of .95, and five predictor variables. Participants were recruited through purposive sampling, serving as the primary study site due to the researcher's institution, lead to ease of data collection. The online questionnaire link was also distributed to secondary school students from other institutions to expand participant reach. Purposive sampling ensured that all respondents met the inclusion criteria. A total of 111 students were invited and accessed the survey, all of whom completed the questionnaire in full with no missing data, yielding a response rate of 100%.

Inclusion Criteria

1. Being a secondary school student (Lower or Upper secondary level) currently studying at the study site.
2. Willingness to participate voluntarily and provision of informed consent via the online platform.
3. Ability to access and complete the online Google Form questionnaireindependently.

Exclusion Criteria

1. Incomplete questionnaire submissions or missing key study data.
2. Refuse to provide consent or withdraw before completion.

Data collection was conducted among secondary school students, using self-administered questionnaires distributed over the study duration. Prior to participation, informed consent and parental consent were properly obtained, and strict measures were implemented to ensure participant confidentiality and data quality throughout the process.

Research instrument

Research instruments included six structured questionnaire sections:

1. **Confidence in water quality scale:** Consisted of 8 items rated on a 5- point Likert scale (1= Strongly Disagree to 5 = Strongly Agree). It was translated and adapted from the Drinking Water Trust Scale developed by Brouwer et al. (2020). The scale comprised three dimensions: 1) Safety (2 items), 2) Cleanliness (4 items), and 3) Water Supply Authority (2 items). Total scores ranged from 8 to 40 (Mean range: 1.00–5.00), where higher scores reflected higher confidence in water safety. Example items included: "I am confident that the drinking water provided at school is clean and safe" and "I trust the quality of the school's water filtration system."The scale demonstrated a Cronbach's alpha of .92, and satisfactory construct validity ($\chi 2\ /df$ = 1.25, p = .217, $RMSEA$ = .047, $SRMR$ = .019).
2. **Water literacy scale:** Consisted of 9 items rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). It was translated and adapted from the Water Literacy Scale developed by (13). The scale measured three dimensions: 1) Ability to access and understand basic water-related information (3 items), 2) Ability to evaluate information and confidence in information sources (3 items), and 3) Health-related water practices (3 items). Total scores ranged from 9 to 45 (Mean range: 1.00–5.00), with higher scores indicating greater water health literacy. Example items included: "I understand how much daily water intake my body requires" and "I can evaluate the credibility of drinking water information sources." The scale demonstrated a Cronbach's alpha of .93, and satisfactory construct validity ($\chi 2\ /df$ = 1.17, p = .261, $RMSEA$ = .039, $SRMR$ = .030).

3. **Exercise scale:** Consisted of 8 items rated on a 5-point Likert scale (1 = Never to 5 = Always). It was translated and adapted from the International Physical Activity Questionnaire developed by (14). Total scores ranged from 8 to 40 (Mean range: 1.00–5.00), with higher scores denoting higher physical activity levels. Example items included: "I perform moderate to vigorous physical exercises during the week" and "I maintain a regular exercise routine." The scale demonstrated a Cronbach's alpha of .91 and satisfactory construct validity ($\chi 2\ /df$ = 1.21, p = .253, $RMSEA$ = .044, $SRMR$ = .029).

4. **Hydration awareness scale:** Consisted of 4 items rated on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). It was translated and adapted from the awareness scale developed by (4). Total scores ranged from 4 to 20 (Mean range: 1.00–5.00), where higher scores indicated stronger body sensory awareness of hydration needs. Example items included: "I notice subtle physical signals from my body when I begin to feel dehydrated" and "I pay attention to internal thirst cues during daily activities." The scale demonstrated a Cronbach's alpha of .89 and satisfactory construct validity ($\chi 2\ /df$ = 0.088, p = .767, $RMSEA$ = .000, $SRMR$ = .002).

5. **Drinking frequency scale:** Consisted of 2 items rated on a 6-point Likert scale (1 = Very Infrequently to 6 = Very Frequently). It was translated and adapted from the Water Drinking Frequency Scale developed by (15). Total scores ranged from 2 to 12 (Mean range: 1.00–6.00), with higher scores representing higher drinking frequency. Example items included: "How frequently do you consume water throughout the school day?" and "How often do you take water breaks during activities?" The scale demonstrated a Cronbach's alpha of .18. Although this scale exhibited low reliability property, items of scale were still retained to cover the definition of the scale.

6. **Drinking behavior scale:** Consisted of 1 item measuring the number of water intake in a 600-milliliter bottle per day on average. It was translated and adapted from the water intake assessment guideline from Gandy (2015) (16). Higher numerical values indicated greater daily fluid consumption. Example item: "On average, how many 600 mL bottles of water do you drink per day?"

Score Interpretation Criteria: Mean scores for the 5-point Likert scales were interpreted using class intervals of 0.80 based on the criteria established by Srisa-ard (2010) (1.00 – 1.80: Very Low, 1.81 – 2.60: Low, 2.61 – 3.40: Moderate, 3.41 – 4.20: High, 4.21 – 5.00: Very High)

Data analysis

All collected data were analyzed using statistical software (e.g., R studio, R), employing descriptive statistics, Pearson's correlation analysis, and multiple regression analysis, with the statistical significance level adopted at p < .05.

1. Description of water literacy, hydration awareness, drinking frequency, drinking behaviors, exercise, and confidence in water quality among secondary school students used descriptive statistics.

2. Study about relationships between water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise with confidence in water quality among secondary school students used Pearson's correlation analysis.

3. Examination of the association between water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise on confidence in water quality among secondary school students used multiple regression analysis.

RESULT

The background characteristics of the student participants are presented in Table 1 and Table 2.

Table 1 Frequency and percentage of demographic characteristics of students (*N* = 111).

Demographic characteristics	***n***	**%**
Gender		
- Male	30	27.00
- Female	81	73.00
Education level		
- Lower secondary school	13	11.70
- Upper secondary school	98	88.30
Total	111	100.00

Table 2 Mean and standard deviation of demographic characteristics of students (*N* = 111)

Demographic characteristics	***M***	***SD***
Age	16.58	1.37
weight	50.42	8.31
height	158.21	6.54
BMI	20.84	3.82

The descriptive statistics for continuous variables, including age, weight, height, and BMI, were reported using means and standard deviations along with their minimum and maximum values to provide a complete and thorough description of the study sample and variables. Demographic Characteristics: As presented in Tables 1 and 2, the sample comprised predominantly female (73.00%) upper secondary school students (88.30%), with a mean age of 16.58 years (SD = 1.37).

Descriptive statistics for water literacy, hydration awareness, drinking frequency, exercise, drinking behavior, and confidence in water quality among secondary school students are presented in Table 3.

Table 3 Descriptive statistics of the study variables.

Variables	***M***	***SD***
Confidence in water quality	4.13	0.72
Water literacy	3.85	0.92
Exercise	3.30	0.96
Drinking behavior	1.98	0.63
Hydration awareness	3.92	0.93
Drinking frequency	3.72	1.14

Descriptive Statistics of Study Variables: Descriptive statistics for all main study variables are summarized in Table 3. Overall, participants demonstrated high levels of confidence in water quality, hydration awareness, and water literacy. Moderate mean scores were observed for exercise engagement and drinking frequency, whereas drinking behavior reflected lower average daily volume consumption.

Pearson's correlation analysis for water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise with confidence in water quality among secondary school students is presented in Table 4.

Table 4 Pearson's correlation analysis of the study variables.

Variables	Confidence in water quality	Water literacy	Exercise	Drinking behavior	Hydration awareness	Drinking frequency
Confidence in water quality	1.000					
Water literacy	.518* (p < .001)	1.000				
Exercise	.274* (p = .004)	.237* (p = .012)	1.000			
Drinking behavior	.038 (p = .694)	.099 (p = .301)	.196* (p = .039)	1.000		
Hydration awareness	.578* (p < .001)	.551* (p < .001)	.305* (p = .001)	-.175 (p = .066)	1.000	
Drinking frequency	-.223* (p = .018)	-.187* (p = .049)	-.043 (p = .657)	-.083 (p = .387)	-.148 (p = .120)	1.000

N = 111. r = Pearson correlation coefficient; p = p-value (two-tailed probability value). *p < .05.

Correlation Analysis: Bivariate correlation analysis (Table 4) revealed key significant relationships among the study variables. Confidence in water quality showed strong and statistically significant positive correlations with hydration awareness (r = .578, p < .001) and water literacy (r = .518, p < .001), alongside a moderate positive correlation with exercise (r = .274, p = .004). Conversely, drinking frequency exhibited a statistically significant negative correlation with confidence in water quality (r = – .223, p = .018). Drinking behavior did not demonstrate a statistically significant correlation with confidence in water quality (r = .038, p = .694).

Multiple regression analysis for water literacy, hydration awareness, drinking frequency, drinking behaviors, and exercise with confidence in water quality among secondary school students is presented in Table 5.

Table 5 Multiple regression analysis of the study variables.

Variables	*B*	*SE*	*Beta*	*t*	*p*
Water literacy	0.202	0.071	0.259	2.870	.005*
Exercise	0.077	0.060	0.103	1.296	.198
Drinking behavior	-0.101	0.088	-0.088	-1.149	.253
Hydration awareness	0.310	0.071	0.401	4.353	< .001*
Drinking frequency	-0.075	0.048	-0.118	-1.552	.124

R^2 = .42, $R^2_{adjusted}$ = .39, F (5,105) = 15.05, p < .001

*p < .05

Multiple regression analysis was performed to examine the predictive influence of the five variables on confidence in water quality (Table 5). The overall model was statistically significant, F(5,105) = 15.05, p < .001, accounting for 42.0% (R^2 = .420, R^2_{adj} = .392). Cognitive and perceptual factors emerged as the primary drivers of confidence in water quality. Specifically, hydration awareness served as the strongest positive predictor (β = .401, p < .001), followed by water literacy (β = .259, p = .005). In contrast, behavioral and physical routine variables including exercise (β = .103, p = .198), drinking frequency (β = - .118, p = .124), and

drinking behavior (β = - .088, p = .253) showed no statistically significant associations with confidence in water quality.

DISCUSSION

The results of the study revealed that hydration awareness has a statistically significant positive association with confidence in water quality, demonstrating that hydration awareness directly contributes to increasing students' confidence levels. This may be because individuals with high hydration awareness tend to be more diligent in seeking information and possess a detailed appreciation for the value and importance of their surroundings, leading to confidence derived from accurate and safe information. This mechanism aligns with the framework of (17), which explains that mindful perception facilitates the decision-making process in seeking information about water consumption to appropriately meet one's health needs.

In a similar vein, water literacy was found to have a statistically significant positive association with confidence in water quality. Individuals with high water literacy often utilize cognitive processes to stay open to, seek, and understand factual data regarding drinking water safety standards. Cognitive and social skills may determine an individual's ability to access and understand information for health maintenance, which is consistent with the health literacy concepts of (18-19) stating that cognitive and social skills determine an individual's ability to access and understand information for health maintenance. Furthermore, such individuals can critically analyze, screen, and evaluate the credibility of water sources or filtration systems, echoing the views of (20), who noted that literate individuals can effectively apply health information to daily decision-making.

Regarding exercise behavior, frequency of water intake, and drinking behavior, although these factors were important as stated in the literature, the statistical tests for multiple regression revealed insignificant association with students' confidence in water quality. This suggests that these physical health behaviors may be the external factors related to daily routines and may not directly involve the internal cognitive processes or the assessment of safety standards. This finding aligns with (21), which defines exercise as a physical movement for fitness rather than a cognitive assessment. Similarly, drinking behavior is often driven by immediate environmental contexts and external factors. As noted by (22), it is a situational process, and (5, 23) further emphasize that these patterns are heavily influenced by culture, sensory properties, accessibility, and convenience rather than internal cognitive evaluation.

In summary, when comparing the standardized regression coefficients, hydration awareness and water literacy acted as internal factors that exert a greater association with water quality confidence than external behavioral factors. Hydration awareness serves as the most significant positive driver, while water literacy reinforces rational analytical thinking. These results support the theories of (17-18,20), identifying mindful perception and health literacy as crucial cognitive safeguards. These safeguards may enable students to effectively screen and apply information in making appropriate decisions regarding their own hydration health, thereby reducing anxiety when facing health risks such as heatstroke in a timely and effective manner, while further enhancing students' confidence in the safety of the drinking water they consume in their daily lives.

CONCLUSION

This cross-sectional study examined the relationships and predictive influence of water literacy, hydration awareness, exercise, drinking behavior, and drinking frequency on confidence in water quality among 111 secondary school students. Bivariate correlation analysis demonstrated that confidence in water quality was positively correlated with water literacy, hydration awareness, and exercise, negatively correlated with drinking frequency, and showed no significant correlation with drinking behavior. Multiple regression analysis revealed that these

variables collectively explained 42% of the variance in confidence in water quality. Specifically, hydration awareness and water literacy showed statistically significant positive associations with confidence in water quality, whereas exercise, drinking frequency, and drinking behavior showed no significant associations.

These findings indicate that cognitive and perceptual factors are important for strengthening confidence in water quality and promoting adequate hydration. School-based and public health initiatives should prioritize hydration awareness and understanding of physiological responses to heat exposure. Practical strategies may include scheduled water breaks during outdoor activities to encourage students to monitor thirst signals and reduce dehydration risks. Future research should focus on developing innovative approaches to hydration literacy and evaluating their effectiveness through randomized controlled trials (RCTs) or research and development (R&D) frameworks to support sustainable heatstroke prevention in school settings

ETHICAL DECLARATION

Formal ethical approval for this study was waived because data were collected through an anonymous online survey with no physical or psychological risks**.** The details of the study purpose, data confidentiality, and voluntary nature of participation were given. Electronic consent was integrated into the questionnaire, and participants were required to agree to the consent terms before accessing the survey questions. Those who did not provide consent could not proceed with the survey.

LIMITATION

This study has limitations regarding sample demographic distribution. Specifically, there were imbalances in gender representation, age groups, and educational levels between lower and upper secondary school students. Although efforts were made to collect data across all groups, these demographic disparities may limit the generalizability of the findings to the broader secondary school student population.

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Track V

Migration, Population and Ageing

ASSOCIATION BETWEEN THAI LANGUAGE PROFICIENCY AND PSYCHOSOCIAL WELL-BEING AMONG MYANMAR MIGRANTS IN SAMUT SAKHON PROVINCE, THAILAND

Kyaw Kyaw Phyo Myat[1], Orapin Laosee[1*], Piyapong Janmaimool[1], Cheerawit Rattanapan[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand
**Corresponding Author: Orapin Laosee, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73170, Thailand, Email: orapin.lao@mahidol.ac.th*

ABSTRACT

Introduction: Thailand hosts an estimated 4.1 million Myanmar migrants. Limited host-country language proficiency is widely theorised to undermine migrant well-being, but direct evidence using a positive mental health framework is limited.

Objectives: To examine the association between Thai language proficiency and psychosocial well-being and its domains among Myanmar migrants in Samut Sakhon Province, and to describe the levels of proficiency and well-being.

Methodology: A community-based cross-sectional study recruited 427 Myanmar migrants in Mueang Samut Sakhon District from 15 to 31 May 2026 by purposive multistage sampling with voluntary response recruitment. The sample size followed Cochran's formula for a single proportion ($Z = 1.96$, $p = 0.50$, $e = 0.05$) with a 10% non-response adjustment. Thai oral proficiency (listening and speaking) was assessed with a CEFR-aligned objective test; literacy was excluded because reading and writing showed floor effects (>94% at the lowest level). Well-being was measured with the 14-item Mental Health Continuum-Short Form and dichotomised, using Keyes' criteria, into poor (languishing) versus non-poor. Covariates identified by bivariate screening were entered with oral proficiency into multivariate logistic regression ($p < 0.05$).

Results: Most participants were not orally proficient in Thai (61.4%). Poor psychosocial well-being affected 31.1% overall and 38.6%, 41.2% and 24.1% in the emotional, social and psychological domains. Thai oral proficiency was not independently associated with poor well-being in any domain (all $p > 0.12$). Bamar ethnicity predicted poor overall (AOR 2.24, 95% CI 1.28-3.89) and psychological (AOR 2.49, 95% CI 1.31-4.72) well-being; low co-ethnic social support predicted poor overall (AOR 1.70, 95% CI 1.08-2.69) and social (AOR 1.75, 95% CI 1.14-2.70) well-being; and low host social integration predicted poor social (AOR 2.58, 95% CI 1.39-4.78) and psychological (AOR 2.46, 95% CI 1.09-5.59) well-being. Impaired physical health independently predicted poor well-being in the overall, emotional, and social domains. Ethnic minorities were more proficient in Thai yet less likely to report poor well-being.

Conclusion: Thai oral proficiency was not an independent predictor of psychosocial well-being, which was instead shaped by ethnicity, physical health and social connectedness. Strengthening co-ethnic support and host integration, integrating physical and mental health care, and prioritising higher-risk Bamar and older migrants are the principal implications.

Keywords:
Thai Language Proficiency; Psychosocial Well-Being; Myanmar Migrants; Mental Health Continuum; Ethnicity

INTRODUCTION

International migration has expanded markedly in recent decades, driven mainly by labour demand. Migrant workers contribute to host economies but face insecure legal status, restricted employment and limited social protection, producing measurable health inequalities (1). Language barriers are a primary mechanism: limited host-country language proficiency reduces service access and worsens communication, workplace risk, and mental health, and is especially consequential for

psychosocial well-being because language mediates participation in institutions and social life (2).

Across the Asia-Pacific region, most migration is intra-regional and labour-driven, and migrants are concentrated in dirty, dangerous, and demanding sectors. A 2025 systematic review of migrant workers in Association of Southeast Asian Nations (ASEAN) countries reported pooled prevalences of 34.8% for depression and 37.7% for anxiety, substantially exceeding global averages (3).

Thailand hosts the largest migrant population in Southeast Asia, with an estimated 4.1 million Myanmar nationals, including many undocumented workers (4). Samut Sakhon, a centre of seafood and industrial labour, has one of the densest concentrations of Myanmar migrants, where language barriers, limited integration and discrimination are commonly reported (5). Thai is acquired only after arrival and largely informally; it is tonal, uses a non-Latin script, and is linguistically distant from Burmese, producing basic oral ability but very limited literacy (6).

Global syntheses have linked host-language proficiency to all three domains of psychosocial well-being and to social integration, with marginalisation associated with the poorest outcomes (7-9). That evidence comes mainly from high-income Western settings, where the host language is also a global language and literacy is central to daily life and work. Whether it holds in Thailand, where Thai is learned after arrival, has limited utility abroad and many migrants live within their own ethnic communities, is unclear, and no prior study in this population has combined an objective, skill-specific measure of Thai proficiency with a positive-mental-health framework. This study therefore examined whether Thai proficiency is independently associated with psychosocial well-being and its domains after adjustment.

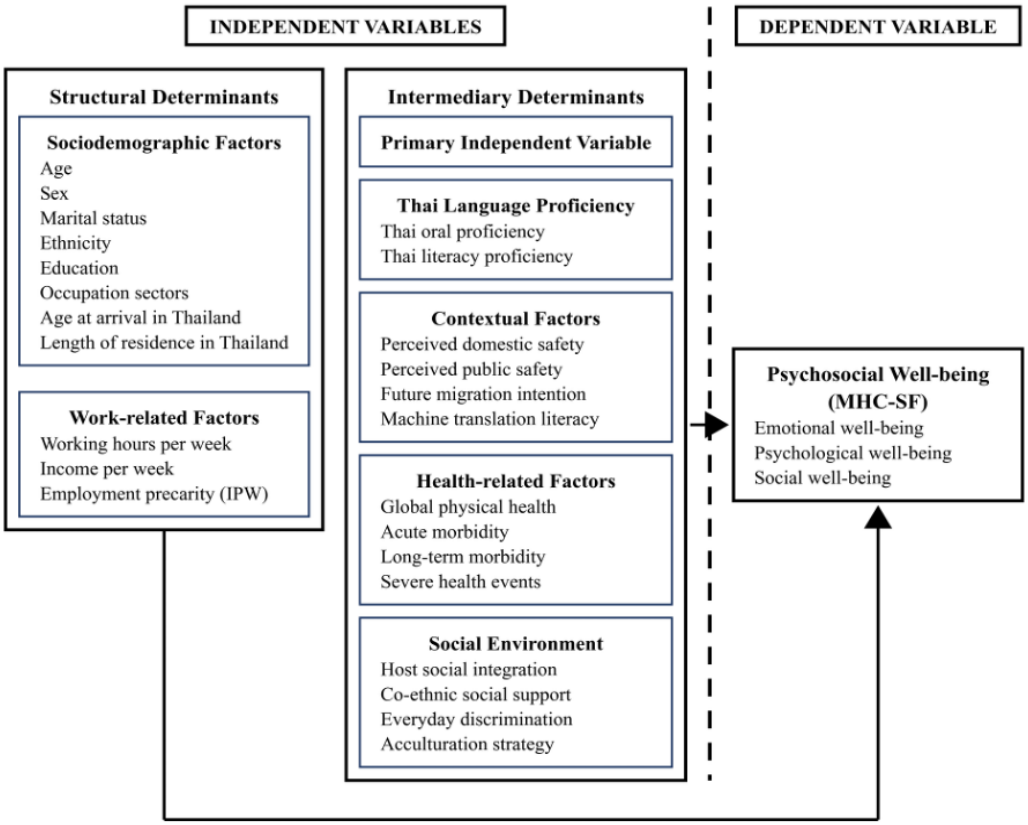

Figure 1 Conceptual framework: Thai language proficiency as an intermediary determinant of psychosocial well-being, adapted from the WHO Social Determinants of Health framework

METHODOLOGY

Study design and population

This community-based cross-sectional study was conducted among Myanmar migrant workers in Mueang Samut Sakhon District, Samut Sakhon Province. Eligible participants were self-identified Myanmar nationals aged 18 years or older who had lived in Thailand for at least six months and gave informed consent. Those with an uncorrected severe speech, vision, or hearing problem that could interfere with the language assessment were excluded. Because the true population size is unknown owing to undocumented workers, an infinite population was assumed, and the initial sample size was obtained from Cochran's formula for a single population proportion, $n_0 = Z^2p(1-p)/e^2$, with Z = 1.96 (95% confidence level), p = 0.50 (the most conservative assumption, yielding maximum variance) and e = 0.05 (margin of error), giving $n_0 \approx 384$ (10). A 10% inflation for anticipated non-response and incomplete questionnaires gave a final target of 427 participants.

Sampling

Participants were recruited by purposive, multistage sampling with voluntary response recruitment. The district and migrant-dense communities within it were selected on the basis of migrant density and diversity, with the sample allocated proportionally to estimated population size across sub-clusters. Although the protocol had specified probability-based sampling, random selection proved infeasible in this undocumented, highly mobile and gatekeeper-mediated population. Consenting migrants were therefore recruited at accommodation complexes on weekdays and Saturdays and at public gathering places on Sundays. Data were collected from 15 to 31 May 2026, when most migrants were free, by three bilingual or trilingual research assistants (Thai-Burmese, two also speaking Mon) supervised by the principal investigator.

Measures

The primary exposure was Thai oral proficiency, assessed by an objective test aligned with the Common European Framework of Reference for Languages (CEFR), covering listening and speaking. Listening used three audio clips at CEFR levels A1, A2, and B1 in a stepwise ("stop-and-go") structure: all participants began with the A1 clip and answered three multiple-choice questions, and at least two correct answers were required to move up a level. Speaking was assessed in the same stepwise way with recorded responses to Thai prompts. Each participant was classified as Below A1, A1, A2, or B1 (Figure 2) and, for analysis, as orally proficient or orally incompetent. Reading and writing were measured with self-rated CEFR-based items but were removed because more than 94% scored at the lowest level.

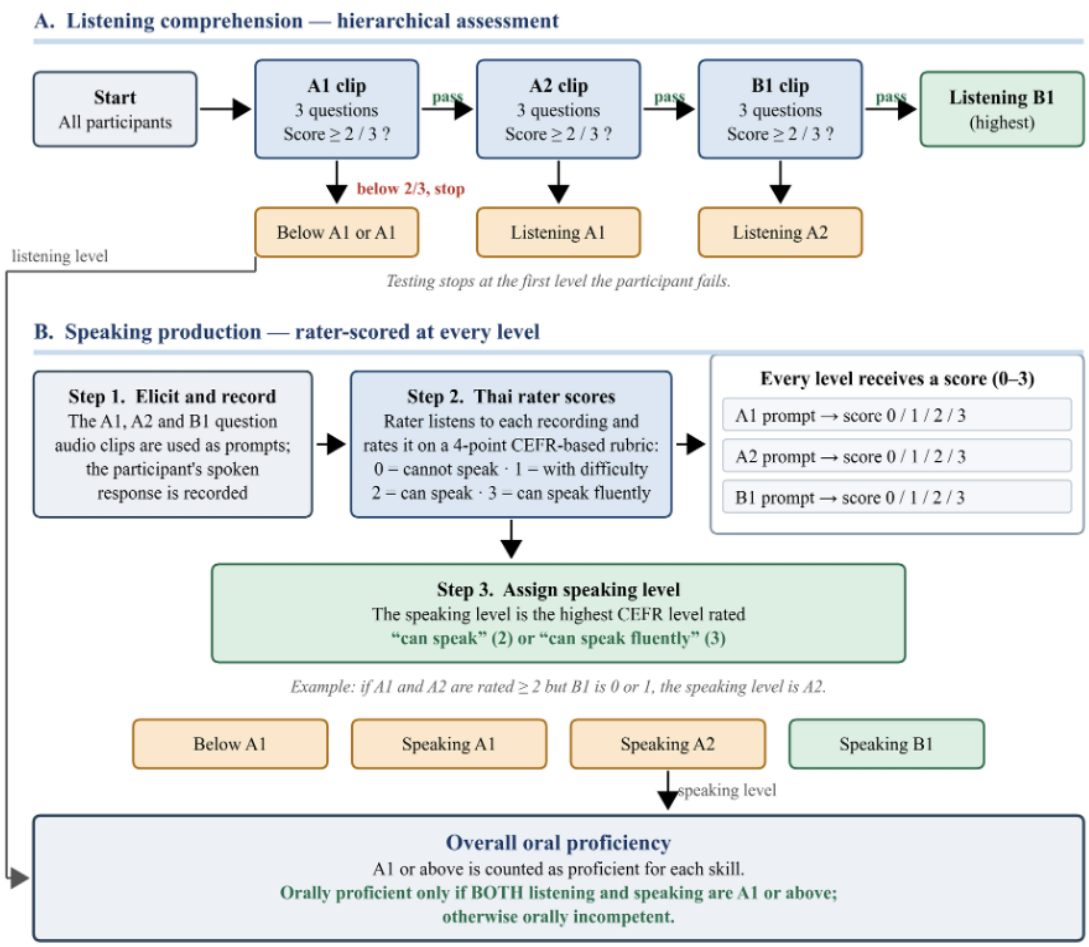

Figure 2 Objective stepwise ("stop-and-go") assessment of Thai listening and speaking

Psychosocial well-being was measured with the 14-item Mental Health Continuum-Short Form (MHC-SF), which gives a total score (0-70) and emotional, social, and psychological subscale scores (11). Participants were classified as flourishing, moderately mentally healthy, or languishing by Keyes' diagnostic criteria, which depend on how frequently the highest or the lowest response options are endorsed on the three emotional items and on the eleven social and psychological items (11,12). For analysis, this was grouped into poor (languishing) versus non-poor.

Validity and reliability of the instruments

All items were translated into Burmese by forward and backward translation. Content validity was assessed by three experts using the Item-Objective Congruence index, with all items exceeding the 0.50 threshold, and the instrument was pilot-tested with 30 migrants. Internal consistency of the multi-item scales, including the MHC-SF, was examined with Cronbach's alpha ($\alpha \geq 0.70$ accepted), the eight binary items of the Index of Precarious Work with the Kuder-Richardson Formula 20, single-item health measures by test-retest at seven days, and inter-rater agreement for the speaking task between two trained raters, both using Cohen's kappa ($\kappa \geq 0.70$ accepted). The MHC-SF is well validated: its three-factor structure has been confirmed independently (13), internal consistency is acceptable to high across settings (α = 0.74-0.91), and metric invariance is demonstrated in a 38-nation study (14).

Covariates

Covariates spanned sociodemographic characteristics (age, sex, ethnicity, marital status, education, age at arrival, length of residence),

work-related factors (occupational sector, working hours, weekly income, employment precarity), contextual factors (perceived domestic and public safety, machine-translation literacy, migration intention), the social environment (host social integration and co-ethnic social support, measured with the Immigration Policy Lab subscales, discrimination and acculturation strategy) and health-related factors (PROMIS Global Physical Health T-score, acute morbidity, chronic illness, severe health events).

Statistical analysis

Analyses were performed in IBM SPSS Statistics. Categorical variables are summarised as frequencies and percentages, and continuous variables, all non-normally distributed, as medians with interquartile ranges (IQR). Bivariate (unadjusted) logistic regression was run for each of the four binary outcomes, giving crude odds ratios (COR) with 95% confidence intervals (CI). Variables associated with an outcome at $p < 0.25$ were entered into multivariate logistic regression, giving adjusted odds ratios (AOR) with 95% CI (15). Oral proficiency, the main exposure, was kept in every model regardless of significance. The primary analysis was backward stepwise (likelihood-ratio) elimination, with forced entry of all screened variables for comparison. Host social integration and co-ethnic social support were each entered as categorical predictors (high versus low), cut at the conceptual midpoint of the scale (1.5 on the 0-3 scale) rather than the sample median. Significance was set at $p < 0.05$.

RESULTS

Sample characteristics, proficiency and well-being

Among the 427 participants, the median age was 34 years (IQR 28-41), and 74.7% were female; the female predominance reflected reluctance among conscription-aged men to participate following Myanmar's 2024 military-service law. Bamar was the largest ethnic group (64.6%), 68.4% were married, and 63.5% had only basic education. Just over half worked in seafood processing (53.2%). Most participants were not orally proficient in Thai (61.4%); only 3.8% had any functional literacy, with more than 94% scoring at the lowest level in reading and writing.

The median MHC-SF total score was 33 (IQR 19-42). Overall, 31.1% had poor (languishing) well-being and 68.9% had non-poor well-being (50.6% moderately mentally healthy, 18.3% flourishing). Poor well-being was most common in the social domain (41.2%), followed by emotional (38.6%) and psychological (24.1%) (Figure 3).

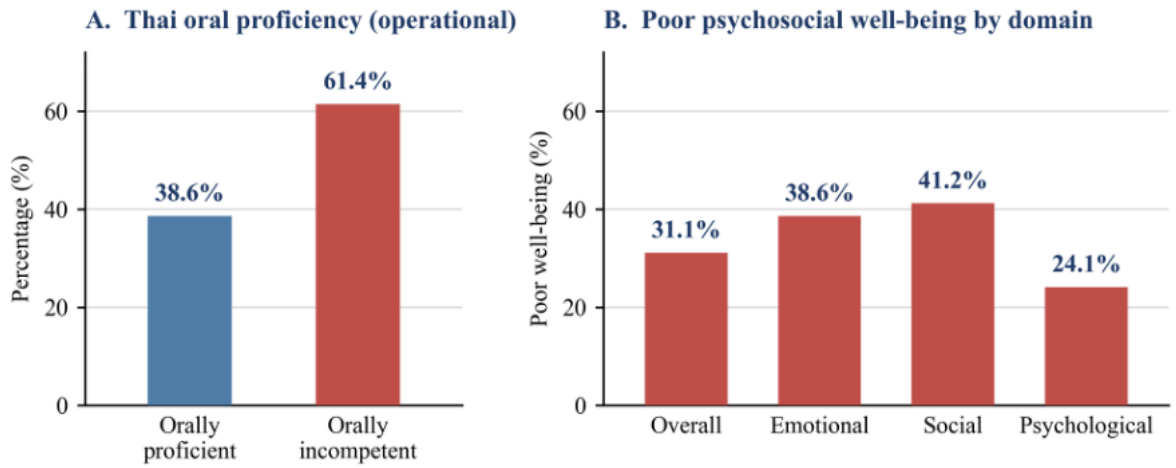

Figure 3 Levels of Thai oral proficiency and poor psychosocial well-being by domain among Myanmar migrants (n = 427) *Poor well-being = languishing on the MHC-SF, or the poor category in each domain.*

Predictors of poor well-being (logistic regression)

Bivariate associations for all candidate predictors are given in Table 1. In the multivariate models, Thai oral proficiency was not associated with poor well-being in any domain (all $p > 0.12$). Bamar ethnicity predicted poor overall (AOR 2.24, 95% CI 1.28-3.89) and psychological (AOR 2.49, 95% CI 1.31-4.72) well-being; low co-ethnic social support predicted poor overall (AOR 1.70, 95% CI 1.08-2.69) and social (AOR 1.75, 95% CI 1.14-2.70) well-being; and low host social integration predicted poor social (AOR 2.58, 95% CI 1.39-4.78) and psychological (AOR 2.46, 95% CI 1.09-5.59) well-being. Impaired physical health independently predicted poor well-being in the overall, emotional, and social domains. Predictors significant in the final models are given in Table 2 (area under the ROC curve 0.70-0.74); the complete full and final models are available from the corresponding author on request.

Table 1 Bivariate logistic regression of candidate predictors and poor psychosocial well-being across four domains (n = 427)

Variables (risk category)	Overall		Emotional		Social		Psychological	
	COR (95% CI)	*p*	COR (95% CI)	*p*	COR (95% CI)	*p*	COR (95% CI)	*p*
Thai oral proficiency (Ref: orally proficient)								
Orally incompetent	1.81 (1.17-2.80)	**0.008****	1.65 (1.09-2.48)	**0.017***	1.58 (1.05-2.36)	**0.027***	2.22 (1.36-3.65)	**0.002****
Ethnicity (Ref: non-Bamar)								
Bamar	1.93 (1.22-3.03)	**0.005****	1.81 (1.19-2.76)	**0.006****	2.23 (1.46-3.40)	**<0.001*****	1.99 (1.20-3.28)	**0.008****
Age group (Ref: 25-45 y)								
18-24 years	1.16 (0.60-2.24)	0.659	1.40 (0.75-2.61)	0.288	1.44 (0.78-2.65)	0.248	1.95 (0.99-3.84)	0.052
Over 45 years	1.91 (1.14-3.21)	**0.014***	2.48 (1.49-4.13)	**<0.001*****	2.04 (1.23-3.38)	**0.006****	2.90 (1.69-4.97)	**<0.001*****
Education (Ref: secondary)								
Basic	1.34 (0.85-2.10)	0.211	1.43 (0.93-2.21)	0.104	1.45 (0.94-2.23)	0.095	1.55 (0.95-2.51)	0.077
Tertiary	0.75 (0.41-1.37)	0.344	0.56 (0.31-1.02)	0.057	0.98 (0.57-1.68)	0.928	0.75 (0.38-1.47)	0.398
Occupational sector (Ref: seafood)								
Manufacturing	0.80 (0.47-1.34)	0.393	0.84 (0.52-1.37)	0.495	1.15 (0.71-1.85)	0.564	1.20 (0.68-2.09)	0.532
Other	1.32 (0.80-2.18)	0.271	1.36 (0.84-2.20)	0.209	1.71 (1.05-2.76)	**0.029***	2.03 (1.19-3.45)	**0.009****
Length of residence (Ref: <3 y)								
4-9 years	0.71 (0.39-1.28)	0.254	0.88 (0.50-1.55)	0.647	0.72 (0.41-1.26)	0.249	0.56 (0.30-1.06)	0.076
10-19 years	0.68 (0.39-1.20)	0.187	0.65 (0.37-1.13)	0.128	0.62 (0.36-1.07)	0.086	0.47 (0.25-0.87)	**0.016***
≥ 20 years	0.77 (0.41-1.42)	0.400	1.23 (0.68-2.22)	0.493	0.78 (0.43-1.41)	0.413	0.80 (0.42-1.51)	0.484
Weekly income (Ref: higher)								
Lower	1.89 (1.23-2.92)	**0.004****	1.73 (1.14-2.62)	**0.010***	2.01 (1.33-3.05)	**<0.001*****	2.64 (1.66-4.17)	**<0.001*****
Employment precarity (Ref: moderate)								
Low	1.67 (0.97-2.86)	0.063	1.01 (0.60-1.70)	0.967	1.19 (0.72-1.98)	0.496	1.66 (0.92-3.01)	0.094
High	1.94 (1.21-3.11)	**0.006****	1.67 (1.07-2.60)	**0.024***	1.49 (0.96-2.32)	0.076	2.21 (1.32-3.68)	**0.002****
Perceived domestic safety (Ref: higher)								
Lower	1.55 (1.01-2.37)	**0.044***	1.44 (0.96-2.17)	0.080	1.45 (0.97-2.18)	0.073	1.27 (0.80-2.02)	0.308
Host social integration (Ref: high)								
Low	1.70 (0.97-2.98)	0.062	1.87 (1.11-3.17)	**0.019***	2.67 (1.55-4.61)	**<0.001*****	3.15 (1.52-6.54)	**0.002****

Variables (risk category)	Overall		Emotional		Social		Psychological	
	COR (95% CI)	*p*	COR (95% CI)	*p*	COR (95% CI)	*p*	COR (95% CI)	*p*
Co-ethnic social support (Ref: high)								
Low	1.71 (1.13-2.58)	**0.011***	1.38 (0.93-2.04)	0.111	1.81 (1.22-2.67)	**0.003****	2.48 (1.57-3.90)	**<0.001*****
Global physical health (Ref: not impaired, T ≥ 40)								
Impaired (T < 40)	1.92 (1.20-3.06)	**0.006****	2.22 (1.41-3.51)	**<0.001*****	1.55 (0.99-2.44)	0.057	1.01 (0.60-1.70)	0.974
Acculturation strategy (Ref: integration)								
Assimilation	2.93 (1.02-8.45)	**0.047***	1.68 (0.64-4.42)	0.292	1.12 (0.41-3.08)	0.824	1.77 (0.44-7.14)	0.420
Separation	2.39 (1.01-5.64)	**0.048***	2.10 (1.01-4.37)	**0.048***	2.05 (0.99-4.28)	0.055	2.57 (0.87-7.62)	0.088
Marginalisation	3.68 (1.55-8.73)	**0.003****	2.76 (1.31-5.82)	**0.007****	4.10 (1.95-8.62)	**<0.001*****	6.72 (2.29-19.67)	**<0.001*****

Note. COR = crude odds ratio; CI = confidence interval; reference category in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 2 Predictors statistically significant in the final multivariate models of poor psychosocial well-being, by domain (n = 427)

Variables	Bivariate		Full model		Final model	
	Unadjusted OR	95% CI	Adjusted OR	95% CI	Adjusted OR	95% CI
Overall psychosocial well-being						
Thai oral proficiency: orally incompetent (Ref: orally proficient)	1.81**	1.17-2.80	1.41	0.81-2.45	1.46	0.90-2.37
Ethnicity: Bamar (Ref: non-Bamar)	1.93**	1.22-3.03	2.24**	1.28-3.89	2.23**	1.36-3.66
Employment precarity: low (Ref: moderate)	1.67	0.97-2.86	0.54*	0.30-0.99	0.53*	0.30-0.94
Co-ethnic social support: low (Ref: high)	1.71*	1.13-2.58	1.70*	1.08-2.69	1.73*	1.11-2.67
Global physical health: impaired (Ref: not impaired)	1.92**	1.20-3.06	1.82*	1.06-3.12	1.85*	1.10-3.12
Emotional well-being						
Thai oral proficiency: orally incompetent (Ref: orally proficient)	1.65*	1.09-2.48	1.37	0.81-2.32	1.38	0.83-2.29
Education: tertiary (Ref: secondary)	0.56	0.31-1.02	0.48*	0.24-0.97	0.40**	0.20-0.78
Global physical health: impaired (Ref: not impaired)	2.22***	1.41-3.51	2.17**	1.27-3.70	2.27**	1.39-3.70
Social well-being						
Thai oral proficiency: orally incompetent (Ref: orally proficient)	1.58*	1.05-2.36	0.88	0.52-1.48	0.89	0.55-1.43
Weekly income: lower (Ref: higher)	2.01***	1.33-3.05	1.66	0.95-2.92	1.66*	1.05-2.61
Host social integration: low (Ref: high)	2.67***	1.55-4.61	2.58**	1.39-4.78	2.23**	1.26-3.94
Co-ethnic social support: low (Ref: high)	1.81**	1.22-2.67	1.75*	1.14-2.70	1.82**	1.20-2.76
Global physical health: impaired (Ref: not impaired)	1.55	0.99-2.44	1.54	0.91-2.63	1.67*	1.02-2.78
Psychological well-being						
Thai oral proficiency: orally incompetent (Ref: orally proficient)	2.22**	1.36-3.65	1.31	0.69-2.48	1.29	0.72-2.32
Ethnicity: Bamar (Ref: non-Bamar)	1.99**	1.20-3.28	2.49**	1.31-4.72	2.24**	1.29-3.89
Weekly income: lower (Ref: higher)	2.64***	1.66-4.17	1.67	0.89-3.12	1.99**	1.20-3.31
Host social integration: low (Ref: high)	3.15**	1.52-6.54	2.46*	1.09-5.59	2.38*	1.11-5.12

Note. OR = odds ratio; CI = confidence interval; reference category in parentheses. Unadjusted estimates are bivariate; full model = all screened covariates entered together; final model = backward stepwise (likelihood-ratio) selection. Thai oral proficiency, the primary exposure, is shown for every domain irrespective of significance; otherwise, only covariates significant in the final model are listed. Nagelkerke R^2 = 0.152, 0.177, 0.179 and 0.227 for the four full models. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

DISCUSSION

The primary finding, across two analytic approaches and all four outcomes, was that Thai oral proficiency was not an independent predictor of well-being. This is inconsistent with studies in which host-language proficiency was protective (2,8), but consistent with evidence that its effects operate through the social environment (9). An additional model with oral proficiency as the outcome showed that it is determined mainly by exposure timing and host social integration, the same factors tied to well-being; once these are accounted for, proficiency retains little unique variance with which to predict well-being.

The strongest and most consistent protective factor was social connectedness. Low co-ethnic support predicted poorer overall and social well-being, whereas low host integration predicted poorer social and psychological well-being, so the two operate through partially distinct pathways, consistent with acculturation theory and with meta-analytic evidence that social connectedness protects migrant mental health (8,16,17). Because co-ethnic support is more readily fostered than host-society integration where structural inclusion is limited, strengthening co-ethnic networks is a pragmatic and modifiable lever (18).

Physical health was a further robust correlate, supporting the case for integrated care. Older migrants (45+ years) and those with lower income were also more vulnerable, consistent with the strains of precarious labour migration. Employment precarity itself was not straightforwardly associated with well-being, echoing observations that objective material conditions and subjective well-being do not always align among migrants (19).

The most notable unexplained finding was the disadvantage associated with Bamar ethnicity, which was significant for every outcome and, unexpectedly, strengthened after adjustment. Bamar respondents were relatively advantaged on education, employment precarity and physical health, and were less proficient in Thai; holding these factors constant revealed an even larger ethnic gap, suggesting statistical suppression rather than confounding. The disparity points instead to unmeasured, ethnicity-linked stressors such as perceived discrimination or the pre-migration and settlement experience; discrimination and distress vary by migration stage and origin group elsewhere (20).

This study provides the first community-based evidence linking objectively assessed Thai proficiency to multidimensional psychosocial well-being in this population. It reconceptualises language as a distal, enabling resource rather than a direct determinant, and highlights social connectedness and ethnicity-linked disadvantage as more proximate.

CONCLUSION

Among Myanmar migrants in Samut Sakhon, Thai oral proficiency was not an independent predictor of psychosocial well-being. Well-being was instead shaped by ethnicity, physical health and, most consistently, social connectedness: low co-ethnic social support and low host social integration each carried higher risk in specific domains. The Bamar majority had poorer outcomes in every domain, and this gap widened after adjustment despite their educational, occupational and health advantages.

RECOMMENDATIONS

Because social connectedness and physical health, rather than Thai proficiency, were linked to well-being, interventions should target these, and workable delivery models already exist locally. Co-ethnic support can be strengthened through Sunday peer-support groups in the accommodation complexes and community spaces where migrants already gather, led by community leaders and migrant-school teachers and sustained by Burmese- and Mon-language messaging groups. Host integration can be fostered through workplace Thai conversation clubs and joint activities with Thai co-workers. Physical and mental health care can be linked by adding a brief MHC-SF check to

the annual migrant health examination, with referral to Migrant Health Volunteers trained in Burmese-language psychological first aid and with Bamar and older migrants prioritised. Short smartphone sessions on translation applications would help migrants over 45 years manage daily communication. Such measures align with Thailand's commitments to migrant-inclusive health and universal health coverage. Future research should measure perceived discrimination, pre-migration circumstances and documentation status, and use longitudinal and mixed-methods designs.

LIMITATIONS

The cross-sectional design precludes causal inference, and proficiency, integration and well-being are plausibly reciprocal. All measures were self-reported except the oral-proficiency test, and Thai literacy could not be analysed because of floor effects. The female-predominant sample and the focus on a single industrial province may limit generalisability, and voluntary response sampling means selection and volunteer bias cannot be excluded. Finally, perceived discrimination, documentation status and relationship quality were not directly modelled.

ETHICAL DECLARATION

The study protocol was approved by the Mahidol University Central Institutional Review Board (MU-CIRB 2026/235.1704; approved on 14 May 2026). Written informed consent was obtained from all participants. Participation was voluntary and anonymous; no personal identifiers were linked to the data, and migrants were included regardless of documentation status.

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FACTORS ASSOCIATED WITH SOCIOCULTURAL ADAPTATION AMONG FILIPINO MIGRANTS IN BANGKOK, THAILAND

Cinderella Robles Rancap[1], Orapin Laosee[1]*, Piyapong Janmaimool[1], Syarifah Aqilah[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Nakhon Pathom 73170, Thailand
Corresponding Author: *Orapin Laosee, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand, Email: orapin.lao@mahidol.ac.th*

ABSTRACT

Introduction: Filipino migrants represent one of the largest migrant populations in Thailand and contribute substantially to the country's workforce. Although many experience favorable migration outcomes, adapting to a new sociocultural environment remains a complex process influenced by social relationships, cultural integration, language proficiency, and psychological well-being. Sociocultural adaptation refers to an individual's ability to effectively adjust to the social and cultural demands of the host environment and is essential for successful integration and overall well-being. However, evidence on the factors associated with sociocultural adaptation among Filipino migrants residing in Bangkok remains limited.

Objectives: To determine the level of sociocultural adaptation and identify factors associated with high sociocultural adaptation among Filipino migrants residing in Bangkok, Thailand.

Methodology: A cross-sectional study was conducted among 385 Filipino migrants in Bangkok, Thailand, using multistage sampling. Sociocultural adaptation was assessed using the 23-item Sociocultural Adaptation Scale (SCAS), while migration life experiences and mental health were measured using validated questionnaires. Descriptive statistics, Pearson's chi-square, Mann-Whitney U tests, and logistic regression analyses were performed. Variables with $p \leq 0.25$ were entered into a multiple logistic regression model using the Backward Likelihood Ratio method. Statistical significance was set at $p < 0.05$.

Results: Participants demonstrated a high level of sociocultural adaptation (mean = 4.07 ± 0.72). Positive migration experiences showed the strongest association with high sociocultural adaptation (AOR = 24.69, 95% CI: 9.57–63.72). Lower perceived disconnection (AOR = 2.53, 95% CI: 1.30–4.91), stronger social relationships (AOR = 2.78, 95% CI: 1.33–5.81), greater interpersonal closeness (AOR = 2.61, 95% CI: 1.01–6.75), depression (AOR = 1.73, 95% CI: 1.09–2.75), Thai language proficiency ($p < 0.001$), and monthly income ($p = 0.026$) were also independently associated with high sociocultural adaptation. The final model demonstrated good calibration (Hosmer-Lemeshow $p = 0.202$), explained 80.5% of the variance (Nagelkerke $R^2 = 0.805$), and correctly classified 91.7% of participants.

Conclusion: Filipino migrants in Bangkok demonstrated a high level of sociocultural adaptation. Positive migration experiences were the strongest predictor, followed by lower perceived disconnection, stronger social relationships, greater interpersonal closeness, Thai language proficiency, monthly income, and depression. These findings support the development of culturally responsive migrant support and Primary Health Care programs that promote social integration, language proficiency, and mental well-being.

Keywords:
Sociocultural Adaptation; Filipino Migrants; Bangkok; Thailand; Mental Health; Social Relationships.

INTRODUCTION

International migration involves adjustment to unfamiliar social, cultural, and institutional environments. Migrants must learn new cultural norms, establish social networks, and adapt to everyday life in the host society, with important implications for their well-being and social integration (1-3).

Sociocultural adaptation refers to an individual's ability to effectively function within a new cultural environment through the acquisition of knowledge, skills, and behaviors (4-6). Successful sociocultural adaptation has been associated with better psychological well-being, stronger social integration, and quality of life, whereas adaptation difficulties may contribute to social isolation and psychological distress (3, 4, 7).

Thailand has emerged as an important destination for Filipino migrants due to employment opportunities in education, healthcare, business, hospitality, and other professional sectors (8). Filipino migrants constitute a visible migrant community in Thailand, particularly in educational and professional sectors, and contribute significantly to the country's labor market and service industries (9, 10). Despite these opportunities, Filipino migrants may still encounter challenges related to language barriers, cultural differences, social integration, and psychological adjustment while adapting to life in Thailand. These migration-related experiences may influence their ability to establish meaningful social relationships and successfully integrate into Thai society. Similar adjustment challenges have been reported among migrant populations in Thailand and other cross-cultural settings. (11)

Previous research has demonstrated that migrants' adaptation outcomes are shaped by a combination of social, psychological, and environmental factors. Positive life experiences, supportive social relationships, and a sense of closeness and belonging have been associated with better adaptation outcomes and lower levels of acculturative stress (12). In contrast, perceived discrimination, social disconnectedness, anxiety, and depression may hinder the adaptation process by limiting social participation and reducing engagement with the host culture (13, 14). Migrants experiencing psychological distress often face greater difficulties in adapting to host environments and maintaining overall well-being (15, 16).

While migration and adaptation have been widely studied in various international contexts, evidence regarding Filipino migrants in Thailand remains limited. Existing studies have primarily focused on migration patterns, employment conditions, and legal status, with relatively little attention given to sociocultural adaptation and its associated factors among Filipino migrants residing in Bangkok. Understanding these factors is important for developing interventions and policies that promote migrant well-being and facilitate successful integration within the host society.

Therefore, this study aimed to examine the level of sociocultural adaptation among Filipino migrants residing in Bangkok, Thailand and to identify the factors associated with sociocultural adaptation, including life experiences, social relationships, and mental health.

METHODOLOGY

Study Design

A cross-sectional descriptive study was conducted among Filipino migrants residing in Bangkok, Thailand. The study was guided by Ward's Sociocultural Adaptation Framework and Life Course Theory.

Study Sampling

A multistage sampling procedure was used to recruit Filipino migrants residing in Bangkok, Thailand. Bangkok was selected because it hosts one of the largest Filipino migrant populations. Five districts, Bang Rak, Sathorn, Pathum Wan, Dusit, and Phaya Thai, were purposively selected because they were known to contain established Filipino migrant communities and identifiable congregation sites where eligible participants could be reached. Following district selection, proportionate stratified allocation was used to distribute the target sample according to the estimated Filipino migrant population in each district. Eligible participants were subsequently recruited through three rounds of spatial systematic

random sampling at churches, community centers, and other Filipino congregation venues.

The sample size was calculated using Cochran's formula for estimating a proportion in a large or unknown population because no complete and reliable sampling frame was available for Filipino migrants residing in Bangkok. A 95% confidence level (Z = 1.96), 5% margin of error (e = 0.05), and an expected proportion of 0.50 (p = 0.50) were used.

The sample size was calculated as: $n_0 = Z^2p(1-p) / e^2$

where $Z = 1.96$, $p = 0.50$, and $e = 0.05$. This yielded a minimum required sample size of approximately 384 participants, which was rounded up to 385 respondents. A total of 385 eligible Filipino migrants completed the survey and were included in the final analysis.

Participants were eligible if they were Filipino nationals aged 18–60 years, residing in Bangkok, Thailand, and able to read and understand English independently. Individuals were excluded if they were temporary visitors or tourists, resided outside Bangkok, were unable to provide informed consent, or submitted questionnaires with substantial incomplete responses according to the predefined data-quality criteria.

After providing written informed consent, participants completed a structured self-administered electronic questionnaire using KoboToolbox (https://kf.kobotoolbox.org/) by scanning a QR code with their mobile devices or using a tablet provided by the research team. The questionnaire included previously validated instruments assessing sociodemographic characteristics, sociocultural adaptation, migration life experiences, and mental health. Responses were securely stored in the KoboToolbox database for subsequent analysis.

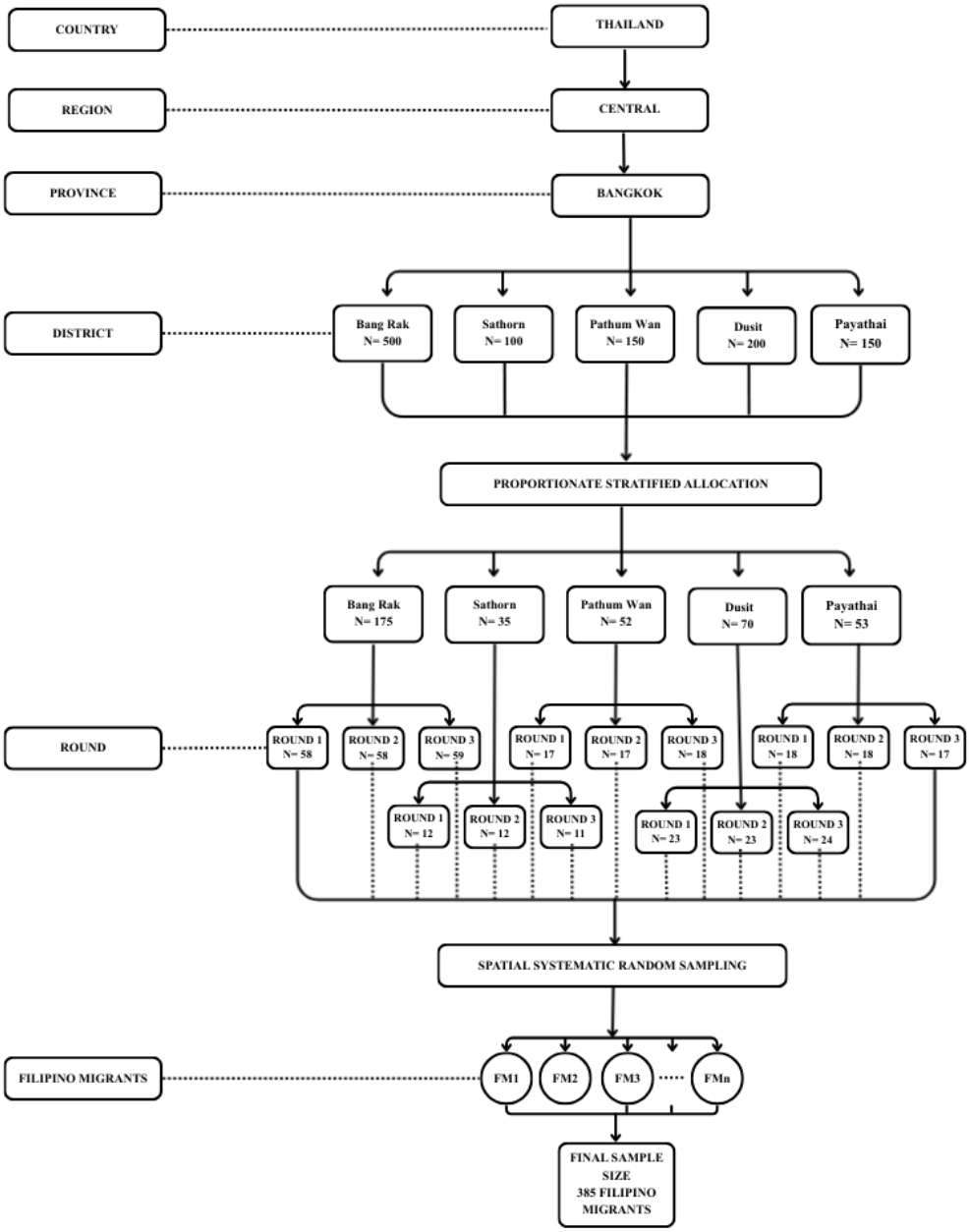

Figure 1. Flow Diagram of Sample Selection

Measures

The questionnaire consisted of four sections: sociodemographic characteristics, sociocultural adaptation, life experiences, and mental health. Sociocultural adaptation was assessed using an adapted version of the Sociocultural Adaptation Scale (SCAS) developed by Ward and Kennedy and revised by Wilson (17, 18). Life experiences, including positive experiences, disconnection, social relationships, and closeness, were adapted from the UK Home Office Feasibility Study for a Survey of Migrants(19). Mental health was assessed using anxiety and depression items adapted from the Brief Symptom Inventory (20). All items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with negatively worded disconnection items reverse-coded before composite scores were calculated.

All instruments used in this study were open access and did not require paid licensing. The adapted questionnaire underwent expert

content validation and pilot testing before the main data collection. Internal consistency was assessed using Cronbach's alpha. The Sociocultural Adaptation Scale demonstrated excellent reliability (α = 0.953). The coefficients for Positive Experiences, Disconnection, Social Relationships, and Closeness were 0.900, 0.800, 0.875, and 0.893, respectively. Cronbach's alpha was 0.980 for Anxiety and 0.864 for Depression, indicating good to excellent internal consistency across all constructs.

For descriptive interpretation, composite mean scores were classified as 1.00–1.80 = very low, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, and 4.21–5.00 = very high. For inferential analyses, scores of 1.00–3.40 were classified as low and scores of 3.41–5.00 as high.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics were used to summarize participants' characteristics and study variables. Normality was assessed using the Shapiro–Wilk test, and all continuous variables were found to be non-normally distributed ($p < 0.001$). Therefore, Pearson's Chi-square test was used to examine associations between categorical variables and sociocultural adaptation, while the Mann–Whitney U test was used for continuous variables. Crude binary logistic regression was performed to estimate crude odds ratios (CORs), and variables with $p \leq 0.25$ were included in the multiple logistic regression model. Prior to multiple logistic analysis, multicollinearity was assessed using tolerance and variance inflation factor (VIF). A Backward Likelihood Ratio (Backward LR) multiple logistic regression was conducted to identify independent predictors of sociocultural adaptation. Adjusted odds ratios (AORs), 95% confidence intervals (95% CIs), and p-values were reported. Statistical significance was set at $p < 0.05$.

RESULTS

Baseline Characteristics

Among the 385 participants, the largest age group was 26–35 years (22.6%), followed by 53–60 years (22.3%). Most participants were female (61.8%), married (56.6%), full-time employed (72.1%), and had a bachelor's degree or lower (75.6%). Most reported good or very good Thai language proficiency (78.4%). Detailed characteristics are presented in Table 1.

Table 1 Sociodemographic characteristics of Filipino migrants in Bangkok, Thailand (n = 385)

Characteristic	n	%
Age Category		
18–25 years	58	15.1
26–35 years	87	22.6
36–43 years	75	19.5
44–52 years	79	20.5
53–60 years	86	22.3
Gender		
Female	238	61.8
Male	147	38.2
Marital Status		
Single	167	43.4
Married	218	56.6

Characteristic	n	%
Educational Attainment		
Bachelor's degree or below	291	75.6
Postgraduate degree	94	24.4
Length of Stay in Thailand		
<1 year	20	5.2
1–3 years	46	11.9
4–6 years	74	19.2
7–10 years	121	31.4
>10 years	124	32.2
Employment Status		
Student	42	11.0
Self-employed	56	14.6
Unemployed	9	2.3
Full-time employed	276	72.1
Monthly Income (THB)		
<10,000	39	10.1
10,001–20,000	11	2.9
20,001–30,000	28	7.3
30,001–40,000	156	40.5
>40,000	151	39.2
Thai Language Proficiency		
Poor	26	6.8
Fair	57	14.8
Good	166	43.1
Very Good	136	35.3
Religious Affiliation		
Non-Roman Catholic	44	11.4
Roman Catholic	341	88.6

Descriptive Statistics of Study Variables

Table 2 summarizes the descriptive statistics of sociocultural adaptation, life experiences, and mental health among the respondents. Overall, Filipino migrants demonstrated a high level of sociocultural adaptation (Mean = 4.07, SD = 0.72). Positive experiences (Mean = 4.10, SD = 0.77), social relationships (Mean = 3.94, SD = 0.86), closeness (Mean = 4.00, SD = 0.72), and reverse-coded disconnection (Mean = 3.42, SD = 0.93) were likewise interpreted as high, indicating generally positive psychosocial experiences. Anxiety (Mean = 1.63, SD = 0.86) and depression (Mean = 2.15, SD = 1.19) were both classified as low, suggesting relatively low levels of psychological distress among the participants.

Table 2 Descriptive statistics of sociocultural adaptation, life experiences, and mental health (n = 385)

Variable	Mean	SD	Interpretation
Sociocultural Adaptation	4.07	0.72	High
Positive Experiences	4.10	0.77	High
Disconnection (Reverse-coded)	3.42	0.93	High
Social Relationships	3.94	0.86	High
Closeness	4.00	0.72	High
Anxiety	1.63	0.86	Low
Depression	2.15	1.19	Low

Factors Associated with High Sociocultural Adaptation

Table 3 presents the results of the binary logistic regression analysis examining the association between each independent variable and high sociocultural adaptation. Crude odds ratios (COR), 95% confidence intervals (CI), and corresponding p-values are reported. Variables with p-values < 0.25 were subsequently entered into the multiple logistic regression model.

Table 3 Binary logistic regression analysis of factors associated with high sociocultural adaptation among Filipino migrants (n = 385)

Variable	COR (95% CI)	p-value
Age (per year)	1.024 (1.007–1.042)	0.005
Educational attainment		0.004
• Postgraduate vs Bachelor's	2.01 (1.26–3.22)	
Length of stay (overall)	—	<0.001
Monthly income (overall)	—	<0.001
• >40,000 THB vs <10,000 THB	3.32 (1.56–7.05)	0.002
Thai language proficiency (overall)	—	<0.001
• Good vs Poor	4.60 (1.05–20.25)	0.044
• Very good vs Poor	28.80 (6.50–127.65)	<0.001
Positive experiences	47.61 (23.53–96.33)	<0.001
Disconnection (reverse-coded)	4.10 (2.95–5.69)	<0.001
Social relationships	8.81 (5.74–13.51)	<0.001
Closeness	22.18 (11.81–41.68)	<0.001
Anxiety	0.41 (0.30–0.57)	<0.001
Depression	0.57 (0.47–0.69)	<0.001

Abbreviations: COR = crude odds ratio

Table 4 presents the final multiple logistic regression model. The model was statistically significant (Omnibus Test of Model Coefficients, $p < 0.001$) and demonstrated good model fit, as indicated by the non-significant Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 10.994$, $p = 0.202$). The model explained 80.5% of the variance in high sociocultural adaptation (Nagelkerke $R^2 = 0.805$) and correctly classified 91.7% of respondents.

Positive experiences remained independently associated factors with high sociocultural adaptation (AOR = 24.69, 95% CI: 9.57–63.72, $p < 0.001$). Higher reverse-coded

disconnection scores (AOR = 2.53, 95% CI: 1.30–4.91, p = 0.006), stronger social relationships (AOR = 2.78, 95% CI: 1.33–5.81, p = 0.006), greater interpersonal closeness (AOR = 2.61, 95% CI: 1.01–6.75, p = 0.048), and higher depression scores (AOR = 1.73, 95% CI: 1.09–2.75, p = 0.020) were also independently associated with high sociocultural adaptation.

Among the sociodemographic variables, Thai language proficiency remained significantly associated with high sociocultural adaptation (overall p < 0.001). Respondents reporting very good Thai language proficiency had significantly higher odds of high sociocultural adaptation than those with poor proficiency (AOR = 29.03, 95% CI: 2.33–361.79, p = 0.009). Monthly income also remained significantly associated with high sociocultural adaptation (overall p = 0.026), with respondents earning more than 40,000 THB having lower odds of high sociocultural adaptation than those earning less than 10,000 THB (AOR = 0.14, 95% CI: 0.03–0.57, p = 0.006). Anxiety remained in the final model but was not independently associated with high sociocultural adaptation after adjustment for the other variables (AOR = 0.54, 95% CI: 0.27–1.09, p = 0.087).

Table 4 Final multiple logistic regression model of factors associated with high sociocultural adaptation among Filipino migrants (n = 385)

Predictor	AOR (95% CI)	p-value
Monthly income (overall)	—	**0.026**
• >40,000 THB vs <10,000 THB	0.14 (0.03–0.57)	0.006
Thai language proficiency (overall)	—	**<0.001**
• Very good vs Poor	29.03 (2.33–361.79)	0.009
Positive experiences	24.69 (9.57–63.72)	<0.001
Disconnection (reverse-coded)	2.53 (1.30–4.91)	0.006
Social relationships	2.78 (1.33–5.81)	0.006
Closeness	2.61 (1.01–6.75)	0.048
Anxiety	0.54 (0.27–1.09)	0.087
Depression	1.73 (1.09–2.75)	0.020

Abbreviations: AOR = adjusted odds ratio; CI = confidence interval

DISCUSSION

Filipino migrants in Bangkok demonstrated high sociocultural adaptation. Positive experiences, lower perceived disconnection, stronger social relationships, greater interpersonal closeness, Thai language proficiency, monthly income, and depression were independently associated with high sociocultural adaptation.

Positive experiences showed the strongest association with high sociocultural adaptation. This is consistent with acculturation and sociocultural adaptation frameworks, which emphasize positive engagement with the host society and successful intercultural interactions as important components of adjustment (4, 5, 17)

Lower perceived disconnection, stronger social relationships, and greater interpersonal closeness were also independently associated with high sociocultural adaptation, consistent with evidence that social support and social connectedness facilitate cross-cultural adjustment and belonging (4, 17).

Thai language proficiency also remained an important predictor of high sociocultural adaptation. Respondents with very good Thai language proficiency had substantially higher odds of reporting high sociocultural adaptation than those with poor proficiency. This finding is consistent with previous studies demonstrating that proficiency in the host country's language

facilitates communication, employment opportunities, access to healthcare, and participation in community life, ultimately supporting successful integration (17). Improved language skills may also reduce communication barriers and increase migrants' confidence in navigating everyday social and cultural interactions.

The strong performance of the final model should be interpreted cautiously. Although sociocultural adaptation, social relationships, and closeness were measured using separate constructs, their conceptual relatedness may have contributed to the high Nagelkerke R^2 and classification accuracy despite acceptable multicollinearity diagnostics. The wide confidence interval for very good Thai proficiency (AOR = 29.03, 95% CI: 2.33–361.79) also indicates imprecision, possibly due to the small poor-proficiency reference group. These findings should therefore be confirmed in larger and more diverse samples.

Monthly income remained significantly associated with sociocultural adaptation after adjustment for other variables. Adequate financial resources may improve access to housing, transportation, healthcare, education, and opportunities for community participation, all of which can facilitate adjustment to the host society (4). However, because the adjusted odds ratio for the highest income category was less than one relative to the reference group, this association should be interpreted cautiously. The observed relationship may reflect residual confounding, differences in the distribution of participants across income categories, or other unmeasured contextual factors.

Depression also remained independently associated with sociocultural adaptation, whereas anxiety was no longer statistically significant after adjustment for the other variables. Previous studies have consistently shown that migration-related psychological distress influences migrants' adaptation and overall well-being (21, 22). The present findings suggest that depressive symptoms remain associated with sociocultural adaptation even after accounting for psychosocial experiences and sociodemographic characteristics, while the association between anxiety and sociocultural adaptation may be explained by other factors included in the final model. Because this study employed a cross-sectional design, causal relationships cannot be established, and longitudinal studies are warranted.

Several variables, including age, educational attainment, and length of stay in Thailand, were associated with sociocultural adaptation in the univariable analyses but were no longer significant after adjustment in the multiple logistic model. This suggests that their crude associations may have been explained by stronger psychosocial and contextual factors, particularly positive experiences, social connectedness, language proficiency, income, and depression.

CONCLUSION

This study demonstrated a high level of sociocultural adaptation among Filipino migrants in Bangkok. Positive experiences, lower perceived disconnection, stronger social relationships, greater interpersonal closeness, Thai language proficiency, monthly income, and depression were independently associated with high sociocultural adaptation.

From a Primary Health Care (PHC) perspective, these findings support culturally responsive migrant-centered interventions that strengthen social support, promote positive migration experiences, improve Thai language proficiency, and address migrants' mental health needs. Future longitudinal and multicenter studies are recommended to confirm these findings and further examine the causal pathways influencing sociocultural adaptation.

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Central Institutional Review Board (CIRB) of Mahidol University (Protocol No. MU-CIRB 2026/191.0304; Certificate of Approval No. 78.0130/1487; approved on 6 May 2026). Participation was voluntary, and written informed

consent was obtained from all respondents prior to data collection. Confidentiality and anonymity were maintained throughout the study.

STRENGTHS AND LIMITATIONS

This study included a relatively large sample and examined multiple psychosocial and sociodemographic factors. However, self-reporting may have introduced recall and social desirability bias. Purposive selection of central Bangkok districts may limit geographic and socioeconomic representativeness. The strong model performance and wide confidence interval for Thai proficiency also warrant cautious interpretation. Future longitudinal and multicenter studies with larger and more heterogeneous samples are recommended.

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MULTILEVEL BARRIERS TO CHILDHOOD IMMUNIZATION AMONG MIGRANT AND REFUGEE CAREGIVERS: A SCOPING REVIEW USING THE SOCIO-ECOLOGICAL FRAMEWORK

Kyaw Hein[1], Kaung Pyae Wynn[2], Hein Naing Aung[1], Wandee Sirichokchatchawan[3], Htet Zaw Shein[3]

[1] School of Health Science, Mae Fah Luang University, Chiang Rai, Thailand, 57100.
[2] University of Medicine 2, Yangon, Myanmar, 11031.
[3] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.
*[*] **Corresponding Author:** Kyaw Hein, School of Health Science, Mae Fah Luang University, Chiang Rai, Thailand, 57100, Email: heinkyaw493@gmail.com, 6731804037@lamduan.mfu.ac.th*

ABSTRACT

Introduction: Caregivers hold primary responsibility for childhood immunization and significantly influence community vaccination rates. However, migrant and refugee caregivers often experience disproportionate barriers to immunization, leading to increased vaccine hesitancy and delayed uptake.
Objectives: Therefore, this scoping review aimed to map the existing documented barriers to childhood immunization among those populations and identify priority targets for intervention through the socio-ecological framework and priority mapping.
Methodology: A comprehensive search was conducted in Google Scholar, Scopus, Medscape, and PubMed, encompassing "vaccine hesitancy", "childhood immunization", "migrant and refugee populations", "caregivers", and "associated barriers". Cross-sectional and mixed-methods studies, published between 2021 and 2025, on childhood immunization among displaced and migrant caregivers were included. Following the PRISMA guidelines, of 11,000 records screened, 175 underwent secondary screening, 27 underwent full-text review, and 15 were included in the final synthesis. Data were systematically extracted, summarized, and analyzed using the Socio-Ecological Framework (SEM), categorizing barriers across five levels: individual, interpersonal, community, organizational, and policy. Identified barriers were further synthesized to highlight priority areas, using the Expert Recommendations for Implementing Change (ERIC) importance and feasibility matrix, for identifying actionable solutions to improve access. R-studio Version 2025.09.2 was used for data analysis and visualizing the priority mapping via a bubble plot.
Results: The 15 included studies covered refugee and migrant parents and caregivers across Asia (n = 5), Africa (n = 4), the Middle East (n = 4), North America (n = 1), and Oceania (n = 1). Synthesized findings revealed that individual-level barriers were the most heavily documented across the literature, driven predominantly by poor vaccine knowledge (n = 13), low parental education (n =12), vaccine safety concerns (n = 10), and misinformation/rumors (n = 9). These barriers spanned four distinct socio-ecological levels, with a major cluster emerging in the high impact, high feasibility quadrant. The deep-seated structural and policy factors, including financial barriers (n = 8), migration or displacement dynamics (n = 6), and distrust of institutions (n = 3), exhibited high negative impacts on vaccination uptake, despite presenting lower immediate intervention feasibility.
Conclusion: This study demonstrates that deep-seated structural and policy factors remain critically overlooked in the existing literature, while individual-level vaccination barriers are highly reported and feasible to target. Future studies should evaluate the systemic impacts of migration and displacement on sustainable and equitable access to childhood immunization. Immunization programs should complement caregiver-focused interventions with system-level approaches that address access, continuity of care, and policy barriers in displacement settings.

Keywords:
Childhood Vaccination; Vaccine Hesitancy; Migrant; Refugee; ERIC.

INTRODUCTION

Childhood immunization is a critical public health intervention for mitigating infectious disease outbreaks and reducing global pediatric mortality (1-2). Life course modeling estimates that the World Health Organization Expanded Program on Immunization initiatives have averted approximately 154 million deaths globally, 95% of which were among children under five years of age (3). Because primary caregivers hold the direct responsibility for timely vaccine administration, their capacity to utilize healthcare services determines population-level coverage and herd immunity (4-6).

Under stable conditions, routine immunization relies on established clinic access and functional health infrastructure (7). However, forced displacement and migration severely disrupt these dynamics. Displaced, migrant, and refugee families frequently navigate unfamiliar health systems without retained medical records (8). These vulnerable cohorts encounter persistent linguistic, legal, and administrative barriers, driving increased vaccine hesitancy, delayed uptake, and incomplete immunization schedules (9-10). Addressing these disparities requires evaluating how broader social and environmental determinants constrain caregiver agency within host health systems.

Because immunization barriers interact dynamically across social levels, compiling flat lists of isolated factors is insufficient (11-13). For example, a caregiver's information deficit interacts with community-level misinformation and policy-level legal restrictions governing healthcare access for non-citizens (14-15). The Socio-Ecological Model (SEM) provides a framework to categorize these determinants across individual, interpersonal, community, organizational, and policy domains (16-17), differentiating internal caregiver perceptions from structural service constraints (18-19). To translate these barriers into actionable strategies, implementation science tools are necessary. The Expert Recommendations for Implementing Change (ERIC) framework evaluates barriers along dual dimensions of clinical impact (importance) and operational feasibility, systematically prioritizing target areas for public health programming (20).

A major shortcoming in health program design for displaced populations is an over-reliance on individual-level interventions (21). Public health planners frequently prioritize localized educational strategies; such as translated brochures or community meetings—due to low implementation costs and straightforward evaluation (22-23). However, when caregivers face severe financial hardship, transport deficits, or deportation fears, educational campaigns alone fail to improve completion rates (2,24). This creates an operational mismatch between implemented solutions and structural bottlenecks. This scoping review synthesizes empirical literature from 2021 to 2025 using SEM mapping and ERIC priority analysis to document this structural gap, offering data-driven insights to transition public health strategies from isolated caregiver messaging toward system-level infrastructure reform.

METHODOLOGY

Study Design and Protocol Guidelines

This research utilized a systematic scoping review methodology to map, synthesize, and prioritize the existing body of evidence regarding multi-level barriers to pediatric immunization among migrant and refugee populations. To ensure methodological rigor, the investigation adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines. This framework facilitated a systematic, transparent, and reproducible approach to database searching, abstract screening, full-text evaluation, and data extraction (25).

Search Strategy and Databases

The comprehensive electronic database search was executed across PubMed, Scopus, MedScape, and Google Scholar on May 15, 2025, capturing peer-reviewed primary literature published between January 1, 2021, and May 15,

2025. The search strategy utilized a combination of targeted keywords and Boolean operators to examine the intersection of three specific domains: the study population, the immunization outcome, and structural or systemic barriers to access. The definitive search string utilized was: ("vaccine hesitancy" OR "vaccination hesitancy" OR "immunization hesitancy" OR "vaccine refusal" OR "vaccine acceptance" OR "vaccine confidence") AND (childhood OR child OR children OR pediatric OR pediatric OR infant OR under-five) AND (vaccination OR immunization OR immunisation OR EPI OR "routine immunization" OR "routine vaccination") AND (migrant OR migrants OR migration OR immigrant OR immigrants OR refugee OR displaced population OR mobile population OR cross-border population) AND (caregiver OR care-taker OR caretaker OR parent OR parents OR mother OR fathers OR guardian) AND (prevalence OR determinants OR predictors OR "associated factors" OR correlates OR barriers). The publication timeline was restricted to papers published between 2021 and 2025 and ensured relevance to recent global displacement trends and changes in public health environments. The search filters restricted results to peer-reviewed, primary literature published in the English language.

Eligibility and Article Selection Flow

The inclusion criteria comprised primary empirical studies employing cross-sectional or quantitative mixed methods designs, published in English between 2021 and 2025. Eligible studies reported routine childhood immunization outcomes, including vaccine hesitancy, confidence, refusal, or uptake, among parents or primary caregivers of migrant, immigrant, refugee, displaced, or mobile children aged under five years. Studies were excluded if they were reviews, meta-analyses, theoretical or modelling studies, focused exclusively on a single vaccine antigen, or evaluated clinical trials, biological mechanisms, or specific immunization interventions.

The initial electronic search yielded a primary pool of 11,000 records across the four databases. Following automated and manual duplicate removal, 4,200 duplicate records were excluded, leaving 6,800 unique records for title and abstract screening. From this pool, 6,625 records were excluded for irrelevance to the target population or study design. A comprehensive full-text review was conducted on 175 articles. Of these, 160 were excluded due to wrong target population/age group (n = 72), intervention/trial designs (n = 48), publication dates outside the 2021–2025 window (n = 25), or incomplete/duplicate preprint records (n = 15). A total of 15 studies met all inclusion criteria and were included in the final qualitative and quantitative synthesis.

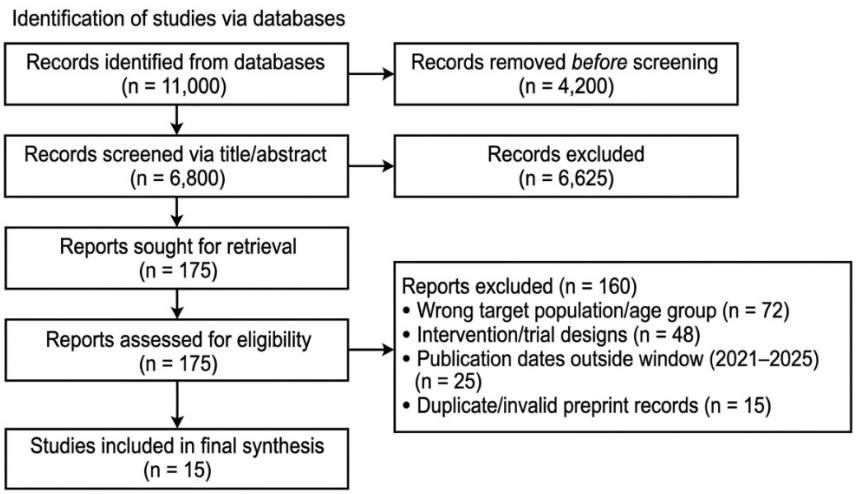

Figure 1 PRISMA-ScR Flow Diagram of Study Selection

ERIC-Based Priority Mapping

Following socio-ecological synthesis, the identified barriers were prioritized using the Expert Recommendations for Implementing Change (ERIC) importance–feasibility matrix. Two independent reviewers rated each barrier on a 5-point Likert scale ranging from 1 (Very Low) to 5 (Very High).

Importance / Negative Impact:

Operationalized based on the frequency of the barrier reported across the included studies, consistency of findings, and the extent to which the barrier directly reduces immunization coverage.

Implementation Feasibility:

Operationalized based on the relative ease of addressing the barrier within routine healthcare or humanitarian program settings, taking into account required financial resources, administrative complexity, and time to implementation. Inter-rater reliability between the two reviewers prior to consensus was evaluated using Cohen's kappa coefficient, demonstrating strong initial agreement ($\kappa = 0.82$). Disagreements were systematically resolved through consensus discussion involving a third senior reviewer. Final consensus mean ratings were plotted in R software (Version 2024.04.2+764) to generate a bubble plot, where bubble size represents study frequency and color denotes the Socio-Ecological Model (SEM) level.

RESULTS

Characteristics of Included Studies

Table 1 summarizes the descriptive characteristics of the 15 included studies published between 2021 and 2025. Geographic representation was predominant across Asia (n = 5, 33.3%), Africa (n = 4, 26.7%), and the Middle East (n = 4, 26.7%). Methodologically, the majority of studies employed quantitative cross-sectional designs (n = 14, 93.3%). The primary target populations comprised parents and primary caregivers of displaced, migrant, or refugee children (n = 11, 73.3%). Sample sizes varied across study settings, with 80.0% (n = 12) evaluating cohorts of fewer than 500 participants.

Table 1 Descriptive characteristics of included studies

Characteristics	N (%)
Year of Publication	
2021	4 (26.4%)
2022	2 (13.3%)
2023	4 (26.7%)
2024	2 (13.3%)
2025	3 (20.0%)
Geographic Region	
Asia	5 (33.3%)
Africa	4 (26.7%)
Middle East	4 (26.7%)
North America	1 (6.7%)
Oceania	1 (6.7%)
Study Design	
Quantitative Cross-sectional Study	14 (93.3%)
Mixed methods Study	1 (6.7%)
Study Population	
Parents/Caregivers (Migrants)	11 (73.3%)
Other Migrants/Refugees	4 (26.7%)

Characteristics	N (%)
Sample Size	
Less than 500	12 (80.0%)
500 to 1000	1 (6.7%)
More than 1000	2 (13.3%)

Table 2 Individual study characteristics

No.	Author (Year)	Country	Population	Study Design	Sample Size	Primary Outcome	Summary Findings
1	Nyamvula et al. (2023)	Kenya	Mothers/caregivers of children <5 years	Cross-sectional	263	Childhood immunization uptake	Lower maternal education and geographical inaccessibility were associated with incomplete childhood immunization.
2	Wang et al. (2023)	China	Internal migrants	Cross-sectional	10,013	Childhood vaccination uptake	Low awareness of public health services, lower education, and mobility reduced vaccination uptake.
3	Emlek Sert et al. (2023)	Türkiye	Parents of children 0–5 years	Cross-sectional	302	Vaccination knowledge, beliefs, and behaviors	Misinformation, service access barriers, and conflict-related disruptions contributed to hesitancy.
4	Obohwemu et al. (2025)	Nigeria	Mothers/caregivers	Cross-sectional	321	Vaccination attitudes	Cultural beliefs, misinformation, distrust, and fear of side effects were major barriers.
5	Saleh & Chedid (2025)	Lebanon	Mothers of children 0–5 years	Cross-sectional	212	Childhood immunization KAP	Financial hardship, transportation barriers, and limited healthcare access reduced uptake.
6	Pangandaman et al. (2025)	Philippines	Parents	Qualitative Phase (Mixed Methods)	5	Measles vaccination perceptions	Fear of adverse events and declining trust after vaccine controversies.
7	Kanyi (2021)	The Gambia	Mothers of children <5 years	Community-based cross-sectional	132	Childhood immunization	Low education, poor knowledge, travel distance, and limited access were barriers.
8	Al-Qerem et al. (2022)	Iraq	Parents	Online cross-sectional	491	COVID-19 vaccination	Safety concerns, misinformation, and low confidence increased hesitancy.
9	Debela et al.	New Zealand	Refugee parents	Cross-sectional	178	Vaccine hesitancy	Language barriers and limited health literacy.
10	Voo et al. (2021)	Malaysia	Parents	Cross-sectional	405	Immunization uptake	Provider recommendation and parental knowledge were key determinants.

No.	Author (Year)	Country	Population	Study Design	Sample Size	Primary Outcome	Summary Findings
11	Touray et al. (2021)	The Gambia	Caregivers of children 12–23 months	Community-based cross-sectional	200	Complete immunization	Accessibility, maternal education, and ANC utilization influenced immunization.
12	Gupta et al. (2021)	India	Mothers/caregivers	Community-based cross-sectional	9,466	Full immunization coverage	Poverty, rural residence, low education, and poor access contributed to incomplete immunization.
13	Abdulhaq et al. (2024)	Jordan	Syrian refugee parents	Cross-sectional	332	Vaccination barriers	Refugee status, transport costs, healthcare access, and misinformation.
14	Alghalyini et al. (2024)	Canada	Syrian refugee parents	Cross-sectional	540	Vaccination attitudes	Language barriers, cultural differences, and limited trust.
15	Ahmed et al. (2023)	Bangladesh	Rohingya refugee parents	Cross-sectional	244	Childhood vaccination KAP	Displacement, poor healthcare access, low health literacy, and misinformation.

Characteristics of Individual Studies

The included studies evaluated primary outcomes encompassing childhood immunization uptake, complete immunization, vaccine hesitancy, acceptance, and knowledge, attitudes, and practices (Table 2). Across settings, incomplete vaccination was consistently associated with poor vaccine knowledge and low parental education. Vaccine hesitancy was predominantly driven by safety concerns, misinformation, institutional distrust, and fear of adverse effects. Additionally, access-related constraints—including financial hardship, transportation difficulties, language barriers, and legal displacement status—substantially impaired service utilization. These collective findings demonstrate that pediatric immunization barriers among mobile populations extend beyond caregiver awareness to encompass complex social, structural, and system-level determinants.

Frequency of Reported Barriers

Caregiver-level individual factors predominated across the included studies, led by poor vaccine knowledge (n = 13, 86.7%), low parental education (n = 12, 80.0%), vaccine safety concerns (n = 10, 66.7%), and misinformation (n = 9, 60.0%) (Table 3). Structural and access barriers formed the second major cluster, with geographic inaccessibility and financial constraints each reported in 53.3% of studies (n = 8), followed by general health-system access barriers and religious or cultural beliefs (n = 7, 46.7%), as well as migration or displacement-related challenges (n = 6, 40.0%). Lower-frequency operational and social barriers included vaccine stock-outs, health-worker communication gaps, and caregiver workload constraints (n = 5, 33.3% each), while institutional distrust (n = 3, 20.0%) and gender-related barriers (n = 2, 13.3%) were less commonly documented. While individual-level determinants were most visible, structural and system-level barriers remained repeatedly cited.

Table 3 Barriers frequency mapping

Identified Barrier	Frequency	Prevalence (% of Studies) *
Poor vaccine knowledge / awareness	13	86.67%
Low parental education	12	80.00%
Vaccine safety concerns / fear of side effects	10	66.67%
Misinformation / rumors	9	60.00%
Geographic accessibility barriers (distance, transport, terrain)	8	53.33%
Financial barriers / poverty	8	53.33%
Religious & cultural beliefs	7	46.67%
Health system access barriers	7	46.67%
Migration / displacement / refugee-related barriers	6	40.00%
Vaccine availability / stock-outs	5	33.33%
Health worker communication gaps	5	33.33%
Caregiver workload / family constraints	5	33.33%
Distrust of institutions / government	3	20.00%
Gender-related barriers	2	13.33%

Synthesis of Barriers According to the Socio-Ecological Model

The identified barriers were synthesized across the five levels of the Socio-Ecological Model (SEM) to illustrate their interconnected nature (Table 4). Individual-level determinants were primarily driven by caregiver knowledge gaps, vaccine safety concerns, and prevailing misinformation. Interpersonal factors encompassed parental education levels, competing domestic responsibilities, and communication gaps with healthcare providers. Community-level dynamics included religious or cultural influences, local distrust, and negative media messaging. At the organizational level, barriers centered on health-system constraints—such as vaccine stock-outs, staff shortages, and service disruptions—alongside geographic challenges including distance, terrain, and transport. Finally, policy and structural factors comprised financial constraints, population mobility, fragile infrastructure, and conflict-related access restrictions. This multi-level distribution demonstrates that caregiver decision-making is heavily constrained by broader environmental and system-level determinants, directly informing the subsequent implementation prioritization.

Table 4 Narrative synthesis of barriers according to the socio-ecological model.

SEM Level	Barrier	Significant Factors
Individual	Poor Vaccine Knowledge	Poor knowledge of vaccination schedules; poor knowledge of vaccine-preventable diseases (VPDs); lack of awareness regarding immunization
Individual	Vaccine Safety Concerns	Fear of side effects; AEFI concerns; vaccine safety concerns
Individual	Misinformation & Rumors	Autism myths; social media misinformation; conspiracy beliefs
Interpersonal	Low Parental Education	Low maternal education; low paternal education; illiteracy; lack of formal education
Interpersonal	Caregiver Time & Family Constraints	Multiple children; household workload; employment constraints; competing domestic responsibilities
Interpersonal	Health Worker Communication Gaps	Lack of provider recommendation; inadequate counselling; lack of follow-up from healthcare workers
Community	Religious & Cultural Beliefs	Religious opposition; cultural norms; community distrust; anti-vaccination religious messages
Community	Community Misinformation	Community rumors; misinformation circulating within communities; negative media influence
Organizational	Vaccine Availability Problems	Vaccine stock-outs; vaccine shortages; vaccine unavailability
Organizational	Health System Capacity Constraints	Staff shortages; missed immunisation sessions; weak service delivery; disrupted health services
Organizational	Geographic Accessibility Barriers	Long travel time; difficult terrain; transportation difficulties; distance to health facilities
Policy	Financial Barriers	Poverty; vaccine costs; transportation costs; indirect costs of accessing services
Policy	Migration, Displacement& Mobility	Refugees; migrants; internally displaced persons (IDPs); population mobility; relocation
Policy	Structural Accessibility Barriers	Poor infrastructure; remote locations; conflict-related access constraints

ERIC-Informed Prioritization of Identified Barriers

The conceptual ERIC importance–feasibility matrix categorized the identified barriers according to their perceived importance and implementation feasibility Poor vaccine knowledge, low parental education, vaccine safety concerns, and misinformation were positioned as high-importance and high-feasibility barriers. Migration and displacement-related barriers, financial hardship, vaccine stock-outs, and structural accessibility barriers were positioned as high-importance but lower-feasibility barriers. The remaining barriers were placed in intermediate priority categories, including religious and cultural beliefs, health system access, caregiver workload, health worker communication gaps, distrust of institutions, and gender-related constraints. The ERIC importance–feasibility matrix presented the identified barriers by combining their reported importance with their feasibility for implementation response, thereby supporting the study's objective of informing prioritization of intervention strategies.

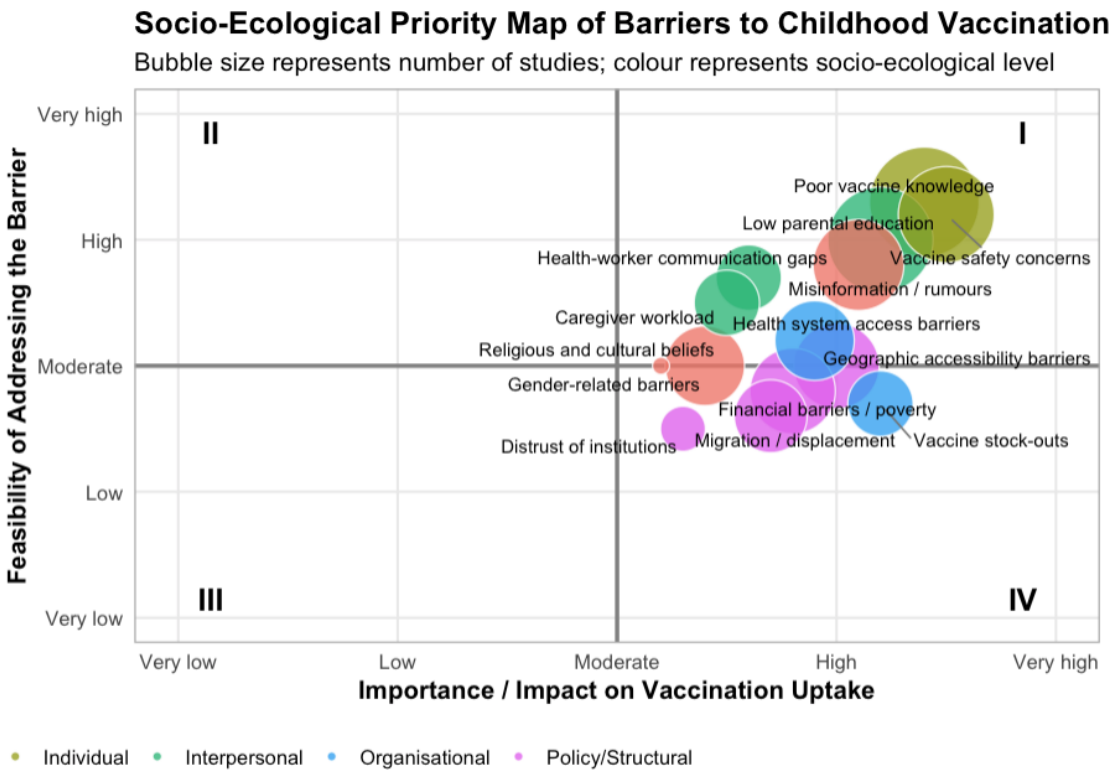

Figure 2 ERIC-Informed Prioritization of Identified Barriers

DISCUSSION

This scoping review demonstrates that childhood immunization barriers among migrant, refugee, and displaced populations are multidimensional and extend beyond caregiver awareness. Although poor vaccine knowledge, low parental education, safety concerns, and misinformation predominated across reported literature, these factors consistently coexisted with financial hardship, transportation deficits, health-system limitations, and migration-related constraints. These findings align with the Socio-Ecological Model (SEM), affirming that pediatric vaccination behaviors are governed by interacting individual, interpersonal, organizational, and structural determinants rather than individual agency alone (17-18, 26-28).

The predominance of knowledge- and education-related barriers likely reflects the research community's reliance on quantitative cross-sectional designs, which prioritize easily measurable caregiver variables (27, 29-30). However, our synthesis indicates that educational campaigns alone are insufficient to increase coverage in displaced populations. Caregivers with adequate health literacy remain unable to vaccinate

their children when constrained by transportation costs, geographic distance, service disruptions, legal insecurity, or physical mobility (28, 31-32). This reinforces prior evidence showing that structural determinants frequently supersede individual behavior in humanitarian settings (20), (8).

Misinformation and safety fears were widespread across diverse geographical contexts. Fear of adverse events, post-controversy erosion of trust, and rumors in Iraq, Türkiye, Nigeria, the Philippines, and Kenya illustrate that vaccine confidence is a collective social phenomenon mediated by trusted leaders, communication networks, and healthcare personnel rather than an isolated psychological trait (31,33-37). Consequently, tailored risk communication, peer engagement, and provider-patient rapport offer greater efficacy than generic health education.

Organizational and policy-level barriers remain substantial despite receiving less empirical emphasis. Geographic inaccessibility, vaccine stock-outs, facility constraints, financial hardship, and legal status were cited repeatedly (30-31, 37), reflecting the systemic fragility of routine immunization in conflict-affected regions (37). Mitigating these challenges requires health-system strengthening through mobile clinics, resilient supply chains, and inclusive health policies that guarantee access regardless of legal status (2,7).

Finally, the ERIC prioritization matrix offers operational clarity for public health planning (20). Behavioral and knowledge gaps represent high-importance, high-feasibility targets suitable for rapid deployment through provider training and community outreach (20). Conversely, structural barriers, including financial distress, legal mobility, and supply logistics, are equally critical but demand sustained, multisectoral policy commitment due to lower immediate feasibility. Sustainable coverage equity among displaced children ultimately requires pairing short-term behavioral solutions with long-term system infrastructure reform (20).

LIMITATIONS

This review has several limitations that should be acknowledged. First, only English-language studies were included, which may have introduced language bias and excluded relevant evidence published in local languages from high-displacement contexts. Second, the majority of the included studies employed quantitative cross-sectional designs, limiting the ability to establish temporal relationships or causal inferences. Third, geographically, most studies originated from Asia and Africa, which may restrict the direct generalizability of the findings to displaced populations in Western or other host regions. Finally, while the ERIC prioritization was grounded in study barrier frequency and structured expert consensus with high inter-rater agreement (κ = 0.82), empirical implementation trials remain necessary to validate these priority ratings across specific humanitarian field contexts.

CONCLUSION

This review has several strengths. It synthesizes recent evidence published between 2021 and 2025, applies the Socio-Ecological Model to organize complex determinants, and integrates implementation science through the ERIC importance–feasibility framework to support intervention prioritization (17,20). Nevertheless, several limitations should be acknowledged. Only English-language studies were included, and most employed cross-sectional designs, limiting causal inference. Furthermore, the majority of studies originated from Asia and Africa, which may restrict generalizability to other settings. Finally, while ERIC prioritization was informed by study barrier frequency and structured expert consensus with high inter-rater reliability (κ= 0.82), empirical implementation trials are still needed to validate these priority ratings across specific humanitarian contexts.

Overall, the findings demonstrate that childhood immunization barriers among migrant and refugee populations are driven by interconnected behavioral, social, health-system, and structural determinants. While improving caregiver knowledge and vaccine confidence remains essential, sustainable improvements in vaccination coverage will require interventions that simultaneously strengthen health systems, improve

service accessibility, reduce financial and geographic barriers, and address policy constraints affecting displaced populations. Integrating socio-ecological analysis with implementation science offers a practical framework for prioritizing interventions capable of improving equitable immunization delivery in humanitarian settings (17,20).

RECOMMENDATIONS

Based on the findings of this review, childhood immunization programs serving migrant, refugee, and displaced populations should prioritize high-impact and feasible interventions, including culturally appropriate vaccine education, improved healthcare worker communication, and community engagement to address vaccine misinformation and safety concerns. These behavioral interventions should be complemented by health-system strengthening strategies, such as mobile vaccination services, improved vaccine supply chains, and enhanced service accessibility for hard-to-reach populations. Policymakers and humanitarian agencies should adopt multi-level implementation approaches that address barriers across the individual, community, organizational, and policy levels. Future implementation research is also needed to evaluate the effectiveness, feasibility, and sustainability of these strategies across diverse humanitarian settings.

ETHICAL DECLARATION

This manuscript is a scoping review based entirely on previously published primary literature and secondary data. It did not involve any direct human participant interaction, collection of personal private data, or animal experimentation. Consequently, formal ethical approval from an Institutional Review Board (IRB) or informed consent was not required for this study.

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PSYCHOLOGICAL WELL-BEING IN SOLITARY AND PARENT–CHILD LIVING ARRANGEMENTS AMONG OLDER PERSONS IN THE PHILIPPINES

Joy Marie A. Gillera[1], Truc Ngoc Hoang Dang[1]*, Sutthida Chuanwan[1]

[1]Institute for Population and Social Research, Mahidol University, Salaya, Nakhon Pathom, 73170

Corresponding Author: *Truc Ngoc Hoang Dang, Institute for Population and Social Research, Mahidol University, Nakhon Pathom 73170, Thailand, E-mail: truc.ngo@mahidol.edu*

ABSTRACT

Introduction: The Philippines is rapidly approaching an aging society. While co-residence with adult children remains the traditional eldercare structure, modern adaptations like solitary living and "network living" (living alone with children in the same barangay) are emerging. However, differences in mental health outcomes across these structures remain insufficiently explored.

Objectives: This study evaluated the psychological well-being of older Filipino adults across three distinct living arrangements: co-residence, solitary living, and solitary living with children nearby.

Methods: Using cross-sectional data from Wave 1 (2018–2019) of the Longitudinal Study of Ageing and Health in the Philippines (LSAHP), we analyzed 3,779 community-dwelling adults aged ≥ 60 years. Psychological well-being was assessed using the locally validated 11-item Center for Epidemiological Studies Depression Scale (CES-D 11), where higher scores indicate greater psychological distress. Multiple linear regression models were adjusted for socioeconomic characteristics, physical health, social participation, and intergenerational support exchanges, utilizing co-residence with children as the reference category. Heteroskedasticity-robust standard errors and survey weights were applied.

Results: Participants had a mean age of 71.86 ± 7.87 years, and 63.56% were women; 54.99% reported perceived income insufficiency. Regarding health, 63.32% rated themselves as healthy, and 80.68% had no limitations in Activities of Daily Living. However, indicators of social disengagement were high: 70.10% were not members of civic organizations, 68.38% were inactive in religious activities, and 67.03% seldom/never heard from friends. Most co-resided with children (82.16%), while 10.66% were in solitary living with children nearby, and 7.17% were in solitary living. Compared with co-residence, solitary living with children nearby was not significantly associated with distress (b = 0.75, 95% CI: −0.28 to 1.79), whereas solitary living was associated with greater distress (b = 3.23, 95% CI: 1.65 to 4.82). Greater psychological distress was also associated with being married, perceived income insufficiency, poor self-rated health, non-membership in social organizations, and emotional support exchanges with children.

Conclusion: This study distinguishes between solitary living with children nearby and solitary living among older Filipinos. Residential independence does not inherently impair well-being, provided older adults remain embedded within accessible community networks. Consequently, contemporary Philippine eldercare policy can no longer rely solely on co-residential family structures. To support safe, independent aging, targeted interventions must shift toward community-level frameworks that promote social participation, identify functionally vulnerable older adults living alone, and provide tailored psychosocial support for older women using barangay-level aging-in-place frameworks.

Keywords:

Network Living, Aging in Place, Psychological Well-Being, Depressive Symptoms, Philippines

INTRODUCTION

In the Philippines, co-residence with children has traditionally and constitutionally served as the primary source of support in old age, reflecting deeply institutionalized norms of filial obligation and reciprocity (1). Grounded in the cultural value of *utang na loob*, or reciprocal indebtedness, this shared domestic space is where aging is experienced as "*reaping what one sows*," and where the quality of care received in later life reflects relationships cultivated throughout the life course (2). Beyond these moral imperatives, co-residence serves as a practical mechanism of support for older Filipinos facing poor health, increasing disability (3), multimorbidity (4, 5), and economic hardship (6, 7). However, this longstanding family structure is rapidly changing. Driven by declining fertility, sustained labor migration, and changing family formations and values, solitary living among older adults nearly tripled over the past decade, rising from 4.5% in 2007 to 13.5% in 2018, while co-residence with children declined from 73.9% to 60.2% (8). As population aging accelerates, understanding the consequences of these shifts has become increasingly important.

The psychological stakes of this transition are substantial. Depressive symptoms affect 32.1% of older Filipinos, exceeding global estimates and worsening with advanced age (9, 10). In a context where formal long-term care remains limited, proximity to family may be a critical determinant of psychological well-being (11, 12) by shaping access to emotional, instrumental, and social support (1). Yet existing gerontological research largely treats living arrangements as a binary distinction between co-residence and solitary living, leaving unanswered whether maintaining proximity to children without sharing a household can confer similar psychological benefits.

An increasingly prominent alternative is network living, in which older adults maintain an independent household while having at least one adult child nearby (13). In the Philippines, this typically refers to residing within the same barangay, the country's smallest administrative unit. In 2019, 61.5% of older Filipinos living alone had a child residing nearby (14), suggesting a pragmatic compromise between residential independence and continued familial accessibility (15). Drawing on applications of Social Exchange Theory in aging research (16), the psychological consequences of living arrangements may depend less on household structure itself than on opportunities for reciprocal exchange and support. Whether network living provides sufficient social and emotional resources to protect psychological well-being, therefore, remains an open question.

Using Wave 1 of the Longitudinal Study of Ageing and Health in the Philippines (LSAHP) (17), this study compares psychological well-being across three living arrangements: co-residence with children, solitary living, and solitary living with children nearby. Psychological well-being shall be measured using the CES-D11 measurement scale, initially a 20-item scale developed by Radloff; the shortened version has been locally validated in older persons (18). By distinguishing older adults who live alone with nearby children from those who live alone without such proximity, the study moves beyond the conventional co-residence-versus-isolation framework and reflects the evolving realities of later-life living arrangements in the Philippines. The findings may inform policies aimed at promoting psychological well-being in an aging population.

METHODS

Study Design and Data Source

This study employs a quantitative, explanatory design using secondary data from Wave 1 of the Longitudinal Study of Ageing and Health in the Philippines (LSAHP); it is the country's only publicly available dataset, as subsequent follow-up waves were delayed by the COVID-19 pandemic, with the official Wave 2 report released in late 2025 (19). Nevertheless, Wave 1 provides a significantly larger baseline sample size, allowing for an explanatory analysis of a broader range of variables and detailed categorical stratification. Wave 1 was conducted

from October 2018 to February 2019 (N = 5,985) using a multistage probability sampling design, with provinces serving as primary sampling units. (20).

Study Sampling

Out of the initial sample, 1,604 participants were excluded: 550 who lived with a spouse only and 1,054 in other living arrangements. Additionally, because the Center for Epidemiologic Studies Depression Scale (CES-D 11) does not permit proxy responses, 602 proxy-reported cases were removed, including 116 from solitary living arrangements and 486 from those living with a child (21).

This yielded a final sample of 3,779 older adults, comprising 3,105 co-residing individuals and 674 living alone. The solitary living group was further stratified by geographic proximity to children, resulting in 271 individuals without children nearby and 403 with children residing in the same *barangay*, as detailed in **Table 1.**

Table 1 Sample selection from LSAHP wave 1

LSAHP Four Living Arrangements	Frequency (%)	Three Living Arrangements*	Frequency (%)
Living Alone	790 (13.20)	Living Alone	674 (17.84)
With Spouse Only	550 (9.19)	Solitary Living	271 (7.17)
Other Types	1,054 (17.61)	Solitary Living with Children Nearby	403 (10.66)
With at least 1 child	3,591 (60.00)	Co-residing with Child	3,105 (82.16)
Total	**5895**		**3779**

*Notes. *Proxies removed*

Measures

Psychological distress was measured using the 11-item CES-D 11, a locally validated (18) shortened version of the 20-item Radloff scale (22), validated for this population ($\alpha = 0.74$). Items were rated on a 3-point scale (0 = Rarely/Not at all, 2 = Often) (3); two positive-affect items were reverse-coded. Total scores range from 0 to 22, with higher scores reflecting greater distress. The scale was treated as a continuous outcome, similar to its reporting in the LSAHP (3).

Living arrangements were operationalized as three mutually exclusive categories: (1) co-residing with children (reference), (2) solitary living with children nearby (same *barangay*), and (3) solitary living.

Socioeconomic characteristics: age was stratified into three cohorts (60–69, 70–79, and 80+ years); marital status (never-married, married, and others, including separated, divorced, annulled, and widowed); educational attainment (completed elementary or below versus high school or higher); economic status is average monthly income quartiles, a household wealth index in quintiles, and income sufficiency (sufficient if reporting surplus income, and insufficient if reporting any financial strain or uncertainty); and urbanity was retained its original classification (urban and rural).

Physical health captured self-rated health and the Activities of Daily Living (ADL) status. Self-rated health was dichotomized into (1) healthy (very healthy, healthier than average, or average health) and (2) not healthy (somewhat unhealthy, very unhealthy, or not sure). The ADL status was operationalized as a continuous composite score ranging from 1 to 7 as utilized in the original study (23), constructed by summing "No" responses across seven functional capacity items for no limitation; any “Yes” response constituted having limitations.

Social networks adjusted for organizational membership, religious participation, and social contact frequency. Contact frequency with friends was dichotomized into (1) Often (often, very often, or always) and (2) Seldom/Never (never, seldom, or sometimes).

Fourth, intergenerational exchange evaluated financial, material, emotional, and instrumental support flows, with each type categorized as (1) no exchange, (2) equal exchange, or (3) unequal exchange. Exchange categories were constrained by living arrangement: solitary living assumed no exchanges with children; co-residence assumed exchanges with co-resident children only; network living assumed exchanges with non-resident nearby children.

Data Analysis

Data management was executed using Stata and R, with inferential analyses conducted in Stata/SE 17. Using Wave 1 data, the analysis began with descriptive and bivariate statistics, utilizing unweighted frequencies to report baseline characteristics. Independent t-tests and one-way ANOVA confirmed that all final covariates were significantly associated with psychological distress ($p < 0.01$). To assess the association between living arrangements and psychological distress, a fully adjusted multiple linear regression model was constructed. This model simultaneously controlled for socioeconomic characteristics, physical health indicators, social networks, and intergenerational support. Overall model fit was evaluated using the F-test of joint significance and the adjusted R^2. Model diagnostics were systematically evaluated before finalization. Multicollinearity was assessed via a pairwise correlation matrix and variance inflation factors (VIFs). A moderate correlation between material and financial support ($r = 0.5414$) was detected; a likelihood ratio test supported dropping material support to achieve a more parsimonious model. Additionally, a Breusch-Pagan test revealed significant heteroskedasticity ($p < 0.05$), which was addressed by utilizing robust standard errors. Sample weights were also applied to account for spatial autocorrelation and variance inflation stemming from the clustered sampling design.

RESULTS

Table 2 Baseline characteristics from LSHAP 1 (Unweighted)

Variables		Frequency	(%)	Sig
Psychological Well-being				
Average score of CES-D 11	5.5			
Coresiding with Children	5.29			
Solitary Living	6.25			
Solitary Living with Children	6.57			
Nearby				
Living Arrangements				
Coresiding with Children		3,105	(82.16)	
Solitary Living		271	(7.17)	
Solitary Living with Children		403	(10.66)	
Nearby				
Socioeconomic Characteristics				
Sex				< .001
Male		1,377	(36.44)	
Female		2,402	(63.56)	
Age group				< .001
60-69		1,541	(40.78)	
70-79		1,474	(39.01)	
80+		764	(20.22)	

Variables		Frequency	(%)	Sig
Marital Status				< .001
Never-Married		66	(1.75)	
Married		1,398	(36.99)	
Others		2,315	(61.26)	
Educational Level				< .001
Completed Elementary and Lower		2,449	(64.81)	
High School or Higher		1,330	(35.19)	
Urbanity				< .001
Urban		1,765	(46.71)	
Rural		2,014	(53.29)	
Average Monthly Income	PhP 5405.05			
Average Monthly Income in Quartiles:				< .001
Poorest 25%		975	(25.80)	
Lower Middle		1,140	(30.17)	
Upper Middle		779	(20.61)	
Richest 25%		885	(23.42)	
Sufficiency of Income				< .001
Sufficient		1,701	(45.01)	
Insufficient		2,078	(54.99)	
Household Wealth Index				
Lowest		712	(18.84)	< .001
Second		884	(23.39)	
Middle		774	(20.48)	
Fourth		761	(20.14)	
Highest		648	(17.15)	
Health Factors				
Health Status				< .001
Healthy		2,393	(63.32)	
Not Healthy		1,386	(36.68)	
ADL Status				< .001
No Limitation		3,049	(80.68)	
With Limitation		730	(19.32)	
Social Support Network				
Member of other organizations				< .001
Yes, a member		1,130	(29.90)	
Not a member		2649	(70.10)	
Active in Religious Activities				< .001
Yes		1,195	(31.62)	
No		2,584	(68.38)	
Contact with friends				< .001
Often hears from friends		1,246	(32.97)	
Seldom/never hears from friends		2,533	(67.03)	

Variables	Frequency	(%)	Sig
Intergenerational Exchange			
Financial assistance			< .001
No Exchange	725	(19.18)	
Equal	480	(27.04)	
Unequal*	2,032	(53.77)	
Material assistance			
No Exchange	536	(14.18)	
Equal	1,288	(34.08)	
Unequal*	1,955	(51.73)	
Emotional assistance			< .003
No Exchange	454	(12.01)	
Equal	2,781	(73.59)	
Unequal	544	(14.40)	
Instrumental assistance			< .001
No Exchange	3,336	(88.28)	
Equal	87	(2.30)	
Unequal	356	(9.42)	
Any assistance			
No Exchange	331	(8.76)	
Equal	3,084	(81.61)	
Unequal	364	(9.63)	

Note. PhP is Philippine pesos. *OP gives more in unequal exchanges; Sig/P-Value are from bivariate analysis, t-test, or ANOVA

Participant Characteristics

Table 2 presents full baseline characteristics. The sample (n = 3,779) had a mean CES-D 11 score of 5.50. Co-residing adults reported the lowest mean distress ($\bar{x}$ = 5.17), compared to those in network living ($\bar{x}$ = 6.57) and solitary living ($\bar{x}$ = 6.25). The majority co-resided with children (82.16%); 10.66% were in network living, and 7.17% in solitary living. The sample was predominantly female (63.56%), concentrated in the 60–69 (40.78%) and 70–79 (39.01%) cohorts, with a mean age of 71.86 ± 7.87 years, and most were widowed or in other non-married statuses (61.26%). Educational attainment was low (64.81% completed elementary or below), the mean monthly income was PhP 5,405 ± PhP9,816.74, and 54.99% reported income insufficiency. Most were rated as healthy (63.32%) and free of ADL limitations (80.68%), but socially disengaged: 70.10% were non-members of organizations, 68.38% were not active in outside religious activities, and 67.03% had infrequent contact with friends. Intergenerational exchanges were predominantly asymmetric, with financial (53.77%) and material (51.73%) flows from children to parents. In comparison, emotional exchanges were mostly equal (73.59%), but an overall absence of instrumental support (88.28%).

Table 3 Multivariate regression analysis of predictors of psychological distress scores

	Coefficients [95% CI]
Living Arrangements (ref. Living with Children)	
Solitary (No children nearby)	**3.23 [1.65, 4.82]****
Solitary (Children Nearby)	0.75 [-0.28, 1.79]

	Coefficients [95% CI]
Demographic and Socio-economic characteristics	
Sex (ref. Male)	
Female	**0.56 [0.02, 1.10]***
Age Group (ref. 60–69)	
70–79	-0.21 [-0.70, 0.27]
80+	-0.08 [-0.68, 0.52]
Marital Status (ref. Never Married)	
Married	**1.79 [0.34, 3.25]***
Others	**2.14 [0.77, 3.52]****
Education Level (ref. Elementary or lower)	
High School or Higher	-0.19 [-0.72, 0.34]
Monthly Income Quintile (ref. Lowest 25%)	
Lower-Middle	-0.36 [-1.03, 0.32]
Upper-Middle	**-0.88 [-1.59, -0.15]***
Richest 25%	**-1.27 [-2.19, -0.35]****
Household Wealth Index (ref. Lowest)	
Second	-0.25 [-1.05, 0.54]
Middle	-0.53 [-1.32, 0.26]
Fourth	**-1.02 [-1.96, -0.07]***
Highest	**-1.30 [-2.40, -0.29]***
Income Sufficiency (ref. Sufficient)	
Insufficient	**0.55 [0.05, 1.05]***
Urbanity (ref. Urban)	
Rural	0.33 [-0.25, 0.88]
Health Factors	
Self-Rated Health (ref. Healthy)	
Not Healthy	**1.68 [1.14, 2.23]****
Functional Limitations (ref. No limitations)	
With ADL Limitations	**0.53 [-0.00, 1.06]***
Social Support Network	
Member of Social Orgs (ref. Yes)	
No	**1.56 [1.04, 2.08]****
Religious Act. Outside Home (ref. Yes)	
No	0.15 [-0.37, 0.66]
Social Contact Frequency (ref. Always)	
Seldom/Never	0.18 [-0.34, 0.70]
***Intergenerational* Support & Reciprocity (ref. No Exchange)**	
Financial Assistance	
Equal	0.74 [-0.11, 1.58]
Unequal	0.26 [-0.46, 0.99]
Social/Emotional Assistance	
Equal	**1.83 [0.67, 2.98]****
Unequal	**2.42 [1.17, 3.67]****
Instrumental/Physical Assistance	
Equal	0.68 [-0.29, 1.65]
Unequal	0.27 [-0.50, 1.05]

	Coefficients [95% CI]
Model Fit Indices	
AIC	19430.38
BIC	19611.26
Adjusted R^2 (df, n)	0.25 (28, 3750)
F-Statistics	14.53

Note. n = 3,779; **Bold** are significant values; Significance is represented as *p < 0.05, ** p < 0.01

Associations between Living Arrangements and Psychological Well-Being

As shown in Table 3, the fully adjusted regression model revealed a strong, statistically significant association between specific living arrangements and psychological distress. Older adults living in a solitary household with no children nearby reported substantially greater psychological distress than those living with their children (*b* = 3.23, 95% CI [1.65, 4.82], *p* < 0.01). Conversely, living in a solitary household with children nearby did not significantly differ from the reference group (*b* = 0.75, 95% CI [-0.28, 1.79]).

Several socio-demographic characteristics and economic indicators were also significantly associated with the outcome. Female respondents experienced significantly higher psychological distress scores than male respondents (*b* = 0.56, 95% CI [0.02, 1.10], *p* < 0.05). Compared to never-married individuals, older adults who were married (*b* = 1.79, 95% CI [0.34, 3.25]) or fell into other marital statuses (*b* = 2.14, 95% CI [0.77, 3.52]) exhibited higher distress. Both income and wealth demonstrated clear protective effects. Respondents in the upper-middle income quintile (*b* = -0.88, 95% CI [-1.59, -0.15]) and the richest quintile (*b* = -1.27, 95% CI [-2.19, -0.35]) reported lower distress relative to the lowest quintile. Similarly, the fourth household wealth index category (*b* = -1.02, 95% CI [-1.96, -0.07]) and the highest category (*b* = -1.30, 95% CI [-2.40, -0.29]) were significantly associated with lower distress. Subjective financial strain also mattered; perceived income insufficiency was associated with elevated psychological distress (*b* = 0.55, 95% CI [0.05, 1.05]).

Health status and social context further shaped well-being. Poor self-rated health was a powerful predictor of higher distress (*b* = 1.68, 95% CI [1.14, 2.23]), whereas the positive association for ADL limitations was weaker and only marginally significant (*b* = 0.53, 95% CI [-0.00, 1.06]).

Regarding the social support network, non-membership in social organizations was tied to significantly worse psychological outcomes (*b* = 1.56, 95% CI [1.04, 2.08]). Finally, with respect to intergenerational support, engaging in either equal (b = 1.83, 95% CI [0.67, 2.98]) or unequal (b = 2.42, 95% CI [1.17, 3.67]) social/emotional assistance exchanges predicted higher distress relative to no exchange at all. Financial and instrumental assistance flows did not significantly influence distress scores. Overall, the full model demonstrated strong explanatory power with Adjusted R^2 = 0.25 (df = 28, n = 3,750)

DISCUSSION

The central contribution of this study is to demonstrate that solitary living among older Filipinos is psychologically heterogeneous. Older adults living alone without nearby children reported substantially higher psychological distress than those living with others. In contrast, those in network living arrangements did not differ significantly from co-residents with children. This suggests that psychological well-being depends less on household composition than on the accessibility of family support.

These findings extend a growing body of literature on "network families" across Southeast and East Asia, where older parents and adult children maintain separate but geographically proximate households while continuing emotional, instrumental, and financial exchanges (13, 24-26). Within the barangay, it is assumed that family members can maintain regular

contact, respond to emergencies, and remain involved in everyday life despite living separately. This is consistent with evidence from Singapore showing that geographic proximity can maintain intergenerational assistance without co-residence (25), as well as findings from Thailand and Vietnam that reduced co-residence does not necessarily weaken family involvement (13). Together, these findings suggest that access to family may be more important for psychological well-being than shared residence, indicating that familial contracts are being renegotiated rather than lost amid changing family structures (15).

The findings also contribute to debates on ageing in place. Unlike high-income settings with extensive formal care systems, the Philippines continues to rely primarily on family-based care, with limited formal long-term care services (1, 27). Geographically proximate family networks may therefore enable residential independence while preserving access to assistance and family relationships (2, 15), reflecting the growing preference for independent living when children remain nearby (28, 29). Conversely, complete solitary living may be associated with higher psychological distress when residential independence coincides with reduced family accessibility.

The positive associations between emotional support exchanges and psychological distress were unexpected and may reflect the endogenous relationship between support and distress. Although the stronger association for unequal exchanges is also consistent with Social Exchange Theory, as perceived imbalance in emotional exchanges may lead to feelings of dependency, obligation, or relational strain, particularly in the Filipino context, where being a burden to their children is discouraged (30, 31). These findings suggest that the benefits of family support depend not only on its availability but also on how it is experienced within intergenerational relationships.

Gender and marital status introduce further nuances into psychological distress among older adults. Women reported higher distress, potentially linked to unexamined factors like caregiving responsibilities and emotional labor. Surprisingly, married, widowed, and separated individuals reported higher distress than those who never married. For married adults, declining spousal health can increase caregiving strain (32), a dynamic influenced by gender where men typically expect caregiving from wives, while women expect it from children, particularly daughters (33). Widowhood brings distress through loss of companionship and social roles (34), leaving women especially vulnerable due to longer life expectancies. In contrast, never-married older adults may experience lower distress by developing independent, diverse support networks throughout their lives. These findings highlight the need to consider older women and those experiencing major family transitions in psychosocial support.

Community participation was associated with higher psychological distress. Older adults who did not participate in social organizations reported higher psychological distress, consistent with evidence linking organizational participation with stronger social integration and better psychological well-being in East and Southeast Asia (35, 36). Religious participation outside the home was not independently associated with distress despite the importance of religiosity in older Filipinos (2, 37). This suggests that social engagement and connectedness may be more relevant than religious participation itself.

Economic security followed the expected pattern, with higher personal income and household wealth associated with lower psychological distress, whereas perceived income insufficiency was linked to poorer mental health. Poor self-rated health and limitations in ADLs were likewise associated with greater distress. These findings highlight the importance of economic security and health for psychological well-being in later life, particularly in a setting where out-of-pocket healthcare expenditures remain substantial (38, 39). These factors may be especially important for older adults living alone, who may face greater

vulnerability when economic, health, and social disadvantages accumulate.

CONCLUSION

This study distinguishes between solitary living with children nearby and solitary living among older Filipinos. Residential independence does not inherently impair well-being, provided older adults remain embedded within accessible community networks. Consequently, contemporary Philippine eldercare policy can no longer rely solely on co-residential family structures. To support safe, independent aging, targeted interventions must shift toward community-level frameworks that promote social participation, identify functionally vulnerable older adults living alone, and provide tailored psychosocial support for older women using barangay-level aging-in-place frameworks. These findings support the objectives of the UN Decade of Healthy Ageing and contribute evidence toward SDG 3 (Good Health and Well-Being) and SDG 10 (Reduced Inequalities) by identifying the social and community conditions that sustain well-being in later life.

ETHICAL CONSIDERATIONS

The 2018 LSAHP was commissioned by the Economic Research Institute for ASEAN and East Asia (ERIA) in collaboration with the Demographic Research and Development Foundation, Inc. (DRDF). Analysis of the data was conducted under Certificate of Exemption (COE No. 2026/04-022), provided by the Institutional Review Board of the Institute for Population and Social Research, Mahidol University (IPSR-IRB) on April 30, 2026.

LIMITATIONS

Several limitations should be acknowledged. First, the use of cross-sectional baseline data, rather than the most recent wave of the longitudinal study, precludes causal inference and limits assessment of changes in living arrangements and psychological distress over time. However, as the only publicly available national dataset for older Filipinos, Wave 1 provides an essential baseline capturing continued structural family and care dynamics that remain relevant today. Second, defining network living based on shared *barangay* residence provides a measure of geographic proximity but does not capture contact frequency, relationship quality, or actual access to support. Third, classifying support exchanges by living arrangement may oversimplify the complexity of inter-household assistance. Finally, the exclusion of proxy respondents may introduce selection bias, as individuals requiring proxy responses may have greater physical or cognitive impairments, potentially limiting the generalizability of findings to more vulnerable older adults.

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SOCIOECONOMIC AND DEMOGRAPHIC DRIVERS OF FERTILITY INTENTIONS AMONG MARRIED WOMEN IN KATHMANDU, NEPAL

Samun Acharya*[1] *and Narumol Bhummaphan*[1]

[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.*

[*] ***Corresponding Author****:Narumol Bhummaphan, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: Narumol.b@chula.ac.th*

ABSTRACT

Introduction: Fertility intention reflects reproductive decision-making and future fertility. In urban Nepal. Education, employment, and contraceptive practices may influence plans for first pregnancy. Evidence among never-pregnant married women remains limited; this study examined fertility intention and related socioeconomic, demographic, and contraceptive factors in Kathmandu City.

Objectives: This study aims to assess the socioeconomic and demographic factors associated with fertility intention among married women in Kathmandu City, Nepal.

Methodology: A quantitative cross-sectional survey was conducted among 425 never-pregnant married women in Kathmandu, using convenience sampling and a structured online questionnaire. Fertility intention was categorized as intending or not intending to have a child. Descriptive statistics and Chi-square analysis were applied to examine the association between fertility intention and related factors. A p-value of 0.05 was considered statistically significant. Binary logistic regression was performed to identify factors independently associated with fertility intention, with adjusted odds ratios (AORs) and 95% confidence intervals reported; $p < 0.05$ was considered statistically significant.

Results: Among 425 married women, 173 (40.7%) intended to have a child and 252 (59.3%) did not. Mean age was 27.6 years (SD = 7.118). Age (chi-square = 51.31, p = 0.001), education (chi-square = 16.781, p = 0.002), ethnicity (chi-square = 5.982, p = 0.050), and contraceptive use (chi-square = 3.900, p = 0.048) were significantly associated with fertility intention. In logistic regression, women aged 26-31 years and 32-38 years had higher odds of fertility intention than women aged 20-25 years. Bachelor's degree holders and women from Dalit/Madhesi/Muslim/Other ethnic groups also showed higher odds. Contraceptive use was positively associated with fertility intention in the contraception-related regression model.

Conclusion: Age, education, ethnicity, and contraceptive use were associated with fertility intention among married women in Kathmandu. These findings may support targeted reproductive health and family planning interventions.

Keywords:

Fertility Intention; Married women; Contraceptive use; Educational

INTRODUCTION

The fertility rate all around the world has been in a declining trend over the past few decades, falling from an average of about 5.0 births per woman in 1950 to around 2.3 births per woman in 2023. The World Bank assumes that "by 2050, nearly 75% of the world's total population will be living in countries with fertility rates below the replacement level, that is 2.1 children per woman" (1). Across Southeast Asia, fertility still varies from high in Timor-Leste, with around 3.0, to lowest in Singapore, with just 1.0. Other mainland Southeast Asian countries, such as Laos, Cambodia, and Myanmar, have for now maintained their fertility levels around 2.0-2.4, which is at the borderline for the replacement level (1).

The global and regional fertility decline has been strongly associated with women's educational attainment. Studies across the Organization for Economic Co-operation and Development (OECD) countries have shown that women with post-secondary education, including

university and vocational education, generally have fewer children (2). For example, women with university education, generally in Italy and Spain, often experience their first pregnancy after age 30, with fertility rates of approximately 1.2-1.4 per woman (2). Likewise, in the United States of America, women with professional degrees have been reported to have lower fertility than women whose highest educational attainment is high school or diploma level (3, 4).

Education also plays an important role in fertility patterns across Southeast Asia. In Indonesia, increasing female secondary education has been closely associated with long term fertility decline (5). In Thailand, extending compulsory education from six to nine years significantly reduced the probability of teenage pregnancy among the girls aged 14-17 years (6). Similarly, educational advancement among women in Vietnam has been associated with reduced fertility intention and fewer births (7).
Also, a study done in Nepal in the Madhesh Province found that women with at least nine years of schooling are significantly more likely to marry after the age of 18 and have their child after the age of 20 (8). Other studies across South and Southeast Asia have similarly linked higher education with delayed marriage, later first birth, and changes in fertility intention. Nepal has experienced a substantial fertility transition. From the 1950s to the 1980s, fertility remained at approximately six births per woman, considerably higher than current levels (9). From 1980 to 2000, a sharp decline was seen, which was mainly driven by improvements in female education and literacy and the huge role of Female Community Health Volunteers (FCHVs) (9). By the year 2023, Nepal's Total Fertility Rate (TFR) was approximately 1.9 births per woman, which is lower than the global average (9).

Research using Demographic and Health Survey data has shown that women with higher education are more likely to delay marriage and childbearing, contributing to changes in fertility behavior and fertility intention (10). Additional research has suggested that each additional year of schooling may reduce expected family size, partly through increased contraceptive use and changes in pregnancy planning (8). Marphatia et al. found that in the Terai region of Nepal, girls who have just completed their secondary schooling had significantly increased the odds of delaying their marriage, causing a change in their intention of their pregnancy (11).

The difference in fertility patterns between urban and rural areas is persistent. National survey reports show that the TFR in urban areas is around 2.0 births per woman, whereas in rural areas it is around 2.4 births per woman (9). Kathmandu district, which is also the capital of Nepal, has the highest literacy rate, at 90%, and a female literacy rate of approximately 87%. In addition, Kathmandu district records the lowest fertility rates in the country of about 1.5 births per woman, which is, for the most part, below the replacement level of 2.1 (9). This suggests, in a highly literate community like Kathmandu, education can be a major determinant of fertility preference and the timing of first pregnancy. Kathmandu also represents the largest and most rapidly urbanizing metropolitan region in the country (12). The Kathmandu Valley is the political, economic, educational, and health service center of Nepal and has experienced rapid population growth due to rural-to-urban migration and urban expansion (12, 13). These characteristics make Kathmandu an important setting for studying fertility intention among married women from diverse socio-demographic and socio-economic backgrounds.

Most fertility research in Nepal has focused on overall fertility behavior, contraceptive use, birth spacing, desired additional children, or women who have already experienced pregnancy and childbirth. Comparatively less is known about fertility intention before first pregnancy among married women, particularly in rapidly changing urban settings such as Kathmandu City. Never-pregnant married women represent a distinct population because their fertility intentions relate to the transition to first parenthood rather than decisions about additional births. Their

reproductive preferences are therefore not yet influenced by previous pregnancy experience, parity, or the sex composition of existing children. Studying this group may provide more specific insight into how socioeconomic, demographic, and contraceptive-related factors are associated with decisions surrounding first pregnancy. This study therefore contributes context-specific evidence on reproductive decision-making before first parenthood rather than attempting to identify entirely new determinants of fertility intention.

The broader study was guided by the Knowledge-Attitude-Practice (KAP) framework, together with demographic, socioeconomic, health, contraceptive, and social/interpersonal characteristics that may shape reproductive decision-making. Fertility intention was considered the outcome of interacting individual and contextual influences, including socio-demographic, socio-economic, and contraceptive-related factors that may shape reproductive preference, readiness, and the timing of childbearing. The present manuscript focuses specifically on these three components of the broader conceptual framework.

METHODOLOGY

Study Design and Study Area

A quantitative cross-sectional online survey was conducted in Kathmandu City from April to June 2026. Kathmandu was selected for its urbanization, educational and health services access, female participation in education and work, and changing reproductive norms.

Study population and Sample

The study population comprised legally married women aged 20-45 years residing in Kathmandu City for at least six months with internet access. Women with any previous pregnancy outcome, diagnosed infertility, or inability to provide informed consent were excluded; 17 women were excluded due to known infertility. Sample size was calculated using Cochran's formula (95% confidence level, 5% margin of error=0.50) because no comparable prior estimate was available. After adding 10% for non-response, the planned sample size was 425; the final achieved sample was 425 participants.

Research instrument

Data were collected using a structured questionnaire adapted from relevant literature and tools. This manuscript included sociodemographic, socioeconomic, and contraceptive-related variables. Contraceptive-related variables included contraceptive use and type of contraceptive method. Fertility intention, adapted from the Generation and Gender Survey, was dichotomized as intention to have a child (definitely yes/probably yes) and no intention (probably not/not/undecided). Age, education, ethnicity, husband's migration status, contraceptive use, and contraceptive method were categorized for analysis, while employment type and work/study hours were analyzed only among respondents who were employed or studying (14).

Validity and reliability

Three experts assessed content validity using the Item-Objective Congruence index (IOC 0.67-1.00). Reliability was assessed using Cronbach's Alpha (.0.70 acceptable). The English questionnaire was expert-validated and translated into Nepali.

Data collection procedure

Data were collected through Google Forms distributed through social media and personal and community networks. The first page presented the participants' information sheet, including the study purpose, procedures, voluntary nature of participation, confidentiality protections, potential risks and benefits, and investigator contact details. Participants had to confirm that they had read the information, met the eligibility criteria, and voluntarily agreed to participate by selecting 'I agree' before the questionnaire opened. Those who selected 'I do not agree', reported diagnosed infertility, or failed another eligibility item could not proceed; their screening responses were not retained.

Participants could stop before submission, and no identifying information was requested.

Statistical Analysis

IBM SPSS was used for analysis. Descriptive statistics summarized participant characteristics, and chi-square tests assessed associations with fertility intention at $p<0.05$. Significant bivariate variables were entered into binary logistic regression; adjusted odds ratios (AORs), 95% confidence intervals, and $p<0.05$ were reported.

RESULT

The characteristics of respondents

A total of 425 married women were included in the analysis. The mean age was 27.6 years (SD = 7.18; Range: 20-45 years). Most were Hindu (86.8%), lived in joint or extended families 68.2%), had 4-6 family members (67.5%), belonged to Brahmin/Chhetri ethnicity (64.7%), and had husband's migration; 30.8% and 31.5% had migrant and seasonal migrant husbands, respectively.

Table 1 Socio-demographic characteristics of respondents (n=425)

Socio-Demographic and characteristics	Frequency (n)	Percentage (%)
Age in Categories		
20-25 years	192	45.2
26-31 years	158	37.2
32-38 years	49	11.5
39-45 years	26	6.1
Mean (±Std. Deviation) = 27.6 (± 7.118) (Minimum = 20 years; Maximum = 45 years)		
Education		
Primary (0-10)	47	11.1
Secondary (10-12)	147	34.6
Diploma/Technical/Vocational	19	4.5
Bachelor's degree	157	36.9
Master's degree or above	55	12.9
Religion		
Hindu	369	86.8
Buddhist	45	10.6
Others	11	2.6
Family Type		
Joint/ Extended family	290	68.2
Nuclear family	135	31.8
Number of people in family		
1-3 persons	94	22.1
4-6 persons	287	67.5
≥7 persons	44	10.4
Ethnicity		
Brahmin/Chhetri	275	64.70
Janajati	109	25.65
Dalit/Madhesi/Muslim/Others	41	9.65

Socio-Demographic and characteristics	Frequency (n)	Percentage (%)
Husband's Migration Status		
Migrant (≥6 months)	131	30.8
Non-migrant	160	37.6
Seasonal migrant (<6 months)	134	31.5

Table 2 Socio-economic characteristics of respondents (n=425)

Socioeconomic characteristics	Frequency (n)	Percentage (%)
Household Monthly income		
Less than NPR 10,000	74	17.4
NPR 10,000-19,999	53	12.5
NPR 20,000-39,999	84	19.8
NPR 40,000-50,000	78	18.3
More than NPR 50,000	136	32.0
Employment/Student		
Yes	291	68.5
No	134	31.5
Employment Type (N=291)		
Formal employment	71	24.4
Informal employment	22	7.6
Self-employment	22	7.6
Homemaker	30	10.3
Student	146	50.1
Work/Student hours(N=291)		
Less than 20 hours	123	42.3
20-40 hours per week	74	25.4
More than 40 hours per week	94	32.3

More than one-third had a bachelor's degree (36.9%), 32% had a household monthly income of more than NPR 50,000(Approximately 333 US dollars), and 68.5% were employed or students. Among these, 50.1% were students and 42.3% worked or studied fewer than 20 hours weekly.

Contraceptive use was reported by 60.9% of participants. Among users, modern contraceptive methods were the most used (79.9%), whereas traditional contraceptive methods accounted for 19.2%. Overall, 40.7% intended to have a child, while 59.3% did not intend to have a child.

Table 3 Contraception-related characteristics of respondents and fertility intention(n=425)

Contraception Related Characteristics	Frequency (n)	Percentage (%)
Contraception Use		
Yes	259	60.9
No	166	39.1

Contraception Method (n=341*)		
Modern Contraceptive Methods	275	79.9
Traditional Contraceptive Methods	66	20.1
Fertility Intention		
Intends to have child	173	40.7
Does not intend to have child	252	59.3

**Multiple responses were allowed for contraceptive methods; therefore, method percentages do not sum to 100%. Modern methods included pills, injectables, implants, IUCD, condoms, and emergency contraceptive pills; traditional methods included withdrawal and calendar/ rhythm methods. Multiple responses were allowed, so one respondent could be counted in more than one method category. The denominator for method percentage is therefore 341 method selections, not 259 participants: modern methods 275/344 (79.9%), traditional methods 66/344 (20.1%).*

Association between sociodemographic characteristics and fertility intention

In bivariate analysis, age (p=0.001), education (p=0.002), and ethnicity (p=0.05) were significantly associated with fertility intention. Fertility intention was highest among women aged 39-45 years and 32-28 years. Religion, family type, number of people in the family, and husband's migration status were not significantly associated with fertility intention.

Table 4 Association between socio-demographic characteristics and fertility intention

Socio-demographic characteristics	**Intends to have child**	**Does not intend to have child**	**χ^2 Value**	**p- value**
Age in categories	N %	N %	51.31	0.001*
20-25 years	51 (26.6)	141(73.4)		
26-31 years	59 (37.3)	99 (62.7)		
32-38 years	63 (84.0)	12 (16.0)		
39-45 years	26(100.0)	0 (0)		
Education				
Primary (0-10)	14(29.8)	33(70.2)	16.781	0.002*
Secondary (10-12)	45(30.6)	102(69.4)		
Diploma/Technical/Vocational	9(47.4)	10(52.6)		
Bachelor's degree	81(51.6)	76(48.4)		
Master's degree or above	24(43.6)	31(56.4)		
Religion				
Hindu	154(41.7)	215(58.3)	3.944	0.139
Buddhist	13(28.9)	32(71.1)		
Others	6(54.5)	5(45.5)		
Family Type				
Joint/ Extended family	111(38.3)	179(61.7)	0.135	0.139
Nuclear family	62(45.9)	73(54.1)		
Number of people in family				
1-3 persons	39(41.5)	55(58.5)	2.953	0.228
4-6 persons	111(38.7)	176(61.3)		
≥7 persons	23(52.3)	21(47.7)		
Ethnicity				
Brahmin/Chhetri	107(38.9)	168(61.1)		0.05*
Janajati	42(38.5)	67(61.5)	5.982	
Dalit/Madhesi/Muslim/Others	24(58.5)	17(41.5)		

Socio-demographic characteristics	Intends to have child	Does not intend to have child	χ^2 Value	p- value
Husband's Migration Status				
Migrant (≥6 months)	51(38.9)	80(61.1)	1.900	0.387
Non-migrant	61(38.1)	99(61.9)		
Seasonal migrant (<6 months)	61(45.5)	73(59.3)		

Association between socio-economic characteristics and fertility intention

Household income, employment/ student status, employment type, work/ study hours were not significantly associated with fertility intention.

Table 5 Association between socio-economic characteristics and fertility intention

Socio-economic characteristics	Intends to have child	Does not intend to have child	χ^2 Value	P value
Household Monthly income*				
Less than NPR 10,000	25(33.8)	49(66.2)	2.355	0.671
NPR 10,000-19,999	23(43.4)	30(56.6)		
NPR 20,000-39,999	36(42.9)	48(57.1)		
NPR 40,000-50,000	30(38.5)	48(61.5)		
More than NPR 50,000	59(43.4)	77(56.6)		
Employment/Student				
Yes	118(40.3)	175(59.7)	0.095	0.757
No	55(41.7)	77(58.3)		
Employment Type (N=291)				
Formal employment	28(38.4)	45(61.6)	5.633	0.344
Informal employment	14(63.6)	8(36.4)		
Self-employment	9(40.9)	13(59.1)		
Homemaker	12(40.0)	18(60.0)		
Student	55(37.7)	91(62.3)		
Work/Student hours (N=291)				
Less than 20 hours	49(39.5)	75(60.5)	1.037	0.792
20-40 hours per week	33(44.0)	42(56.0)		
More than 40 hours per week	36(38.3)	58(61.7)		

*USD equivalents were calculated using the exchange rate of approximately NPR 153.14 per USD 1 on the day of analysis.

Association between contraceptive-related factors and fertility intention

Table 6 Association between contraceptive-related factors and fertility intention

Contraception-related Characteristics	Intends to have child	Does not intend to have a child	χ^2 Value	P value
Contraception Use				
Yes	120(46.3)	139(53.7)	3.9	0.048*
No	53(31.9)	113(68.1)		

Contraception-related Characteristics	Intends to have child	Does not intend to have a child	χ^2 Value	P value
Contraception Method (N=)				
Modern Contraceptive Methods	106(38.54)	169(61.45)	0.309	0.578
Traditional Contraceptive Methods	23(34.84)	43(65.15)		

*Multiple responses were allowed for contraceptive methods; therefore, method percentages do not sum to 100%

Contraceptive use was significantly associated with fertility intention (X^2 = 3.90, p= 0.048). whereas contraceptive method was not (X^2 = 0.309, p = 0.578).

Multivariable Analysis (Logistic Regression)

Variables that showed statistically significant bivariate associations in the selected domains were included in logistic regression models as reported in the thesis. The thesis did not provide one combined model adjusted simultaneously for all selected domains; therefore, Table 7 presents the regression estimates exactly as reported. The demographic-economic model included age, education, and ethnicity. Contraceptive use was reported in a separate contraception-related logistic regression model.

Table 7 Logistic regression results for factors associated with fertility intention

Factors	OR/AOR as reported	95% CI lower	95% CI upper	p-value
Age: 20-25 years	Reference			0.001
Age: 26-31 years	1.65	1.05	2.60	0.020*
Age: 32-45 years	14.51	7.24	29.10	<0.001*
Education: Primary (0-10)	Reference			0.002
Education: Secondary (10-12)	1.04	0.50	2.13	0.915
Education: Diploma/Technical/Vocational	2.12	0.70	6.34	0.179
Education: Bachelor's degree	2.51	1.249	5.05	0.010*
Education: Master's degree or above	1.82	0.80	4.15	0.151
Ethnicity: Brahmin/Chhetri	Reference			0.056
Ethnicity: Janajati	0.98	0.72	1.52	0.946
Ethnicity: Dalit/Madhesi/Muslim/Others	2.21	1.14	4.32	0.019*
Contraception use: No	Reference			0.048
Contraception use: Yes	1.86	1.23	2.82	0.003*

DISCUSSION

This study assessed fertility intention among married women aged 20-45 years in Kathmandu. Overall, 40.7% intended to have a child while 59.3 did not. The predominantly young sample may reflect changing reproductive behavior in urban Nepal.

Fertility intention differed significantly across age groups, with higher proportions observed among women in the older age categories. However, this pattern should be interpreted cautiously because the 39- 45-year group included only 26 respondents, all of whom intended to have a child, resulting in sparse data and unstable estimation for this category. This is consistent with Nepal and South Asian studies linking later reproductive age with fertility intention (11, 15, 16), but differs from findings in Madhesh Province, where intention declines with age (17)

Educational attainment was significantly associated with fertility intention. Higher

education may support reproductive knowledge, autonomy, and informed pregnancy planning, consistent with previous evidence on education and childbearing decisions (15, 18).

Ethnicity was also significant. Dalit/ Madhesi/Muslim/other women showed higher fertility intention than Brahmin/Chhetri women. Ethnic differences in fertility preferences have also been reported in Nepal (8, 17).

Household income, religion, household size, employment, work/study hours, and husband's migration status were not significant. Contraceptive use was associated with fertility intention, suggesting a role in pregnancy planning, consistent with previous studies. (19, 20).

CONCLUSION

Fertility intention among married women in Kathmandu City was relatively low, with fewer than half intending to have a child. After adjusting for potential confounding factors, age, education, ethnicity, contraceptive use, and reproductive health knowledge were significantly associated with fertility intention. Women aged 26-38 years, those with a bachelor's degree, women from Dalit/ Madhesi/Muslim/Other ethnic groups, contraceptive users, and those with moderate reproductive health knowledge had greater fertility intentions.

Other examined factors were not independently associated with fertility intention in the adjusted analysis. These findings emphasize the need for reproductive health programs that provide accurate information about fertility and contraception and promote informed reproductive decision-making. Programs should consider women's age, educational background, ethnicity, contraceptive experience, and level of reproductive health knowledge when planning fertility-related services. Strengthening accessible and culturally appropriate reproductive health education may help married women and couples make informed fertility decisions according to their individual needs and circumstances.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1 (COA No. 173/69).

LIMITATIONS

The study has limitations. Convenience sampling through online platforms may have introduced selection bias by disproportionately reaching younger, more educated, and digitally connected women, which may limit the generalizability of the findings. In addition, potentially important determinants of fertility intention, including marriage duration, family expectations or pressure, and career aspirations, were not assessed; their omission may have resulted in residual confounding and influenced the observed associations

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THE EFFECT OF MUSCLE STRENGTHENING AND BALANCE TRAINING PROGRAMS ON FALLS AMONG OLDER ADULTS IN ASIA: A SYSTEMATIC REVIEW

Saowaluk Sudjarawut[1], Dusanee Suwankhong[1*], Tum Boonrod[1]
[1]Master of Public Health Program, Thaksin University, Phatthalung 93210, Thailand
****Corresponding Author:** Dusanee Suwankhong,*
Thaksin University, Phatthalung 93210, Thailand, E-mail: dusanee.s@tsu.ac.th

ABSTRACT

Introduction: Falls among older adults are a major global public health issue, particularly in Asia, where the aging population is rapidly increasing. Previous systematic reviews have shown that multicomponent exercise programs can reduce falls among older adults; however, evidence specifically addressing the effects of muscle-strengthening and balance-training programs among community-dwelling older adults in Asia remains limited.

Objectives: To systematically synthesize and evaluate evidence regarding the effects of muscle-strengthening and balance-training programs on falls, balance, muscle strength, and fear of falling among community-dwelling older adults aged 60 years and older in Asia.

Methodology: This systematic review was conducted in accordance with the PRISMA 2020 guidelines. A comprehensive literature search was performed in PubMed, Scopus, ScienceDirect, and Google Scholar for studies published between January 2020 and January 2025. Search terms included keywords related to exercise, muscle strengthening, balance training, fall prevention, older adults, and Asia. Eligible studies were experimental or quasi-experimental designs involving community-dwelling older adults aged ≥60 years in Asian countries. The included studies were published in English and conducted in community-based settings, with interventions focusing on muscle-strengthening or balance-training programs. Outcomes of interest included falls, balance, muscle strength, and fear of falling. Studies involving non-exercise interventions, qualitative research, review articles, case reports, or those not reporting fall-related outcomes were excluded.

Results: The search strategy identified 6,248 records. After removing duplicates, 5,944 records were screened. Thirty full-text articles were assessed, and nine studies met the inclusion criteria. The included studies were conducted in Indonesia, India, Iran, Japan, and Thailand, involving a total of 358 participants. The majority of whom were older women. Seven studies employed quasi-experimental two-group pretest–posttest designs, whereas two used one-group pretest–posttest designs. Intervention duration ranged from 15 to 60 minutes per session, delivered 2–7 days per week over 2–12 weeks. Only one study reported a 2-year follow-up. Overall, the interventions demonstrated positive effects on balance, muscle strength, physical fitness, and fall risk reduction, particularly among studies using TRX, FallProof™, and resistance training programs. Several studies also reported reductions in fear of falling and improvements in quality of life.

Conclusion: Physical activity programs incorporating balance-training and muscle-strengthening components improve physical function and support fall prevention among older adults in Asia. These findings support the implementation of community-based exercise programs to promote healthy ageing and reduce fall risk.

Keywords:
Asian Population; Fall Prevention; Health Innovation; Older Adults; Physical Activity Interventions

INTRODUCTION

Falls among older adults are a major global public health issue, particularly in Asia, where the aging population is rapidly increasing. Studies have shown that the incidence of falls among older adults is 26.5% worldwide (1). The prevalence of falls was reported at 22.49% in China (2), 27.6% in the United States (3), 11.43% in India (4), 17.7% in the Philippines, and 7.3% in Vietnam (5). Falls are a leading cause of death among older adults, with more than 80% of these occurring in low- and middle-income countries, most of which are in Asia (6). Risk factors include advanced age, poor balance, and lower-limb muscle weakness (7). Physical activity interventions that enhance muscle strength and balance can reduce fall risk among older adults (8), because exercise helps to increase lower-limb muscle mass, improve neuromuscular coordination, and enhance dynamic balance. These are essential components that reduce the possibility of imbalance and falls (9). Various exercise approaches have been implemented across Asian countries, including balance training, resistance training, Pilates, TRX suspension exercises, and traditional physical activities. However, these interventions differ considerably in their exercise components, duration, intensity, and delivery methods.

Although previous systematic reviews have reported that multicomponent exercise programs can reduce falls among older adults (10), evidence specifically addressing the effects of muscle-strengthening and balance-training programs among community-dwelling older adults in Asia remains limited. Therefore, this systematic review aimed to synthesize and evaluate evidence regarding the effects of muscle-strengthening and balance-training programs on fall prevention among community-dwelling older adults aged 60 years and older in Asian countries. The review addressed the following research question: What are the effects of muscle-strengthening and balance-training programs on falls, balance, muscle strength, and fear of falling among community-dwelling older adults in Asia? To answer this question, the review included experimental and quasi-experimental studies published between January 2020 and January 2025.

METHODOLOGY

This study is a systematic review conducted in accordance with the PRISMA 2020 guidelines (11). Articles were searched from PubMed, Scopus, ScienceDirect, and Google Scholar for studies published between January 2020 and January 2025. PubMed, Scopus, and ScienceDirect were selected because they are widely recognized databases for medical and health sciences research. Google Scholar was additionally searched to maximize the retrieval of relevant studies not indexed in the primary databases. All records retrieved from Google Scholar were screened using the same predefined eligibility criteria as the other databases, and duplicate records were manually removed before screening. Keywords related to ("exercise" OR "exercise program" OR "balance training" OR "effects of exercise") AND ("fall prevention" OR "falls" OR "balance") AND ("older adults" OR "elderly" OR "Among older adults") AND ("Asia" OR specific countries such as "China, Japan, Korea, India) AND ("quasi-experimental" OR "Experimental"). The search was limited to published articles in the selected electronic databases. Grey literature, trial registries, and the reference lists of included studies were not searched because the review was designed to synthesize evidence from peer-reviewed published studies retrieved through the predefined electronic databases.

Inclusion criteria included experimental or quasi-experimental study design, participants aged ≥60 years, studies conducted in community-based settings in Asian countries, intervention involving muscle-strengthening or balance training, outcomes measuring falls, balance, or muscle strength, and published in English. Exclusion criteria were: non-exercise interventions, studies outside Asia, qualitative studies, reviews, case studies, and those lacking fall-related outcomes.

In this review, a fall was defined as an unexpected event in which a person comes to rest on the ground, floor, or a lower level. Fall-related outcomes included fall incidence, balance performance, muscle strength, and fear of falling, as measured using validated assessment instruments.

All articles were independently screened and selected by two reviewers. Titles and abstracts were screened first, followed by full-text assessment for eligibility. Any disagreements were resolved through discussion until consensus was reached. Screening was conducted manually. The process began with reviewing titles and removing duplicates and irrelevant studies. This was followed by screening abstracts to exclude articles that did not meet the inclusion criteria. Finally, the remaining full-text articles were reviewed to verify the type of exercise intervention and fall-related outcomes.

RESULTS

A total of 6,248 records were identified through the database search. After removing 304 duplicate records, 5,944 records remained for title and abstract screening. Of these, 5,914 records were excluded because they did not meet the predefined eligibility criteria, including studies conducted outside Asia or those with ineligible study designs. The remaining 30 articles underwent full-text assessment, of which 21 were excluded because they did not report fall-related outcomes, used non-exercise interventions, or were conducted outside Asia. Finally, nine studies were included in the systematic review. The included studies were conducted in Indonesia, India, Iran, Japan, and Thailand and involved a total of 358 participants, most of whom were older women. Sample sizes ranged from 23 to 90 participants and were drawn from both urban and rural community settings. Participants' educational levels ranged from primary to secondary school. Seven studies employed quasi-experimental two-group pretest–posttest designs, whereas two used one-group pretest–posttest designs (Figure 1).

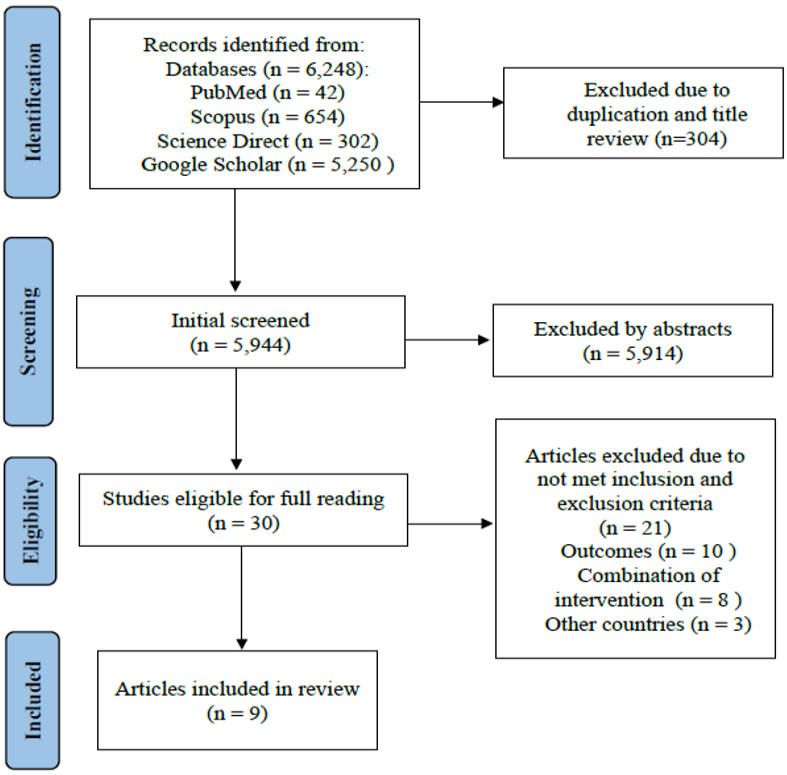

Figure 1 Flowchart for inclusion of students

Table 1 Physical activity interventions for fall prevention among community-dwelling older adults in Asian populations

Author (Year) country	Sample size (each group) Participants	Study design	Intervention	Duration	Assessment Tools	Outcome	Effect
Santoso et al. (2023) (12) Indonesia	n = 36 (IG, n=18, CG, n=18) Older adults, age 60-65 yrs. (61.1%), male and female each as much as 50%	Quasi-experimental, two-group pretest–posttest design	Tandem exercise (15 min/day)	2 weeks	(TUG)	Fall risk	Reduced risk of falling
Widagdo et al. (2024) (13) Indonesia	n = 23 Older adults, age 69.96±6.138 yrs, 87% female	Quasi-experimental, one-group pretest–posttest design	Balance exercise program (Conducted weekly for 60 min/session)	4 weeks follow-up at 2 years	(FRT), (FES-I), (MMSE)	Balance performance and fear of falling	Balance and fear of falling improved
Moradi et al. (2023) (14) Iran	n = 30 (IG, n=16, CG, n=14) Older men, age 67.9±4.3 yrs.	Quasi-experimental, two-group pretest–posttest design	TRX Suspension Functional (3 sessions/week, 60 min/session)	8 weeks	30-Second Chair Stand Test, (BBS), (TUG), (FES-I)	Strength, balance, mobility, fear of falling	Improved strength, balance, and mobility; no effect on fear of falling
Mohammad Ali Nasab Firouzjah & Farnian (2023) (15) Iran	n = 30 (IG, n=15, CG, n=15) Older women, age 60-70 yrs.	Quasi-experimental, two-group pretest–posttest design	Fall Proof Training (3 sessions/week, 60 min/session)	8 weeks	Sharpened Romberg Test, (TUG), Fear of Falling Questionnaire	Static balance, dynamic balance, fear of falling	Balance improved and fear of falling decreased.
Liu et al. (2025) (16) Japan	n = 23 Older women (IG, n=12, CG, n=11), age IG: 67.3±4.8 yrs, CG: 69.4±6.0 yrs.	Quasi-experimental, two-group pretest–posttest design	Low-load resistance training with slow movement using body weight (LRT) (2 sessions/week, 60 min/session)	12 weeks	30-Second Chair Stand Test (CS-30), (OLST-O), (OLST-C), (FES-I)	Lower-extremity muscle strength, balance, fear of falling	Improved muscle strength and balance; no change in fear of falling.

Author (Year) country	Sample size (each group) Participants	Study design	Intervention	Duration	Assessment Tools	Outcome	Effect
Borah et al. (2024) (17) India	n = 30 Older adults, age 63.40±1.77 yrs, 60% female	Quasi-experimental, one-group pretest–posttest design	Mat Pilates Training (MPT) (6 days/week, 60 min/session)	6 weeks	(LBS), (UBS), (AE), (LBF), (UBF), (AG), BMI	Functional fitness parameters	Improved strength, endurance, flexibility, and agility; BMI unchanged.
Khazanin et al. (2022) (18) Iran	n = 24 (IG, n=12, CG, n=12) Older adults, age 60-74 yrs, 60% female	Quasi-experimental, two-group pretest–posttest design	Fallproof Exercises (3 sessions/week, 60 min/session)	8 weeks	(FES-I), Lipad Quality of Life Questionnaire	Fear of falling, quality of life	Reduce fear of falling and improve quality of life
Buransri & Phanpheng (2021) (19) Thailand	n = 90 (IG, n=45, CG, n=45) Older adults, age 60-75 yrs	Quasi-experimental, two-group pretest–posttest design	Traditional Srichiangmai Dance (TSD) (15 postures, 4 rounds per session, 30 min/session, 3 sessions/week)	12 weeks	(FRT), (TUG), (6-min walk test), (Chair stand test), (30-sec Arm curl test)	Balance, mobility, physical fitness	Improved balance and movement
Punlomso et al. (2020) (20) Thailand	n = 72 (IG, n=36, CG, n=36) Older adults, age IG: 68.4±5.2 yrs, CG: 70.3±6.2 yrs.	Quasi-experimental, two-group pretest–posttest design	HBM-based Otago Exercise Program	12 weeks	(BBS), Quadriceps torque measurement, Fall-related knowledge, perception, and behavior questionnaires	Postural balance, leg strength, fall-related health beliefs	Improved postural balance and quadriceps strength; increased fall-related knowledge, perception, and behaviors.

Table 1 showed that physical activity interventions for community-dwelling older adults in Asia vary widely but generally improve physical fitness, balance, and fall risk. Most programs lasted 15–60 minutes per session, 2–7 days per week for 2–12 weeks. Only one study included a 2-year follow-up assessment. Most studies reported improvements in balance and muscle strength, particularly following TRX, Fall Proof, and resistance training programs. Some also reduced fear of falling and improved quality of life, although psychological outcomes were inconsistent. Differences in intervention types and durations, as well as assessment tools and outcome measures, including balance, fear of falling, muscle strength, endurance, and flexibility, may have contributed to variations in the reported outcomes across studies.

DISCUSSION

This systematic review demonstrates that balance- and muscle-strengthening interventions improve balance, muscle strength, and reduce fall risk among older adults in Asia. These benefits may be attributed to improved lower-limb strength, neuromuscular coordination, proprioception, and postural control (8,9). Consistent with previous evidence, multicomponent exercise programs incorporating balance and muscle-strengthening exercises effectively reduce fall risk (9,21). These findings provide practical evidence for healthcare providers, policymakers, and community organizations to develop and implement structured community-based exercise programs for fall prevention among older adults.

A range of physical activity programs—including TRX, FallProof™, Tandem Exercise, the Otago Exercise Program, Mat Pilates, Traditional Thai Dance, and resistance training—demonstrated comparable improvements in balance, muscle strength, and fall-related outcomes (21,22). Despite differences in format and duration, their effectiveness appears to rely more on incorporating balance and strength components than on specific exercise types, aligning with previous findings is consistent with previous evidence demonstrating that multicomponent exercise programs emphasizing balance and muscle-strengthening exercises are the most effective approach for preventing falls among older adults (23). This review provides Asia-specific evidence that the effectiveness of fall-prevention programs depends more on the inclusion of balance-training and muscle-strengthening components than on the specific exercise modality.

Physical activity interventions also reduced fear of falling by enhancing balance confidence and functional performance (24). However, shorter interventions showed limited psychological benefits, whereas programs lasting more than 16 weeks were more effective (22). This finding suggests that while balance and muscle strength can improve with short-term training, reducing fear of falling requires longer and sustained participation (22,23).

Despite limitations in population diversity and study settings, the findings support physical activity interventions as effective strategies for healthy ageing, fall prevention, and improved quality of life in community-dwelling older adults. Future research should include more diverse populations and longer follow-up periods. Implementation in Asian countries should be context-specific, considering cultural practices, community characteristics, health systems, and available resources (19,25,26). Culturally relevant and group-based activities may enhance participation (9,19,27), while home-based programs can improve access and feasibility (25). Core components, particularly balance and muscle-strengthening exercises, should be maintained across settings (26,28)

These findings support the integration of balance-training and muscle-strengthening exercises into community-based fall prevention programs and healthy ageing strategies across Asia. However, evidence remains limited on program implementation in low- and middle-income countries and rural settings. Most studies also included more older women than men, limiting evidence on men's participation. Future

research should include more diverse populations, longer follow-up periods, and standardized outcome measures to better evaluate implementation and sustainability.

CONCLUSION

Physical activity programs incorporating muscle-strengthening and balance-training components consistently improved balance, lower-limb muscle strength, and physical function among community-dwelling older adults in Asia. These findings support the use of such programs to improve physical performance in older adults.

However, evidence for reducing falls and fear of falling remains limited because of the small and non-representative samples, the predominance of quasi-experimental designs, short intervention and follow-up periods, and heterogeneity in outcome measures across the included studies. Therefore, further high-quality randomized controlled trials with larger and more representative populations, standardized outcome measures, and longer follow-up periods are needed to determine the long-term effectiveness of these programs in reducing falls and fear of falling among older adults in Asia.

ETHICAL DECLARATION

Ethical approval was not required for this systematic review, as it involved the analysis of data from previously published studies and did not involve human participants directly.

LIMITATIONS

This review has several limitations, including heterogeneity in intervention characteristics, outcome measures, follow-up periods, and participant characteristics, which may limit comparability. Differences in cultural, healthcare, and socioeconomic contexts across Asia may also affect generalizability. In addition, the findings were influenced by the methodological quality and risk of bias of the included studies.

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THE MISSING LINK BETWEEN COVERAGE AND CARE: INFORMATION ASYMMETRY AMONG MYANMAR MIGRANT WORKERS UNDER THAILAND'S MIGRANT HEALTH INSURANCE SCHEME

Aye Chan Saint[1]*, Wandee Sirichokchatchawan[1]
[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand
**** Corresponding Author:*** *Aye Chan Saint,*
College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, Email: 6874027653@student.chula.ac.th

ABSTRACT

Introduction: In Thailand, the Migrant Health Insurance Scheme (MHIS), often referred to locally as *Pakan Sukapha*, is a key mechanism for extending Universal Health Coverage to migrant populations. Despite widespread enrolment through the work permit process, formal enrolment does not necessarily ensure that migrants understand their healthcare entitlements or how to access services. Understanding how information about the scheme is communicated and understood is essential for identifying the gap between formal coverage and informed healthcare access.

Objective: To explore Myanmar migrant workers' understanding, perceptions, and experiences related to MHIS, with particular attention to sources of information, enrolment experiences, understanding of benefits, and knowledge of how and where to access care.

Methodology: The study employed the qualitative methodology involving in-depth interviews with 30 Myanmar migrant workers from different occupation backgrounds living in Bangkok, Thailand. Participants were recruited through purposive and snowball sampling. Interviews were audio-recorded, transcribed verbatim, and analyzed using reflexive thematic analysis. Coding was conducted inductively with iterative theme development to enhance analytic rigor.

Results: Major theme "Information Asymmetry" has emerged with 3 subthemes as follows.

1) Role of Brokers in Enrolment: Several participants perceived that brokers facilitated insurance enrolment but often provided little information about benefits or service use. Some migrants described experiences in which options to skip mandatory health screening procedures were given, prioritizing convenience and speed. 2) Legal Compliance without Health Service Awareness: Participants overwhelmingly perceived MHIS as a "legal document" necessary for residence and employment rather than a health resource. 3) Health Insurance Literacy Deficits: Many migrants lacked knowledge of the benefits, coverage limits and contracted hospital. Some migrants confused between MHIS and SSS and mistakenly believed that they have no medical rights unless they are employed in a workplace that provides SSS. As a result, some participants were uncertain about their healthcare rights and continued to seek care outside the insurance system.

Conclusion: This study provides new evidence that insurance enrolment does not necessarily translate into informed utilization. Since information asymmetry limits migrants' understanding of their entitlements and available services, it may contribute to underutilization of health services. Providing native-language enrolment guidance and social media-based health education may improve migrants' understanding on MHIS, support appropriate service utilization. Further research is still needed to examine system-level effects.

Keywords:
Migrant Health; Health Insurance; MHIS, Universal Health Coverage; Access to Care; Myanmar Migrant Workers

INTRODUCTION

Equitable healthcare access remains an important public health concern among migrant workers in Thailand. Migrant workers may experience multiple barriers to accessing healthcare, including language barrier, limited knowledge of healthcare entitlements, financial concerns, administrative procedures, and difficulties navigating the health system (1-4). These barriers can affect not only whether migrants are covered by health insurance but also whether they are able to use their coverage when healthcare needs arise.

Thailand established the Migrant Health Insurance Scheme (MHIS), locally known as *Pakan Sukapha*, to extend health protection to migrant populations (5-8) who are outside of the Social Security Scheme (SSS) and Universal Coverage Scheme (UCS). However, while enrolment in the MHIS is mandated as a legal requirement for the work permit process and legal residency, formal enrolment does not necessarily ensure that migrants understand their insurance entitlements or know how to access healthcare through the scheme.

Despite the importance of health insurance literacy for effective access to care, limited qualitative evidence has examined how Myanmar migrant workers who the largest proportion of Thailand's migrant population, receive, perceive and use information about MHIS. Especially in complex urban settings like Bangkok, where Myanmar migrants are highly concentrated but living scattered, one of the expected unique challenges would be lack of information transparency and peer support network (2, 9, 10). To improve health equity and policy effectiveness, it is essential to explore Myanmar migrant workers' understanding, perceptions, and experiences related to MHIS in Bangkok, focusing on their sources of information, enrolment experiences, understanding of benefits, and knowledge of how and where to access healthcare through the scheme.

METHODOLOGY

Study Design, Sampling and Participant Recruitment

This study employed qualitative exploratory approach to explore the understanding, perception and experiences of MHIS among Myanmar Migrant Workers in Bangkok. In-Depth Interviews (IDI) were conducted with 30 Myanmar migrant workers recruited through purposive and snowball sampling. Participants were recruited through migrant communities and network familiar with the researcher. Participants were adults working in informal and diverse occupation sectors who were currently enrolled in MHIS. Participants varied in age, occupation, education, living situation and duration of stay in Thailand.

Data Collection

Data collection took place from May to June 2026 conducting face-to-face interviews in Burmese language in participants' convenient time and places. Interviews lasted about 30-45 minutes, and written informed consent was obtained before conducting each interview. The semi-structured IDI guide which included three main questions focused on the "Understanding of MHIS" exploring the general understanding of MHIS, source of information, and participants' MHIS enrolment experience, was applied in the interview. The validity of IDI guide is ensured with an expert review of item-objective congruence. The single interviewer approach, with the primary researcher being the interviewer, ensured consistency in questioning technique, probing style and rapport-building across all interviews. To minimize potential researcher bias, she adopted a reflexive approach throughout the research process by documenting personal reflections after each interview, and discussing emerging codes and themes regularly with her academic supervisor (additional researcher) to enhance analytical rigor and credibility.

Data analysis

Data analysis for this study encompassed a systematic process, beginning with the meticulous transcribing and familiarization of qualitative data obtained from in-depth interviews. Subsequently, a comprehensive coding process, including iterative and repetitive reviewing and refining of initial codes and potential themes, was undertaken to facilitate the identification and exploration of various themes and patterns associated with Myanmar migrant workers navigating and utilizing health services under MHIS.

Manual coding and identification of themes was done using Microsoft Word and Excel software by main researcher and additional researcher. Regular discussions were conducted to compare coding decisions and interpretations across researchers. Differences in interpretation were reviewed and reconciled to achieve agreement, thereby demonstrating consistency in the analytical process. Thematic analysis, a well-established qualitative approach, was employed to systematically uncover, analyze, and summarize these emergent themes. To enhance the credibility of the findings, member checking was conducted by sharing transcripts with selective participants for feedback.

RESULTS

A total of 30 Myanmar migrant workers (15 females, 15 males) participated in the study, with the majority aged 20-29 years (50%, n=15) followed by those aged 30-39 years (43%, n=13) and by those aged 40-49 years (7%, n=2) (as shown in Table 1). The largest occupation categories were food and beverage sector (20%, n=6) and remote/freelance works (20%, n=6). The other saturated occupation categories were domestic workers (13%, n=4), office administrative workers (10%, n=3), and hospitality services (10%, n=3), showing that heterogeneous employment patterns of Myanmar migrants living in urban Bangkok. The vast majority of migrant workers had lived in Thailand for 1-5 years (70%, n=21) and 10% (n=3) had been in Thailand for less than 1 year, altogether indicating a notable migration influx/ pattern after the 2021 political crisis in Myanmar. A further 20% (n=6) had resided in Thailand for 10 years or more, while no participants reported residing in Thailand for 5-10 years.

Table 1 Sociodemographic characteristics of study participants

Sociodemographic Characteristics	Number (n)	Percentage (%)
Age		
20-29	15	50%
30-39	13	43%
40-49	2	7%
Gender		
Male	15	50%
Female	15	50%
Marital Status		
Single	21	70%
Married	9	30%
Educational attainment		
Primary School	2	7%
Middle School	-	-
High School	9	30%
Undergrads	9	30%
Graduates	10	33%
Living situation		
Living alone	6	20%
Living with family/partner/spouse	11	37%

Sociodemographic Characteristics	Number (n)	Percentage (%)
Living with friends	10	33%
Living with coworkers	3	10%
Occupation sectors		
Food & Beverage	6	20%
Remote/ Freelance	6	20%
Domestic workers	4	13%
Office administrative	3	10%
Hospitality services	3	10%
Others	8	27%
Duration of Stay in Thailand		
<1 year	3	10%
1-5 years	21	70%
5-10 years	-	-
≥10 years	6	20%

Thematic analysis of in-depth interview about Understanding of MHIS revealed major theme as Information Asymmetry with 3 sub-themes including Role of Brokers in Enrolment, Legal Compliance without Health Service Awareness and Health Literacy Deficits.

Major Theme – Information Asymmetry

Sub-theme 1: Role of Brokers in Enrolment

The MHIS enrolment process is currently mediated by an unregulated network of brokers/ agents. Almost all participants from this study, including the long-term residents underwent broker-mediated enrolment and they reported that the process was convenient because brokers/ agents handled every step and documents. To get things done faster, brokers often charge an "all-inclusive" package fee for both work permit registration or extension along with the mandatory enrolment of health insurance for migrant workers. However, information gap became the major drawback of broker-mediated enrolment that migrants were not even aware of themselves enrolled the health insurance. (M6, M9)

Participant M6: *"They just said you need a medical check-up and blood test to process Baht. It was only later, when friends told me, that I knew I had health insurance." – 36 years old driver*

Participant M9: *"I only knew that I would get the work permit and the Pink Card. No one explained anything else to me." – 30 years old worked at a religious media team*

In addition, some agents/ brokers often give options to workers allowing to skip the mandatory annual health checks for highly infectious diseases like TB, HIV, and Hepatitis (M1, F1).

Participant M1: *"If you don't want to do the medical tests and want to save time, just pay the money to skip the steps. So, I just paid and got the documents without actually doing any check-ups or insurance registration myself. I only register MHIS because it was required for the work permit" - 27 years old remote worker*

From the workers' perspectives, bypassing the health screening step by providing counterfeit infection screening test results was for speed and ease. They found the enrolment process easy mentioning that it saved their time, work hours, able to avoid official visit (F1, F12).

Participant F1: *"I only needed to pay the service charges to the broker without even needing to go to the office. Normally, we have to go to the office for infection screening, such as hepatitis B, hepatitis C, and HIV testing. But I did not do that in person because I had no time to go there, as the office was very far from my place. So, my agent helped me skip that step with some additional charges." - 27 years old medical translator*

Participant F12: *"The first time, I had to do them [health screenings]. The second time, I*

didn't have to. So, overall, I can say the enrolment for this insurance was easy. Because the agent arranged everything." – 36 years old supplier

However, participant like M3 showed concern for skipping health screening for speed and ease.

Participant M3: *"I don't want a situation where health check-ups can be skipped. Back then, I didn't think much about it either; I just wanted it to be done quickly. Thinking back now, I wonder what I would do if I had a disease. We don't have much health knowledge, so we are afraid of being checked, afraid of finding out we have a disease. So, most people think it's good that the health check-up step can be skipped." – 26 years old cook*

Besides, some migrants like F13 highlighted the documents are often delivered by agents near or after their expiration date. Some don't even have information about the expiry date which means the health insurance package was sometimes chosen by brokers not by migrants themselves. They pay coverage they never functionally possess.

Participant F13: *"Agents follow their own process and buy the Pakan at a hospital convenient for them. Then, the documents take a long time in their process, so by the time they reach our hands, it's already expired and unusable. Sometimes, we don't even know which hospital the Pakan was bought from" – 34 years old hair stylist*

Sub-theme 2: Legal Compliance without Health Service Awareness

A recurring theme among 13 participants is the perception of the MHIS as a legal requirement for pink card process or work permit extension rather than a medical entitlement.

Participant F4: *"When processing the baht, I've heard that you have to buy health insurance. But I don't know what the benefits are. However, they do give a document for such insurance. You have to buy it. But I don't know its purposes or the benefits you can claim yet." – 28 years old factory worker*

Participant F9: *"I know that when you process Bhat and get a work permit, you must buy health insurance. However, I don't know precisely about the benefits included or how to see a doctor/use a clinic. They just give out documents, but there is no clear explanation." – 31 years old hotel receptionist*

Participant F10: *"To be honest, I don't really know much. I only got it because it's required for living here. Even though a year has passed, I've never used it. I don't know how to use it. The main difficulty is the language barrier. Also, I don't know which clinic or place to go to." – 27 years old online customer service staff*

Participant F2 explicitly noted the belief that the insurance was strictly for "documentation and legal purposes" to prove fitness for work.

Participant F2: *"I thought it was only documentation to prove that a person is fit for work." – 24 years old worked at a kindergarten*

Similarly, M9 assumed the process was merely a mechanism to make staying in Thailand cheaper, entirely unaware that medical benefits were included.

Participant M9: I tried to get the work permit because without it, other visa fees are very high. I just knew it makes staying in Thailand for a year cheaper. About the health insurance, I don't know much. I wasn't told what benefits I would get. I assumed there were no benefits included." - 30 years old worked at a religious media team

Sub-theme 3: Health Literacy Deficits

Specific literacy deficits identified among participants include:

Scheme confusion: Systemic confusion between the *Pakan Sukapha* (MHIS) and the *Pakan Sakhon* (Social Security Scheme - SSS). Misconceptions that medical rights only exist for formal factory workers (F4),

Participant F4*: "For workers, if things are good with the employer, with the employer's support, there's the Social Security Scheme in my current job. They make us buy Pakan Sakhon [Social Security]. I've heard that if you buy that, when you go for treatment, the employer*

contributes half, and you don't have to pay the full amount". – 28 years old factory worker

while those under nominal employers or being different employer between documentation and actual employment, have no legitimate coverage (F2, M14).

Participant F2: *"I understood that we could receive medical benefits only when enrolled in "Pakan Sakhon" (SSS). If we are not enrolled in it, we are not entitled to receive medical services. I thought it was only documentation to prove that a person is fit for work." – 24 years old worked at a kindergarten*

Participant M14*: "I know I have it[insurance], but I'm not sure about the actual benefits. My current employer is different from the one on my visa, so I'm wondering whether that insurance will still work." – 23 years old worked at a restaurant*

Benefits or Coverage Misunderstandings: A belief that the insurance only covers minor issues (M1, M7),

Participant M1: *"I suspect it might not cover major illnesses. I think it's more for minor things like fever or small injuries" – 27 years old remote worker*

Participant M7: *"Although I'm not well-informed, I understand that we can visit a designated hospital for minor health issues, while major health problems are not covered according to my knowledge." – 32 years old remote worker*

or is exclusively for work-related health issues (M13).

Participant M13: *"If you have any health issues related to work, if you go to the hospital, you've purchased coverage for, you can receive benefits." – 26 years old remote worker*

DISCUSSION

The most prominent finding of this study was the pervasive information asymmetry surrounding the Migrant Health Insurance Scheme (MHIS). Although all participants were formally enrolled in the scheme, many demonstrated limited understanding of its purpose, benefits, eligibility criteria, designated healthcare facilities, and procedures for accessing services. This might lead to underuse of healthcare utilization due to lack of sufficient knowledge. This finding is consistent with previous research demonstrating that information barriers remain one of the most persistent obstacles to healthcare access among migrant populations worldwide. Studies conducted among migrants in Thailand and Europe, have repeatedly shown that although documented migrant workers may possess health insurance, many remain unaware of their entitlements and limited health insurance literacy reduces migrants' ability to navigate healthcare systems (10-15).

A notable contribution of this study concerns the role of broker-mediated enrolment in shaping information asymmetry. Nearly all participants reported relying on brokers or agents to process work permits and insurance enrolment as a packaged service. While this arrangement simplified administrative procedures, it simultaneously limited migrants' direct engagement with the insurance system by delegating documentation, hospital selection, and administrative procedures entirely to brokers. Consequently, many participants received insurance cards without understanding which hospital they were assigned to, what services were covered, or even that they had been enrolled in MHIS.

Previous studies have described the widespread use of brokers among migrant workers in Thailand (16-18), but few have examined how broker-mediated enrolment itself may contribute to information asymmetry. This study extends this literature by demonstrating that broker-mediated enrolment can unintentionally reduce migrants' opportunities to learn about their healthcare entitlements. However, there is also a possibility this study's findings suggest but difficult to fully confirm due to the qualitative scope of the study.

Particularly concerning was participants' description of bypassed or falsified health screening procedures during registration while some migrants perceived these practices as convenient and time-saving. When screening procedures are bypassed through informal

arrangements, the effectiveness of these public health safeguards may be compromised, particularly in densely populated urban settings such as Bangkok.

Another important finding was the widespread perception of MHIS as a legal requirement rather than a healthcare entitlement. Many participants viewed the scheme primarily as a mandatory component of obtaining or renewing a work permit and Pink Card. This observation is congruent with the previous studies in Malaysia indicating that migrants covered by mandatory insurance schemes are often unaware of their actual entitlements (19, 20).

Participants described confusion between MHIS and the Social Security Scheme, uncertainty about eligibility, and limited knowledge of covered benefits and designated facilities. Naing et al. (2020) similarly identified policy literacy as an important factor in healthcare accessibility among Myanmar migrant workers.

Overall, this study identifies a gap between being enrolled in MHIS and understanding how to use that entitlement**.** It provides evidence of information and health-literacy barriers and of uncertainty about accessing care, while recognizing that actual utilization and financial consequences require further investigation.

CONCLUSION

Overall, this study demonstrates that information asymmetry constitutes a critical missing link between insurance coverage and healthcare access among Myanmar migrant workers in Bangkok. This study found substantial information gaps among Myanmar migrant workers enrolled in the MHIS in Bangkok. Although participants generally completed the required enrolment process, many had limited understanding of the scheme's purpose, benefits, designated healthcare facilities, or procedures for accessing care. Broker-mediated enrolment appeared to facilitate administrative compliance while reducing migrants' direct engagement with insurance information.

RECOMMENDATIONS

Suggested recommendations are; **Language and Enrolment Reforms**: to mandate native-language guidance at the point of enrolment to bypass the broker bottleneck, every insurance slip must include a native-language or English written breakdown of benefits and entitled conditions, including the specific hospital name and location, and **Targeted Digital Outreach:** authorities should launch a direct-to-migrant health education campaigns on digital platforms such as TikTok and Facebook, explaining how to verify the assigned hospital and the validity period of the insurance, and the benefit scope, specifically highlighting dental care, health screenings, and surgical coverage.

ETHICAL DECLARATION

The study was ethically approved by the Research Ethic Review Committee of Chulalongkorn University (COA No. 180/69).

All participants provided written informed consent, were assured of confidentiality, and reminded of their right to withdraw at any time. Participant pseudonyms were used to protect identities, and all data were securely stored in password-protected devices and accessed only by the principal researcher.

LIMITATIONS

Relevant to the nature of in-depth interviews, social desirability bias might take place where participants might adjust their responses to reflect the socially accepted views rather than their true opinions. Recall bias is possible when participants struggle to accurately remember past interactions and experiences. Lastly, due to the study design and non-probability sampling method, the findings may not represent the perspectives of all Myanmar migrant workers in Bangkok or other provinces of Thailand. Instead, this study captured in-depth insights and lived experiences of urban migrants, offering rich qualitative evidence rather than broad representativeness.

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Track VI

NCDs, Nutrition and Lifestyle

ASSOCIATION BETWEEN ATTITUDES TOWARD ORAL CANCER AND BETEL QUID DEPENDENCY IN MANDALAY, MYANMAR

Ye Yint Htet[1], Htet Zaw Shein[1], May Chan Oo[1*]
[1] College of Public Health Sciences. Chulalongkorn University, Bangkok, 10330, Thailand.
*[*] **Corresponding Author**: May Chan Oo, College of Public Health Sciences. Chulalongkorn University, Bangkok, 10330, Thailand, Email: maychan.o@chula.ac.th*

ABSTRACT

Introduction: Oral cancer is a major public health concern in Myanmar, where betel quid chewing is common and strongly linked to oral cancer risk. However, evidence on the relationship between attitudes toward oral cancer and betel quid dependency remains limited. This study assessed the relationship between attitudes toward oral cancer and betel quid dependency among urban betel quid chewers in Mandalay, Myanmar.

Methodology: A cross-sectional study was conducted among betel quid chewers aged 18–65 years in Mandalay, Myanmar. Following social media-based convenience sampling, data were collected through a self-administered online questionnaire on socio-demographic and lifestyle characteristics, and attitudes. A 12-item, 4-point Likert scale, content-validated by three experts, was used to assess attitudes toward oral cancer and betel quid chewing. Betel quid dependency was measured using the 16-item Betel Quid Dependence Scale (BQDS). Pearson's chi-square and Spearman correlation analyses were performed, with $p<0.05$ considered statistically significant. Correlation magnitude and direction were presented using a heat map.

Results: This study included 361 participants with a mean age of 36.7 ± 10.3 years. Nearly half of participants (44.6%) had high betel quid dependency (≥median,9). Dependency showed significant associations with socio-demographic factors, including age, marital status, religion, education, occupation, ethnicity, and income; betel quid use behaviors, including starting age and daily consumption quantity; smoking status; and attitude toward oral cancer. A weak positive correlation was observed between age and dependency ($\rho=0.294$, $p<0.001$), while attitude toward oral cancer showed a weak negative correlation with dependency ($\rho=-0.257$, $p<0.001$).

Conclusions: Betel quid dependency was common among urban chewers in Mandalay and showed significant associations with multiple socio-demographic and behavioral factors. Despite some study design-related limitations, participants with higher betel quid dependency tended to report less favorable attitudes toward oral cancer. These findings highlight the need for targeted oral cancer awareness, behavioral education, and betel quid cessation programs, particularly among high-risk groups.

Keywords:
Dependency; Betel Quid Dependency Scale (BQDS); Attitude, Oral Cancer; Myanmar.

INTRODUCTION

Betel quid dependence is a behavioral addiction characterized by compulsive betel quid chewing, impaired control over use, craving, tolerance, withdrawal symptoms, and continued consumption despite adverse health or social consequences (1). This dependence may increase the risk of oral cancer by promoting frequent and prolonged exposure to carcinogenic substances in betel quid, particularly areca nut and tobacco, both of which are recognized risk factors for oral malignancies (2). Approximately 600 million people worldwide use betel quid, making it one of the most consumed psychoactive substances globally (1, 3). Betel quid chewing is a well-established risk factor for oral cancer, contributing to a 2–10-fold increased risk of disease, while oral cancer causes nearly 400,000

new cases and 188,000 deaths annually worldwide (3). Dependence on betel quid may exacerbate this burden through sustained and frequent exposure to carcinogenic compounds (3).

Clinically, oral cancers are primarily classified by the location and extent of the primary tumor and commonly present as persistent oral ulcers, loose teeth, oral bleeding, pain or numbness in the mouth or face, and ill-fitting dental prostheses (4). From a public health perspective, oral cancers are a major global health burden and among the most common head and neck malignancies, including cancers of the lip, oral cavity, and oropharynx, ranking as the 13th most common cancer worldwide (5, 6). The global burden continues to increase, with annual incidence rising from approximately 355,000 cases in 2018 to nearly 390,000 in 2022, and deaths increasing from about 177,000 to 188,000 during the same period (5). By 2050, the incidence of oral squamous cell carcinoma is projected to increase by 65% globally and by approximately 148% in low Human Development Index countries (7).

Attitudes regarding oral cancer may influence betel quid dependence. Individuals who perceive oral cancer as a serious health threat and recognize betel quid chewing as a risk behavior may be more likely to reduce or discontinue chewing in the community (8). This aligns with the Health Belief Model in the way of perceived susceptibility and perceived severity are important determinants of health behavior, including substance use and cessation behaviors (9). Previous studies have also reported that inadequate awareness of oral cancer and misconceptions about the risks of betel quid chewing are associated with persistent use, suggesting that perceptions of oral cancer may influence the development and maintenance of betel quid dependence (10).

Awareness and attitudes toward oral cancer remain suboptimal in many Southeast Asian countries despite the high prevalence of betel quid use. In Singapore, only 66% of the public were aware of oral cancer and its risk factors (11), while in Jakarta, Indonesia, 54% had no knowledge of oral cancer risk factors (12). Myanmar faces a particularly high burden of oral cancer due to widespread betel quid chewing; nearly 90% of male oral cancer patients have a history of betel quid use (13), and a community-based study in Yangon reported that 52% of adults were current chewers (14). However, evidence on public attitudes and perceptions toward oral cancer in Myanmar remains limited. This study assesses the association and correlation between attitudes toward oral cancer and betel quid dependency in Mandalay, Myanmar.

METHODOLOGY

A cross-sectional study was conducted from April to November 2025 in four purposively selected high-population-density urban townships in Mandalay, Central Myanmar. Eligible participants were current betel quid chewers aged 18–65 years who consumed betel quid at least once daily and had resided in the selected townships for at least six consecutive months. Individuals working in dental-related professions or diagnosed with or receiving treatment for oral cancer were excluded. Participants were recruited through social media using convenience sampling, and data were collected via a self-administered online questionnaire. The sample size was calculated using the Lwanga and Lemeshow formula for a single population proportion based on a prevalence of 30.8% (15). After accounting for non-response, the final sample included 361 participants.

Measurement Tools

Data were collected using KoboToolbox through a structured questionnaire with five sections: (1) socio-demographic characteristics, (2) betel quid consumption characteristics, (3) lifestyle characteristics (smoking and alcohol use), (4) attitudes toward oral cancer, and (5) betel quid dependency. Attitudes were assessed using 12 items across two sub-sections (six items each) on a four-point Likert scale, with reverse scoring for negatively worded items. Total

attitude scores ranged from 12 to 48, with higher scores indicating more favorable attitudes. Based on the interquartile range (IQR), participants were classified as having unfavorable (<31), neutral (31-35), or favorable (>35) attitudes.

The outcome variable, betel quid dependency, was assessed using the 16-item Betel Quid Dependence Scale (BQDS), with total scores ranging from 0 to 16, where higher scores indicate greater dependency. For bivariate analyses, dependency was categorized as low or high using the sample median score of 9 as the cut-off. Content validity was assessed using the Item-Objective Congruence (IOC) index, and the instrument was refined based on expert feedback. A pilot study demonstrated acceptable internal consistency, with a Cronbach's alpha of ≥0.70.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 29 (licensed by Chulalongkorn University). Descriptive statistics summarized participant characteristics and study variables. Categorical variables were presented as frequencies and percentages, while continuous variables were reported as means ± standard deviations or medians with interquartile ranges, as appropriate. Cross-tabulations described the distribution of betel quid dependency across participant characteristics. Pearson's Chi-square test was used to identify factors associated with betel quid dependency, while Spearman's correlation assessed the relationships between participants' age, total attitude score, and Betel Quid Dependency Score. Statistical significance was set at $p < 0.05$.

RESULTS

Descriptive Findings

A total of 361 betel quid chewers participated in the study as summarized in Table 1. Most participants were aged 30–44 years (41.0%), male (89.2%), married (49.3%), self-employed (48.5%), and had college or university education (39.6%). Most were Buddhist (95.0%) and of Burmese ethnicity (77.8%), while 49.0% reported a monthly income >500,000 MMK. More than half (54.3%) began chewing betel quid at ≥22 years, 47.1% had chewed for 6–17 years, 92.8% chewed ≥9 times per week, and 67.6% regularly added additional ingredients. Additionally, 35.2% were current smokers and 85.9% had consumed alcohol in the previous 12 months

Table 1 Socio-demographic characteristics, betel quid chewing practice and lifestyle factors among betel quid chewers in Mandalay, Myanmar (n = 361)

Characteristics	Number	Percent (%)
Socio-demographic characteristics		
Age group (years)		
≤ 29	101	28.0
30-44	148	41.0
≥ 45	112	31.0
Sex		
Male	322	89.2
Female	39	10.8
Male: Female Ratio ≈ 8: 1		
Marital Status		
Single	171	47.4
Married	178	49.3
Others (Divorced/Separated/Widow/Widower)	12	3.3
Educational status		
No formal education	17	4.7
Primary school (Grade1 to 4)	21	5.8
Middle school (Grade 5 to 8)	52	14.4

Characteristics	Number	Percent (%)
High school (Grade 9 to 10)	128	35.5
College/university and above	143	39.6
Occupation		
Government/public sector employees	42	11.5
Private sector employees	49	13.6
Self-employed	175	48.5
Manual workers	75	20.8
Economically inactive[1]	20	5.6
Religion		
Other	18	5.0
Buddhist	343	95.0
Ethnicity		
Other	80	22.2
Burma	281	77.8
Income		
<200,000MMK	36	10.0
200,000-500,000MMK	148	41.0
>500,000MMK	177	49.0
Betel Quid Consumption characteristics		
Betel starting age		
<22years	165	45.7
≥22years	196	54.3
Duration of betel quid chewing		
≤5years	97	26.9
6-17years	170	47.1
≥18 years	94	26.0
Betel quid chewing frequency per week		
Not frequently (< 9 times/week)	26	7.2
Frequently (≥ 9 times/week)	335	92.8
Additional Components in usual betel quid		
No	117	32.4
Yes	244	67.6
Expense for betel quid chewing		
Below 5500MMK	243	67.3
5500MMK and above	118	32.7
Lifestyle characteristics		
Smoking habits		
Current smoking status		
Not at all	234	64.8
Less than daily	76	21.1
Daily	51	14.1
Drinking habits		
Drinking status (within 12 months)		
No	51	14.1
Yes	310	85.9

Attitudes toward Betel Quid Chewing and Oral Cancer and Betel Quid dependency.

As shown in Figure 1, most participants demonstrated favorable attitudes toward oral cancer prevention and screening, with over three-quarters recognizing the importance of regular oral examinations for early detection (80.0%), even without symptoms (78.7%), and

maintaining oral health (77.9%). However, nearly half perceived oral cancer screening as time-consuming (46.3%), uncomfortable (48.2%), or anxiety-provoking (49.6%). Overall, 60.4% had unfavorable attitudes, 36.6% had favorable attitudes, and 3.0% had neutral attitudes. Additionally, 44.6% of participants had high betel quid dependency, while 55.4% had low dependency.

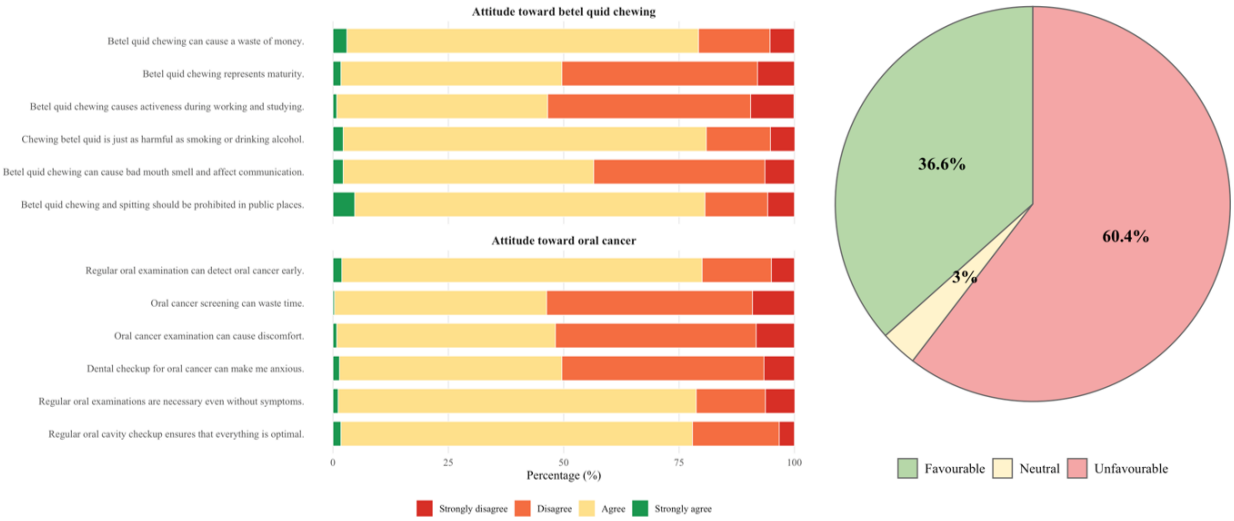

Figure 1.A Attitude towards betel quid chewing and oral cancer (n = 361)

Figure 1.B Attitude levels in percentage (n = 361)

Figure 1 Attitude towards oral cancer (n=361)

Association between participants' characteristics and betel quid dependency

Betel quid dependency was significantly associated with age, marital status, education, occupation, religion, ethnicity, income, starting age of betel quid use, daily consumption, daily expenditure, smoking status, and attitude level (all $p < 0.05$). Higher dependency was more common among older participants (≥ 41 years), married individuals, those with no formal education, government/public sector employees, non-Buddhists, other ethnic groups, higher-income participants, smokers, and those with unfavorable attitudes toward oral cancer. Participants who initiated betel quid chewing at ≥22 years of age and those with higher daily expenditure on betel quid reported a higher proportion of high dependency (Table 2).

Table 2 Association between participants' characteristics and betel quid dependency (n=361)

Participants characteristics	Betel Quid Dependency		p-value
	Low n (%)	High n (%)	
Age group (years)		$X^2 = 74.348$	**<0.001****
≤ 20 years	10(71.4)	4(28.6)	
21-30 years	90(81.1)	21(18.9)	
31-40 years	62(62.0)	38(38.0)	
≥ 41 years	38(27.9)	98(72.1)	
Marital Status		$X^2 = 10.476$	**0.001***
Single	110(64.3)	61(35.7)	
Married and Others	90(47.4)	100(52.6)	

Participants characteristics	Betel Quid Dependency		p-value
	Low n (%)	High n (%)	
Educational status		$X^2 = 99.406$	**<0.001****
No formal education	4(23.5)	13(76.5)	
Primary school (Grade1 to 4)	18(85.7)	3(14.3)	
Middle school (Grade 5 to 8)	41(78.8)	11(21.2)	
High school (Grade 9 to 10)	99(77.3)	29(22.7)	
Higher education level of university and above	38(26.6)	105(73.4)	
Occupation		$X^2 = 55.406$	**<0.001****
Economically Inactive	12(60.0)	8(40.0)	
Manual Worker	37(49.3)	38(50.7)	
Government and Public Sector	4(9.5)	38(90.5)	
Private Sector	23(46.9)	26(53.1)	
Self-employed	124(70.9)	51(29.1)	
Religion		$X^2 = 19.051$	**<0.001****
Buddhist	199(58.0)	144(42.0)	
Others (Christian, Islam, Hindu)	1(5.6)	17(94.4)	
Ethnicity		$X^2 = 59.754$	**<0.001****
Burma	186(66.2)	95(33.8)	
Other Ethnic Groups	14(17.5)	66(82.5)	
Income Levels		$X^2 = 78.427$	**<0.001****
< 200,000 MMK	21(58.3)	15(41.7)	
200,000 – 500,000 MMK	121(81.8)	27(18.2)	
> 500,000 MMK	58(32.8)	119(67.2)	
Starting Age for Betel Quid Consumption		$X^2 = 29.578$	**<0.001****
< 22 years	117(70.9)	48(29.1)	
≥ 22 years	83(42.3)	113(57.7)	
Quantity consumed per day		$X^2 = 20.530$	**<0.001****
< 4quid per day	52(39.7)	79(60.3)	
≥ 4quidperday	148(64.3)	82(35.7)	
Daily Expenses Level		$X^2 = 4.477$	**0.034**
< 5,500 MMK	144(59.3)	99(40.7)	
≥ 5,500 MMK	56(47.5)	62(52.5)	
Smoking Status		$X^2 = 29.175$	**<0.001****
Non-smoker	154(65.8)	80(34.2)	
Smoker	46(36.2)	81(63.8)	
Attitude Levels		$X^2 = 94.589$	**<0.001****
Unfavourable	77(35.3)	141(64.7)	
Neutral	6(54.5)	5(45.5)	
Favorable	117(88.6)	15(11.4)	

Correlates of betel quid dependency

As illustrated in Figure (2), Spearman rank correlation analysis demonstrated a weak but statistically significant negative correlation between total attitude score and participants' age ($r_s = -0.29$, $p < 0.001$), as well as between total

attitude score and total betel quid dependency score (r_s = -0.26, p < 0.001). Conversely, participants' age was positively correlated with total betel quid dependency score (r_s = 0.29, p < 0.001).

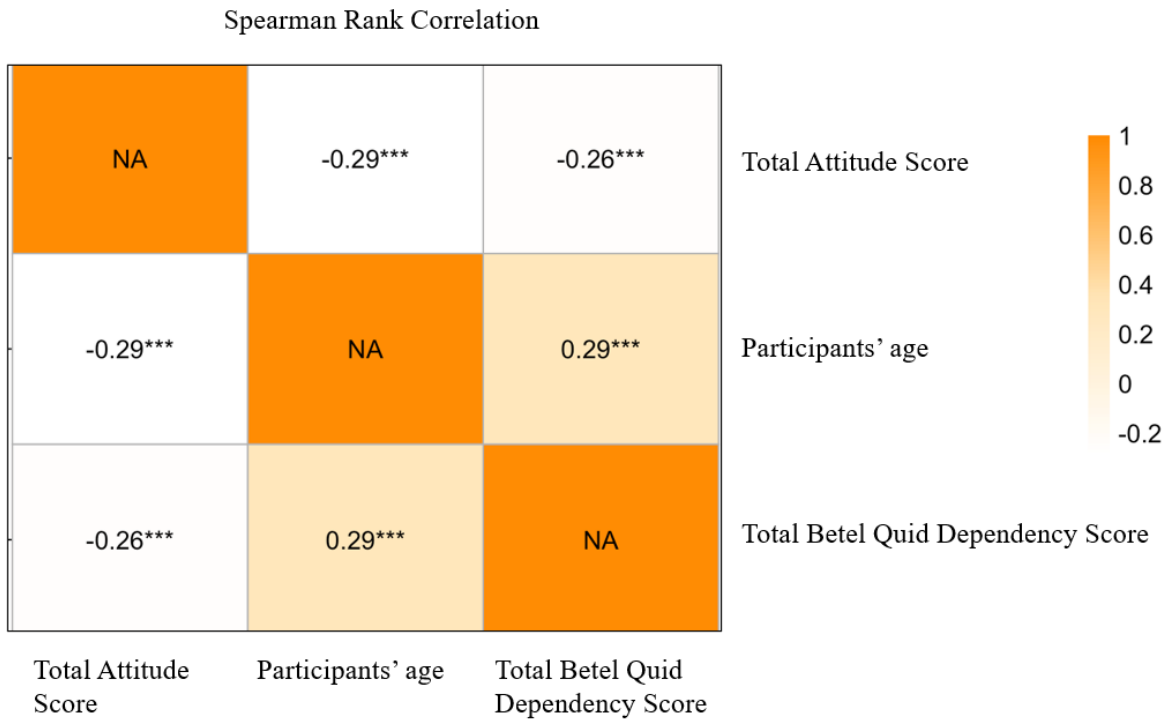

Figure 2 Spearman Rank Correlation among Attitude, Age, and Betel Quid Dependency

DISCUSSION

This study assessed the factors associated with betel quid dependence among chewers in Mandalay, Myanmar. Nearly half (44.6%) reported high betel quid dependency, and only 36.6% had a favorable attitude toward betel quid consumption and oral cancer prevention. The majority (89.2%) of the study participants were male. The high dependency was commonly prevalent in the older age group, bachelor's degree and above, government and public employees, comparatively higher income groups, current smokers, and unfavorable attitude. Similar patterns have been reported in previous studies, which identified sociodemographic characteristics, socioeconomic status, tobacco use, and psychosocial factors as important determinants of betel quid dependence and chewing behaviors (16-18). These findings suggest that betel quid dependency is a multifactorial condition associated with demographic, behavioral, and attitudinal factors.

The present study found a significant association between age and betel quid dependency. Participants aged ≥41 years exhibited the highest proportion of high dependency (72.1%), whereas younger participants, particularly those aged 21–30 years, demonstrated substantially lower dependency levels (18.9%). This finding is consistent with previous studies conducted in Bangladesh, India, and Myanmar, which reported that dependence tends to increase with age due to prolonged exposure and cumulative chewing experience (16, 19, 20). Older adults may have established chewing habits over many years, resulting in stronger physiological and psychological dependence.

Married participants exhibited higher betel quid dependency than single participants (52.6% vs. 35.7%). Similar findings have been

reported in South Asian populations, where marriage was associated with increased betel quid consumption due to greater participation in social and family gatherings where chewing is culturally accepted (16). Married individuals may also experience social reinforcement of chewing behaviors through spouses, relatives, and community interactions.

Educational status was significantly associated with betel quid dependency. Interestingly, participants with no formal education demonstrated the highest proportion of dependency (73.4%), which contrasts with many previous studies, at both the bivariate chi-square test and multivariable analysis, reporting greater dependence among individuals with lower educational attainment (17, 21). This can be explained by the relation between higher-educated individuals, greater purchasing power, and occupational stress, facilitating regular betel quid consumption. Moreover, cultural acceptance among the Myanmar community also exacerbated the dependency, suggesting that educational attainment alone may not adequately predict betel quid dependency (22).

Occupation was significantly associated with dependency. Government and public-sector employees exhibited the highest prevalence of high dependency (90.5%), followed by private-sector workers and manual laborers. Previous studies have reported elevated chewing prevalence among workers who perceive betel quid as enhancing concentration, reducing fatigue, and improving work performance (20, 23). The exceptionally high dependency observed among government employees may reflect workplace norms, prolonged sedentary work, occupational stress, or social patterns of betel quid use. Further qualitative exploration may be necessary to better understand this relationship.

Religion demonstrated a significant association with dependency. Participants from non-Buddhist religions showed substantially higher dependency levels than Buddhists (94.4% vs. 42.0%). Similar associations have occasionally been reported in multicultural populations, where religious affiliation may act as a proxy for cultural traditions and social practices surrounding betel quid use rather than representing a direct religious influence (20). Therefore, the observed relationship may be attributable to underlying cultural and ethnic differences rather than religion itself.

Ethnicity was significantly associated with betel quid dependency. Participants belonging to ethnic groups other than Bamar reported a higher proportion of high dependency (82.5%) than Bamar participants (33.8%). This finding aligns with previous studies suggesting that betel quid chewing practices vary substantially across ethnic groups because of differences in cultural traditions, social norms, and historical patterns of use (24). Betel quid chewing remains deeply embedded in the cultural identity of several ethnic communities in Myanmar, which may contribute to stronger habitual use and dependency.

Income level was significantly associated with dependency. Participants earning more than 500,000 MMK per month demonstrated the highest prevalence of dependency (67.2%), whereas those earning between 200,000 and 500,000 MMK showed the lowest prevalence (18.2%). This finding differs from many previous studies that reported higher chewing prevalence among lower-income groups (25), possibly due to the greater financial capacity in higher purchasing power, resulting in sustained consumption and stronger dependency.

The study found that higher betel quid dependency was more common in participants who began chewing at age 22 years or older than those who initiated before age 22 years. This finding contrasts with previous research, which generally suggests that earlier initiation increases the risk of substance dependence through longer exposure periods (26). This unexpected finding may reflect unmeasured socioeconomic or behavioral factors. Further longitudinal studies are needed to determine whether regular consumption resulted in stronger dependency despite later initiation of betel quid use.

A significant association was observed between daily quantity consumed and dependency. Unexpectedly, participants consuming fewer than four quids per day showed a higher prevalence of dependency (60.3%), differing from conventional evidence indicating that greater consumption predicts stronger dependence (27). This finding contrasts with previous studies and may reflect differences in consumption patterns, measurement methods, or residual confounding. Because this was a cross-sectional study, the underlying reason cannot be determined.

Participants spending ≥ 5,500 MMK daily on betel quid were significantly more likely to exhibit high dependency (52.5%) than those spending less (40.7%). This finding is consistent with previous studies suggesting that greater financial expenditure reflects heavier consumption and stronger dependence behaviors (27). Higher expenditure may indicate frequent purchasing patterns, preference for premium products, or concurrent use of tobacco-containing betel quid preparations, all of which may contribute to dependency.

Smoking status showed a significant association with betel quid dependency, with smokers demonstrating higher dependency than non-smokers. This finding is consistent with numerous studies reporting co-occurrence between tobacco use and betel quid dependence (20, 23). Nicotine and arecoline, the primary psychoactive alkaloid in areca nut, both act on reward pathways within the central nervous system, potentially producing synergistic reinforcing effects that increase dependency risk (28).

Attitude was significantly associated with betel quid dependency. Participants with unfavorable attitudes had a higher prevalence of dependency than those with favorable attitudes. This finding is consistent with previous studies and health behavior theories, suggesting that poor attitudes toward the harmful effects of betel quid and its prevention contribute to persistent chewing and dependency (9, 21, 27). In contrast, favorable attitudes may increase risk awareness and discourage continued use.

The observed relationships among age, attitude, and betel quid dependency suggest that dependency is shaped by both behavioral and psychosocial factors. Older individuals may be more likely to develop dependency because of prolonged exposure and habitual use, while unfavorable attitudes toward the harmful effects and prevention of betel quid use may reinforce continued chewing behaviors. These findings are consistent with previous evidence highlighting the important role of age and attitudes in the development and maintenance of betel quid dependency (16, 29).

STRENGTHS AND LIMITATIONS

A major strength of this study is the use of a validated betel quid dependency scale and the inclusion of both behavioral and attitudinal factors, providing a comprehensive assessment of factors associated with betel quid dependency. The cross-sectional design precludes causal inference, and the use of self-reported data may have introduced recall and social desirability biases. Because data were collected through an online self-administered survey using convenience sampling, the findings may underrepresent individuals without internet access and may be skewed toward younger or more educated participants. Furthermore, only bivariate analyses (Pearson's chi-square and Spearman correlation) were performed, therefore, potential confounding factors were not controlled for, and independent predictors of betel quid dependency could not be identified. Additionally, the findings may have limited generalizability beyond the study population.

CONCLUSION

Betel quid dependency was significantly associated with age, education, occupation, income, smoking status, and attitudes, indicating the influence of demographic, behavioral, and psychosocial factors.

RECOMMENDATIONS

Health education and cessation programs should target high-risk groups, particularly older adults, and smokers, and integrate betel quid cessation into tobacco control and oral cancer prevention efforts.

ETHICAL DECLARATION

This study received ethical approval from the Research Ethics Review Committee for Research Involving Human Participants, Group 1, Chulalongkorn University (Approval No. 282/68). Participation was voluntary, and electronic informed consent was obtained before data collection. All data were anonymized and securely stored to ensure participant confidentiality.

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ASSOCIATION BETWEEN CHEWING TOBACCO USE AND ORAL HEALTH OUTCOMES AMONG WOMEN IN BILASPUR CITY, INDIA: A CROSS-SECTIONAL STUDY

Karuna Ekta Chhatter[1], Pramon Viwattanakulvanid[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

***Corresponding Author:** Pramon Viwattanakulvanid, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, E-mail: pramon.v@chula.ac.th*

ABSTRACT

Introduction: Chewing tobacco use remains a major public health concern among women in India and is associated with adverse oral health conditions. However, evidence on chewing tobacco behaviours and oral health outcomes among women in Bilaspur City, India, remains limited.

Objectives: To assess chewing tobacco behaviours and their association with oral health outcomes among women in Bilaspur City, India, and to identify reasons for chewing tobacco use.

Methodology: A cross-sectional study was conducted among 423 women aged 18–49 years who currently used chewing tobacco in Bilaspur City, India, in November 2025. Data were collected using a structured questionnaire and clinical oral examination. Oral health outcomes were classified as good (0–5 conditions) or poor (6–11 conditions). Ethical approval (COA No. 308/68) and written informed consent were obtained. Descriptive statistics and binary logistic regression were performed ($p < 0.05$).

Results: A total of 423 women participated in the study (mean age: 41.63 ± 7.89 years). Poor oral health outcomes were observed among 309 participants (73.0%). The most prevalent oral conditions were visible plaque (100.0%), dental calculus (80.9%), tooth pain/sensitivity (78.3%), and persistent bad breath (78.3%). The most commonly reported reasons for chewing tobacco use were stress/anxiety relief (30.7%), enjoyment or pleasure (22.9%), and habit/addiction (16.8%). Binary logistic regression showed that longer duration of chewing tobacco use (AOR: 1.99, 95% CI: 1.51–2.63, $p < 0.001$), consumption of one packet/day (AOR: 6.01, 95% CI: 2.53–14.27, $p < 0.001$), and use of two or more tobacco types (AOR: 1.81, 95% CI: 1.03–3.16, $p = 0.039$) were significantly associated with poor oral health outcomes.

Conclusion: Longer duration of chewing tobacco use, consumption of one packet/day, and use of multiple tobacco types were significantly associated with poor oral health outcomes. Tobacco cessation counselling should address stress/anxiety relief and habit/addiction alongside routine oral health screening. These findings apply to current chewing tobacco users and reflect differences according to tobacco-use behaviours within this population.

Keywords:

Chewing Tobacco; Oral Health Outcomes; Women; Public Health, India

INTRODUCTION

Smokeless tobacco (SLT) use remains a major public health concern worldwide, particularly in low- and middle-income countries where its consumption is culturally accepted and widely practised. Unlike smoked tobacco, SLT products are consumed without combustion and contain numerous carcinogenic and toxic substances that adversely affect general and oral health (1,2)

India has one of the largest populations of smokeless tobacco users globally, with 21.4% of Indian adults currently using smokeless tobacco according to the Global Adult Tobacco Survey (GATS-2) (4). Smokeless tobacco is consumed in various forms, including gutkha, khaini, zarda, and betel quid with tobacco, and its use remains common among both men and women (3). According to the Global Adult Tobacco Survey (GATS-2), approximately 12.8% of Indian women use smokeless tobacco, highlighting

the continued public health importance of this behaviour (4). In comparison, only 2.0% of Indian women smoke tobacco, indicating that smokeless tobacco is the predominant form of tobacco use among women in India (4). Cultural traditions, social acceptance, stress relief, and habitual use contribute to the initiation and continuation of chewing tobacco among women in many regions of India (5). The substantial use of smokeless tobacco among women, together with these gender-specific sociocultural and behavioural factors, supports the need to specifically investigate chewing tobacco use and its health consequences among women.

Chewing tobacco exposes the oral mucosa directly to nicotine and several carcinogenic compounds for prolonged periods, resulting in continuous irritation of oral tissues (6). Long-term use has been associated with poor oral hygiene, dental plaque accumulation, calculus formation, periodontal disease, dental caries, tooth mobility, and oral potentially malignant disorders, including leukoplakia and oral cancer (7). The risk of developing these oral conditions increases with prolonged duration of use and greater tobacco exposure (8). Therefore, understanding chewing tobacco behaviours is essential for identifying individuals at increased risk of poor oral health outcomes (9).

Previous studies have demonstrated associations between smokeless tobacco use and specific adverse oral health outcomes. Smokeless tobacco use has been associated with periodontal disease (12), while systematic review and meta-analysis evidence has demonstrated an increased risk of oral cancer associated with smokeless tobacco use (11). However, evidence focusing specifically on women remains limited, particularly in Bilaspur City, Chhattisgarh, India. Furthermore, limited information is available regarding the reasons for chewing tobacco use and their relationship with oral health outcomes among women. Such evidence is important for developing targeted tobacco cessation programmes and effective oral health promotion strategies for this vulnerable population (11).

Therefore, this study aimed to assess chewing tobacco behaviours and their association with oral health outcomes among women in Bilaspur City, India, and to identify the reasons for chewing tobacco use.

METHODOLOGY

Study Design and Participants

A cross-sectional study was conducted in November 2025 among women attending the outpatient department (OPD) of Chhattisgarh Institute of Medical Sciences (CIMS), Bilaspur City, Chhattisgarh, India. The study included 423 women aged 18–49 years who were current chewing tobacco users. The sample size was calculated using Cochran's formula ($n = Z^2p(1-p)/E^2$), with a 95% confidence level ($Z = 1.96$), an estimated proportion of 0.5, and a 5% margin of error ($E = 0.05$). The initial calculated sample size was 384 participants. To account for possible non-response, an additional 10% was added, resulting in a final required sample size of 423 participants. Participants were recruited using convenience sampling.

Data Collection

Data were collected using a structured questionnaire developed by the researcher, informed by an extensive review of the relevant literature. The questionnaire consisted of three sections: (1) socio-demographic characteristics, (2) chewing tobacco behaviours, including duration of use, quantity of tobacco consumed per day, types of chewing tobacco used (gutka, khaini, zarda, paan with tobacco, or other), number of tobacco types used, and reasons for chewing tobacco use, and (3) oral health assessment.

Clinical Oral Examination

Oral health outcomes were assessed through a clinical oral examination conducted by trained dentists using standardised diagnostic criteria. Eleven oral health conditions were assessed, including white/red/grey patches, dental caries, bleeding gums, visible plaque, dental calculus, mobile teeth, oral ulcers, burning

sensation, persistent bad breath, gum recession, and tooth pain or sensitivity. Each condition was recorded as present (1) or absent (0), yielding a total oral health score ranging from 0 to 11. Participants with scores of 0–5 were classified as having good oral health outcomes, whereas those with scores of 6–11 were classified as having poor oral health outcomes. For descriptive purposes, the composite score was initially classified into three levels: good oral health outcome (0–2), moderate oral health outcome (3–5), and poor oral health outcome (6–11). For binary logistic regression analysis, the good and moderate categories were combined into a single reference category (0–5), while the poor oral health outcome category remained as scores of 6–11. Thus, the binary outcome used in the regression analysis was classified as good (0–5) and poor (6–11) oral health outcomes.

Validity and Statistical Analysis

The questionnaire was validated by three experts using the Index of Item–Objective Congruence (IOC). Statistical analyses were performed using IBM SPSS Statistics version 29.0. Descriptive statistics were used to summarize participants' socio-demographic characteristics, chewing tobacco behaviours, reasons for chewing tobacco use, and oral health outcomes. Binary logistic regression analysis was performed to identify factors associated with poor oral health outcomes. Adjusted odds ratios (AORs), 95% confidence intervals (95% CIs), and p-values were reported. Statistical significance was set at $p < 0.05$.

RESULTS

Socio-demographic Characteristics

The socio-demographic characteristics of the participants are presented in Table 1. The mean age was 41.63 ± 7.89 years (range: 18–49 years), with 54.1% aged 46–49 years. Most participants had completed secondary education (61.9%), were married (92.2%), and worked as farmers (46.1%). More than half (57.0%) reported a monthly household income of ≤ ₹10,000.

Table 1 General characteristics of the participants (N = 423)

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
18–30	49	11.6
31–45	145	34.3
46–49	229	54.1
Mean ± SD	**41.63 ± 7.89**	**Range: 18–49**
Education level		
No formal education	33	7.8
Primary	128	30.3
Secondary	262	61.9
Marital status		
Married	390	92.2
Single	26	6.1
Divorced/Widowed	7	1.7
Occupation		
Homemaker	62	14.7
Labourer	119	28.1
Farmer	195	46.1
Office worker	14	3.3
House helper	33	7.8

Characteristics	Frequency (n)	Percentage (%)
Household income (INR/month)		
≤ ₹10,000	241	57.0
₹10,001–20,000	182	43.0

Age minimum = 18 years; Age maximum = 49 years.

Chewing Tobacco Use Behaviours and Reasons for Chewing Tobacco Use

Chewing tobacco use behaviours are presented in Table 2. Occasional use was reported by 42.3% of participants; 72.1% had used chewing tobacco for 1–5 years; 48.9% consumed one packet/day; and 61.7% used two or more tobacco types. The reasons for chewing tobacco use are also in Table 2. Relief of stress or anxiety was the most commonly reported reason for chewing tobacco use (30.7%), followed by enjoyment/pleasure (22.9%), habit/addiction (16.8%), social influence (10.6%), family influence/family tradition (9.7%), and peer pressure (9.2%).

Table 2 Chewing tobacco use behaviours and reasons for Chewing Tobacco Use of the participants (N = 423)

Variables	Frequency (n)	Percentage (%)
Frequency of use		
Occasionally	179	42.3
Weekly	98	23.2
Daily	146	34.5
Duration of use (years)		
<1 year	59	13.9
1–5 years	305	72.1
6–10 years	59	13.9
Quantity consumed per day		
<1 packet/day	56	13.2
1 packet/day	207	48.9
≥2 packets/day	160	37.8
Number of tobacco types used (gutka, khaini, zarda, paan with tobacco, or other)		
Single type	162	38.3
≥2 types	261	61.7
Total	423	100.0
Reason for chewing tobacco		
Relief of stress or anxiety	130	30.7
Enjoyment/pleasure	97	22.9
Habit/Addiction	71	16.8
Social influence	45	10.6
Family influence/family tradition	41	9.7
Peer pressure	39	9.2
Total	423	100.0

Oral Health Outcomes

Table 3 presents the overall and individual oral health outcomes. Overall, 309 participants (73.0%) had poor oral health outcomes, whereas 114 (27.0%) had good oral health outcomes. Visible plaque was observed in all participants (100.0%), followed by dental calculus (80.9%), tooth pain or sensitivity (78.3%), persistent bad breath (78.3%), gum recession (64.8%), mobile teeth (56.0%), dental caries (50.1%), bleeding gums (42.6%), burning sensation (13.9%), white/red/grey patches (11.3%), and oral ulcers (8.0%).

Table 3 Prevalence of overall oral health outcomes and distribution of individual oral health conditions (N = 423)

Oral health outcome	**Frequency (n)**	**Percentage (%)**
Good	114	27.0
Poor	309	73.0
Total	423	100.0
Oral health condition	**Yes n (%)**	**No n (%)**
White/red/grey patches	48 (11.3)	375 (88.7)
Dental caries	212 (50.1)	211 (49.9)
Bleeding gums	180 (42.6)	243 (57.4)
Visible plaque	423 (100.0)	0 (0.0)
Dental calculus	342 (80.9)	81 (19.1)
Mobile teeth	237 (56.0)	186 (44.0)
Oral ulcers	34 (8.0)	389 (92.0)
Burning sensation	59 (13.9)	364 (86.1)
Persistent bad breath	331 (78.3)	92 (21.7)
Gum recession	274 (64.8)	149 (35.2)
Tooth pain/sensitivity	331 (78.3)	92 (21.7)

Factors Associated with Poor Oral Health Outcomes

Factors associated with poor oral health outcomes are presented in Table 4. Longer duration of chewing tobacco use was significantly associated with poor oral health outcomes (AOR = 1.99, 95% CI: 1.51–2.63, p < 0.001). Consumption of one packet/day (AOR = 6.01, 95% CI: 2.53–14.27, p < 0.001) and use of two or more tobacco types (AOR = 1.81, 95% CI: 1.03–3.16, p = 0.039) were also significantly associated with poor outcomes. Increasing age was associated with lower odds of poor oral health outcomes (AOR = 0.88, 95% CI: 0.83–0.93, p < 0.001). Education, marital status, occupation, household income, frequency of use, and knowledge level were not significantly associated.

Table 4 Association between general characteristics, chewing tobacco behaviours and knowledge level with poor oral health outcomes (Binary logistic regression, N = 423)

Variables	**B**	**SE**	**AOR**	**95% CI**	**p-value**
Age (years)	-0.131	0.028	0.88	0.83–0.93	<0.001*
Education level					0.082
No formal education (Ref)			1		
Primary	0.582	0.540	1.79	0.62–5.16	0.281
Secondary	-0.127	0.536	0.88	0.31–2.52	0.813

Variables	B	SE	AOR	95% CI	p-value
Marital status					0.529
Married (Ref)			1		
Single	0.385	0.735	1.47	0.35–6.20	0.601
Divorced/Widowed	1.161	1.141	3.19	0.34–29.91	0.309
Occupation					0.297
Homemaker (Ref)			1		
Labourer	0.245	0.406	1.28	0.58–2.83	0.546
Farmer	-0.404	0.360	0.67	0.33–1.35	0.262
Office worker	-0.537	0.698	0.58	0.15–2.30	0.442
House helper	-0.411	0.551	0.66	0.23–1.95	0.455
Household income					0.089
Low income (Ref)			1		
Middle income	-0.442	0.260	0.64	0.39–1.07	0.089
Frequency of chewing tobacco					0.157
Occasionally (Ref)			1		
Weekly	0.122	0.337	1.13	0.58–2.19	0.718
Daily	0.671	0.361	1.96	0.96–3.97	0.063
Duration of chewing tobacco (years)	0.688	0.142	1.99	1.51–2.63	<0.001*
Quantity of chewing tobacco					**<0.001***
<1 pkt/day (Ref)			1		
1 pkt/day	1.794	0.441	6.01	2.53–14.27	<0.001*
≥2 pkt/day	0.773	0.462	2.17	0.88–5.36	0.094
Knowledge level					0.266
Poor knowledge (Ref)			1		
Good knowledge	0.296	0.266	1.35	0.80–2.27	0.266
Number of tobacco types					0.039*
Single type (Ref)			1		
≥2 types	0.590	0.286	1.81	1.03–3.16	0.039*

** Significant at $p < 0.05$*
Reference categories: No formal education, Married, Homemaker, Low income, Occasionally, <1 pkt/day, Poor knowledge, Single tobacco type
Model statistics: Omnibus test: $\chi^2 = 103.317$, $p < 0.001$
Nagelkerke $R^2 = 0.315$, Hosmer-Lemeshow test: $p = 0.875$

DISCUSSION

The present study found a substantial burden of adverse oral health outcomes among women who use chewing tobacco in Bilaspur City, with 73.0% classified as having poor oral health outcomes. Visible plaque, dental calculus, tooth pain or sensitivity, and persistent bad breath were the most prevalent conditions. Previous evidence has linked smokeless tobacco use with periodontal disease, oral mucosal damage, dental disease, and other adverse oral health outcomes (7–9,12). Repeated and prolonged contact with smokeless tobacco exposes oral tissues to nicotine and other harmful constituents, contributing to chronic irritation and deterioration of oral health (7,8).

Longer duration of chewing tobacco use was associated with poor oral health outcomes, with each additional year of use associated with almost twice the odds of poor outcomes (AOR = 1.99, 95% CI: 1.51–2.63, $p < 0.001$). This finding is consistent with cumulative exposure, whereby

prolonged contact with smokeless tobacco may contribute to chronic oral tissue injury. Previous evidence has similarly reported adverse periodontal and oral health effects associated with prolonged smokeless tobacco exposure (8,9,12), supporting duration of use as an important indicator of oral health risk.

Quantity consumed and number of tobacco types used were also associated with oral health outcomes. Consumption of one packet/day was associated with higher odds of poor outcomes than <1 packet/day (AOR = 6.01, 95% CI: 2.53–14.27, $p < 0.001$), while use of two or more tobacco types was associated with higher odds than single-type use (AOR = 1.81, 95% CI: 1.03–3.16, $p = 0.039$). Smokeless tobacco products contain toxic and carcinogenic constituents capable of damaging oral tissues (6,8,9). However, consumption of two or more packets/day was not statistically significant; therefore, the findings do not demonstrate a simple linear dose–response relationship.

Frequency of chewing tobacco use was not independently associated with poor oral health outcomes after adjustment. Together with the significant associations for duration, quantity, and multiple-product use, this suggests that tobacco exposure should be assessed across several behavioural dimensions rather than frequency alone. This is particularly relevant in India, where several forms of smokeless tobacco are used within established social and cultural contexts (3,5).

Relief of stress or anxiety was the most frequently reported reason for chewing tobacco use (30.7%), followed by enjoyment or pleasure (22.9%) and habit or addiction (16.8%). Cultural and social practices have been identified as important influences on smokeless tobacco use in India (5). These findings suggest that cessation interventions should address not only knowledge of health risks but also coping-related use, habitual behaviour, dependence, and social influences.

Increasing age was independently associated with lower odds of poor oral health outcomes (AOR = 0.88, 95% CI: 0.83–0.93, $p < 0.001$). This unexpected inverse association should be interpreted cautiously because the cross-sectional design cannot establish its explanation. Differences in tobacco-use patterns, oral health practices, healthcare utilisation, or other unmeasured factors warrant further investigation. Education, marital status, occupation, household income, frequency of use, and knowledge level were not independently associated with poor oral health outcomes.

These findings support strengthening tobacco cessation and oral health services for women who use chewing tobacco. Regular oral health assessment can facilitate early identification of tobacco-related conditions (1,10,11), while cessation counselling should consider duration and patterns of tobacco use. Because stress or anxiety relief and habit or addiction were commonly reported, behavioural counselling and coping support may strengthen cessation interventions. Integrating cessation counselling with routine oral health screening may therefore help reduce tobacco-related oral disease among women.

CONCLUSION

This study demonstrated a high prevalence of poor oral health outcomes among women who used chewing tobacco in Bilaspur City, India. Longer duration of use, consumption of one packet/day, use of two or more tobacco types, and age were significantly associated with poor oral health outcomes. Stress or anxiety relief, enjoyment or pleasure, and habit or addiction were the most frequently reported reasons for use. These findings support strengthening tobacco cessation interventions, routine oral health screening, and community-based oral health promotion for women.

RECOMMENDATIONS

Community-based oral health education and tobacco cessation programmes should be strengthened for women who use chewing tobacco. Routine oral examinations should be integrated into primary healthcare to facilitate early detection of tobacco-related oral diseases.

Behavioural counselling and stress-management strategies should be incorporated into cessation interventions. Future studies should use larger, community-based populations and longitudinal designs to better understand the long-term effects of chewing tobacco on oral health.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group 1, Chulalongkorn University (COA No. 308/68). Permission to conduct the study was obtained from Chhattisgarh Institute of Medical Sciences (CIMS), Bilaspur, India. Written informed consent was obtained from all participants before data collection, and participant confidentiality was maintained throughout the study.

STRENGTHS AND LIMITATIONS

A major strength of this study was the use of clinical oral examinations conducted by trained dentists, enhancing the accuracy of oral health assessment. The study also examined multiple chewing tobacco behaviours and their associations with oral health outcomes among women, a population receiving limited attention in previous research.

The study has several limitations. Its cross-sectional design does not allow causal relationships to be established. Recruitment from a single hospital using convenience sampling may limit generalisability. Furthermore, only current chewing tobacco users were included; therefore, findings cannot be compared with women who do not use chewing tobacco.

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BARRIERS TO GLYCEMIC CONTROL AMONG PATIENTS WITH UNCONTROLLED TYPE 2 DIABETES IN A RURAL COMMUNITY IN SOUTHERN THAILAND: A QUALITATIVE STUDY

Taksina Choochuay[1], Dusanee Suwankhong[1*], Vallop Ditsuwan[1], Tum Boonrod[1], Chaitong Churuangsuk[2]

[1]Master of Public Health Program, Thaksin University, Phatthalung, 93210, Thailand
[2]Department of Internal Medicine, Faculty of Medicine, Prince of Songkla University, Songkhla, 90110, Thailand
****Corresponding author:** Dusanee Suwankhong,*
Thaksin University, Phatthalung 93210, Thailand, E-mail: dusanee.s@tsu.ac.th

ABSTRACT

Introduction: Poor glycemic control is a major challenge among patients with type 2 diabetes mellitus (T2D). Various factors, including lifestyle behaviors, dietary practices, and access to healthcare, influence diabetes management. Persistent hyperglycemia increases the risk of cardiovascular disease, chronic kidney disease, diabetic retinopathy, neuropathy, and premature mortality. Understanding patients' experiences and perceived barriers to glycemic control is essential for developing effective and context-specific interventions.

Objectives: To explore barriers to glycemic control among patients with uncontrolled type 2 diabetes in a rural community in Southern Thailand.

Methodology: This was a descriptive qualitative study. Focus group discussions were conducted with patients with type 2 diabetes (T2D) receiving care at Ban Loh Changkra Health Promoting Hospital, Klong Ra Subdistrict, Phatthalung Province, Thailand. Seventy-four participants with HbA1c levels ≥ 7% who lived in the study area and were willing to participate were purposively recruited. A semi-structured interview guide was used during the focus group discussions to gain insights into participants' experiences and perceived barriers to glycemic control. Data were analyzed using conventional content analysis.

Results: The findings revealed that most participants experienced difficulties in maintaining appropriate self-management behaviors. Irregular meal timing was commonly reported, particularly among those engaged in agricultural work and rubber plantation activities. Many participants frequently skipped meals, delayed eating, or consumed excessive amounts of food when feeling hungry. Medication non-adherence was also identified. Participants tended to forget their medications, take them at inappropriate times, and discontinue treatment when symptoms improved. In addition, participants demonstrated limited self-monitoring behaviors and often relied solely on scheduled healthcare visits to assess glycemic status. Although family members played important roles in food preparation and daily care, household eating patterns and community food culture often encouraged the consumption of sweet, salty, and high-fat foods. Participants also reported that social gatherings, religious events, and community traditions made dietary modification difficult. In particular, diabetes self-management behaviors were strongly influenced by personal beliefs, occupational responsibilities, family contexts, and community lifestyles.

Conclusion: Multiple barriers contribute to poor glycemic control among patients with type 2 diabetes in rural communities. These barriers include irregular dietary practices, medication non-adherence, inadequate self-monitoring, and sociocultural influences. Family-centered and community-based interventions focusing on sustainable self-management and culturally appropriate lifestyle modifications may improve glycemic control and reduce diabetes-related complications.

Keywords:
Type 2 Diabetes Mellitus; Glycemic Control; Self-Management; Rural Community; Focus Group Discussion

INTRODUCTION

Type 2 diabetes mellitus (T2D) remains one of the most prevalent chronic diseases worldwide and imposes a substantial burden on individuals, healthcare systems, and societies. Persistent hyperglycemia increases the risk of serious complications, including cardiovascular disease, chronic kidney disease, diabetic retinopathy, neuropathy, and premature mortality. Despite advances in diabetes care, achieving and maintaining optimal glycemic control remains challenging, particularly in rural and underserved communities (1,2).

In Thailand, diabetes prevalence has increased, accompanied by concerns regarding diabetes-related complications and healthcare expenditures. Although diabetes management programs have been widely implemented, many patients continue to experience poor glycemic control and remain at increased risk of adverse health outcomes (3).

Effective glycemic control requires more than pharmacological treatment and depends on self-management behaviors, including medication adherence, healthy dietary practices, physical activity, blood glucose monitoring, and appropriate healthcare utilization. These behaviors are influenced by health literacy, personal beliefs, family support, occupational responsibilities, and social and environmental contexts (4,5). Limited health literacy may hinder patients' understanding of treatment recommendations, interpretation of blood glucose results, and informed decision-making regarding medication and diet, and has been associated with poorer self-management and glycemic control (6,7).

In rural communities of Southern Thailand, diabetes self-management may be challenging because of socioeconomic and cultural contexts. Many individuals engage in agricultural and rubber plantation work with irregular schedules that may interfere with meal timing, medication adherence, and routine self-care. Traditional dietary customs, family eating patterns, religious activities, and community gatherings may also influence health behaviors and glycemic control (8).

Ban Loh Changkra Health Promoting Hospital, located in Phatthalung Province, serves as a primary healthcare facility responsible for providing comprehensive health services to the local community. Diabetes has been identified as one of the major health problems in the service area and is among the leading causes of outpatient morbidity and diabetes-related complications. Local health records indicated that the number of patients with diabetes increased to 149 cases in 2022, representing a 7.38% increase from the previous year. Furthermore, a review of diabetes care outcomes between 2018 and 2022 revealed that the proportions of patients achieving the recommended glycated hemoglobin target (HbA1c < 7%) were only 41.26%, 45.83%, 50.96%, 44.93%, and 37.19%, respectively (9). These findings indicate that a substantial proportion of patients continue to experience difficulties in achieving optimal glycemic control despite receiving routine diabetes care.

Although previous studies have examined diabetes self-management, treatment adherence, family support, and healthcare-system factors, limited evidence is available regarding barriers to glycemic control among patients with uncontrolled T2D in rural communities of Southern Thailand. In particular, the influence of local social, cultural, occupational, and family contexts remains insufficiently understood. Qualitative research can provide an in-depth understanding of patients' perceptions and experiences and help identify context-specific challenges that may not be captured through quantitative methods.

Therefore, this study aimed to explore barriers to glycemic control among patients with uncontrolled type 2 diabetes in a rural community in Southern Thailand.

METHODOLOGY

Study Design and Setting

A descriptive qualitative study was conducted to explore barriers to glycemic control

among patients with T2D. The study was carried out in Ban Loh Changkra, Khlong Chaloem Subdistrict, Kong Ra District, Phatthalung Province, Southern Thailand.

Participants

Participants were purposively recruited from patients diagnosed with T2D who were receiving regular follow-up care at the health promoting hospital. Inclusion criteria were: (1) diagnosis of type 2 diabetes mellitus, (2) HbA1c level ≥7%, (3) residence within the study area, and (4) willingness to participate. A total of 74 participants were enrolled in the study.

Most participants were female (52/74, 70.3%), with a mean age of 61.4 years. More than half were engaged in agriculture, including rubber farming (41/74, 55.4%). In addition, 38 participants (51.4%) had been living with diabetes for more than 10 years. The mean HbA1c level was 8.00 ± 0.97%, with values ranging from 7.0% to 11.3%. Among the participants, 47 (63.5%) had HbA1c levels of 7.00–7.99%, 14 (18.9%) had levels of 8.00–8.99%, 8 (10.8%) had levels of 9.00–9.99%, and 5 (6.8%) had levels of ≥10.00%.

Data Collection

Data were collected through focus group discussions using a semi-structured interview guide developed from a review of literature related to diabetes self-management and glycemic control. Discussion topics included dietary practices, medication adherence, blood glucose monitoring, self-management experiences, family influences, and perceived barriers to glycemic control. A focus group discussion was conducted with all 74 participants in a single group. The discussion lasted approximately 60–90 minutes and was digitally voice-recorded for data analysis. Data collection and analysis were conducted iteratively. Data collection was considered sufficient when the major issues relevant to the research objectives had been adequately covered, and further clarification did not substantially contribute new information.

Data Analysis

Data were analyzed using qualitative content analysis following the approach described by Elo and Kyngäs (10). All digital audio recordings from the focus group discussions were transcribed verbatim in the original language. The transcripts were read repeatedly to achieve immersion in the data and gain a comprehensive understanding of participants' experiences. Meaning units relevant to the study objective were identified and systematically coded. Codes with similar meanings were grouped into subcategories and broader categories, from which themes were developed. Data analysis was conducted iteratively alongside data collection, allowing emerging concepts to be refined and explored in subsequent focus group discussions.

To support the trustworthiness of the qualitative findings, the researcher served as the main facilitator and used probing and clarification to obtain detailed accounts from participants. The research team assisted by listening to the discussion and documenting relevant information. The findings were reviewed and discussed among the research team to ensure consistency and credibility of the analysis.

RESULTS

Table 1. Demographic and clinical characteristics of participants (n=74)

Characteristics	n (%) or Mean ± SD
Age, years	60.54 ± 7.16
Sex	
Male	22 (29.7)
Female	52 (70.3)

Characteristics	n (%) or Mean ± SD
Marital status	
Single	4 (5.4)
Married	59 (79.7)
Widowed	11 (14.9)
Educational level	
No formal education	1 (1.4)
Primary education	48 (64.9)
Lower secondary education	8 (10.8)
Upper secondary/vocational education	8 (10.8)
Diploma/associate degree	3 (4.1)
Bachelor's degree or higher	6 (8.1)
Occupation	
Agriculture/rubber farming	41 (55.4)
Employee/laborer	17 (23.0)
Private business/trading	11 (14.9)
Government/state enterprise/retired	2 (2.7)
Unemployed	2 (2.7)
Other	1 (1.4)
Duration of diabetes, years	9.32 ± 4.35
HbA1c, %	8.00 ± 0.97
HbA1c category, %	
7.00–7.99	47 (63.5)
8.00–8.99	14 (18.9)
9.00–9.99	8 (10.8)
≥10.00	5 (6.8)

Theme 1: Irregular Meal Timing and Dietary Practices

Most participants reported that occupational responsibilities significantly interfered with their ability to maintain regular meal schedules. Many participants worked as rubber tappers or agricultural laborers, occupations that required them to begin work in the early hours of the morning, often between 2:00 and 4:00 a.m. Participants described leaving home before dawn and continuing to work for several hours before having an opportunity to eat. As a result, breakfast was frequently delayed or skipped altogether. Some participants reported that they often prioritized completing work tasks over eating, particularly during periods of heavy workload or unfavorable weather conditions. Mr. Somchai, a rubber plantation worker, explained: "Sometimes I work in the rubber plantation until late morning and skip breakfast. When I become very hungry, I eat a large meal."

Those participants also indicated that irregular work schedules made it difficult to follow dietary recommendations provided by healthcare professionals. Long working hours and unpredictable daily routines often resulted in delayed meals, prolonged fasting periods, and irregular eating patterns. These accounts highlight the challenges that occupational demands pose to maintaining regular meal schedules and adhering to recommended diabetes self-management practices.

Several participants reported a pattern of skipping meals and subsequently consuming large amounts of food when hunger became overwhelming. They explained that prolonged periods of work without eating often resulted in excessive hunger, leading them to consume larger portions than intended. Some participants

also reported eating quickly and choosing readily available foods rather than making deliberate dietary choices. Mrs. Aree stated: "If I miss breakfast, by lunchtime I feel very hungry. I end up eating more rice than usual because I cannot control my appetite."

They described these irregular eating patterns as difficult to avoid because of their occupational responsibilities and daily work routines. These experiences highlighted the challenges of maintaining recommended dietary practices while balancing the demands of agricultural and plantation work.

In addition to work-related challenges, participants described difficulties adhering to dietary recommendations during family gatherings, religious activities, and community events. Traditional Southern Thai foods commonly served during these occasions were often perceived as high in carbohydrates, sugar, or fat. Participants reported feeling socially obligated to eat food prepared by family members or offered by relatives and neighbors, even when they were aware that such foods were not recommended for diabetes management. Mrs. Fatimah explained, "When relatives prepare food for us, it is difficult to refuse. If I do not eat, they may think I do not appreciate their kindness."

Many participants pointed out that maintaining dietary restrictions in social situations was challenging because food sharing was viewed as an important aspect of family and community relationships. Consequently, social expectations and cultural eating practices often influenced food choices and created additional barriers to maintaining healthy dietary behaviors.

Theme 2: Medication Non-adherence

Medication adherence emerged as another important barrier to glycemic control among participants. Many participants reported difficulties taking medications consistently as prescribed. Some frequently forgot to take their medications because of busy work schedules, while others altered medication timing to fit their daily routines. Several participants also reported intentionally skipping doses or discontinuing treatment when they perceived that their symptoms had improved or when they felt physically well. Participants commonly assessed their diabetes status based on how they felt rather than on blood glucose measurements, leading them to believe that medication was unnecessary during periods without noticeable symptoms. Mr. Hassan explained: "When I feel normal, I sometimes stop taking medicine because I think my diabetes is under control."

Similarly, several participants reported taking medications only when they experienced symptoms such as dizziness, fatigue, or excessive thirst. Others described forgetting to carry their medications while working in rubber plantations or agricultural fields, resulting in missed doses. These findings indicate that perceptions of illness, understanding of diabetes management, and occupational demands may influence medication-taking behaviors among patients with uncontrolled type 2 diabetes.

Theme 3: Limited Self-monitoring Behaviors

Many participants demonstrated inadequate self-monitoring practices. Most relied primarily on scheduled clinic visits to assess their diabetes status and rarely monitored their blood glucose levels independently. As Mr. Song stated, "I wait until my next appointment to know whether my blood sugar is high or low." For many participants, blood glucose monitoring was perceived as a task performed by healthcare professionals rather than a routine component of self-care. Consequently, they often lacked awareness of daily fluctuations in blood glucose levels and had limited opportunities to identify potential problems early. This reliance on periodic clinical assessments reduced their ability to actively participate in managing their condition and adjusting health behaviors in response to changes in glucose control. Similarly, Mr. Prajuk reported relying on scheduled appointments to assess his blood glucose levels.

Participants also reported limited confidence in interpreting blood glucose results and determining appropriate actions when

abnormal readings occurred. Some expressed uncertainty about what constituted a normal or dangerous blood glucose level, while others were unsure whether changes in diet, physical activity, or medication were necessary when readings were elevated. These accounts reflected difficulties in understanding blood glucose readings and applying self-management strategies in daily life. Thus, many participants reported relying on healthcare providers for guidance for diabetes management and decision-making.

Theme 4: Family and Sociocultural Influences

Family members played important roles in food preparation and daily diabetes care. However, family eating patterns often encouraged the consumption of sweet, salty, and high-fat foods, making adherence to dietary recommendations more challenging. Participants also reported that community traditions, religious activities, and social gatherings frequently involved foods that were inconsistent with recommended dietary practices. Mrs. Arporn explained: "During community events, there are always sweets and traditional foods. It is difficult to avoid eating them."

These findings highlight the influence of family and community contexts on diabetes self-management and glycemic control.

DISCUSSION

This study explored barriers to glycemic control among patients with uncontrolled type 2 diabetes in a rural community in Southern Thailand. The findings revealed four major barriers, including irregular meal timing and dietary practices, medication non-adherence, limited self-monitoring behaviors, and family and sociocultural influences. These findings suggest that diabetes self-management is influenced by a complex interaction of individual, behavioral, occupational, family, and community factors.

One of the prominent barriers to glycemic control was irregular meal timing, particularly in the context of agricultural and rubber plantation work. The occupational demands and prolonged periods between meals may make it difficult for participants to maintain recommended dietary practices and may contribute to overeating after prolonged hunger. These findings are consistent with Chrvala et al. (4), who found that dietary self-management remains one of the most challenging aspects of diabetes care. Similarly, Powers et al. (5) emphasized that difficulties maintaining recommended dietary practices and meal planning are common barriers to achieving glycemic targets among adults with type 2 diabetes. Irregular meal timing may contribute to fluctuations in blood glucose levels and increase the likelihood of poor glycemic control (1).

Medication non-adherence was another important barrier to glycemic control. Participants' difficulties with medication-taking were related to forgetting medications, missing doses, altering medication schedules, and perceiving medications as unnecessary when symptoms improved. Similar findings were reported by Mayberry and Osborn (11), who demonstrated that inadequate support and inconsistent adherence behaviors were associated with poorer glycemic control among adults with type 2 diabetes. Shrivastava et al. (12) also reported that self-care deficiencies, including medication non-adherence, contribute substantially to poor diabetes outcomes. Because diabetes is often asymptomatic despite elevated blood glucose levels, inconsistent medication use may contribute to persistent hyperglycemia and increase the risk of diabetes-related complications (1).

Inadequate self-monitoring was another important barrier. Participants' reliance on scheduled healthcare visits rather than regular self-monitoring may limit their ability to recognize changes in blood glucose and respond to them in a timely manner. This finding is consistent with the systematic review conducted by Wikström et al. (13), which demonstrated that self-monitoring behaviors are associated with improved glycemic outcomes and greater self-management effectiveness. According to Creer (18), successful self-management requires individuals to actively

monitor symptoms, evaluate health-related information, and make appropriate behavioral adjustments. Therefore, inadequate self-monitoring may reduce opportunities for timely problem recognition and corrective action. Strengthening practical self-management skills, including appropriate use and interpretation of glucose monitoring information, may help patients recognize changes in blood glucose and respond appropriately. The potential influence of equipment costs and access to glucose monitoring devices should also be considered when developing strategies to support regular self-monitoring. However, these healthcare-system and resource-related factors were not identified as direct barriers reported by participants in this study.

Family and sociocultural influences also played a significant role in diabetes management. Participants reported that family eating patterns, traditional food preferences, religious activities, and community gatherings often encouraged the consumption of sweet, salty, and high-fat foods. Similar observations have been reported by Baig et al. (14), who found that family support and household environments significantly influence diabetes self-management behaviors and health outcomes. Likewise, Xu et al. (8) demonstrated that family relationships, cultural beliefs, and social contexts strongly affect self-management practices among individuals with type 2 diabetes. In rural communities, food is closely associated with social relationships, cultural identity, and community participation, making dietary modification particularly challenging. Taken together, these findings indicate that barriers to glycemic control operate across multiple and interacting levels. Individual and behavioral factors included difficulties with dietary practices, medication adherence, and self-monitoring. Interpersonal and family factors influenced daily diabetes management, while occupational demands and community sociocultural practices shaped patients' ability to maintain recommended behaviors. These findings suggest that interventions should address not only individual self-management but also the family, occupational, and community contexts in which diabetes management occurs.

Similar barriers related to diabetes self-management have been reported by Nam et al. (15), who identified patient beliefs, health literacy, and healthcare-system factors as important determinants of diabetes management. Family support has been recognized as a key facilitator of self-management among individuals with uncontrolled type 2 diabetes (16). Social support from family members and community networks has also been associated with improved diabetes outcomes and medication adherence (17). These findings further emphasize that effective diabetes management requires not only individual behavior change but also supportive family and community environments.

The findings of this study are also consistent with Self-Management Theory proposed by Creer (18), which emphasizes the importance of self-regulation, problem-solving skills, decision-making abilities, and behavioral monitoring in chronic disease management. The barriers identified in this study indicate that many participants experienced difficulties in several key dimensions of self-management. Therefore, interventions designed to improve glycemic control should extend beyond individual education and incorporate family engagement, community participation, and culturally appropriate strategies that support sustainable behavior change.

Overall, the findings suggest that poor glycemic control is not solely the consequence of individual behavior but is strongly influenced by broader social and environmental contexts. Family-centered and community-based interventions that address occupational constraints, medication adherence, self-monitoring skills, and cultural dietary practices may provide more effective and sustainable approaches to improving glycemic outcomes among patients with type 2 diabetes in rural communities.

CONCLUSION

This study identified multiple barriers to glycemic control among patients with uncontrolled type 2 diabetes in a rural community in Southern Thailand. Irregular meal timing associated with occupational responsibilities, medication non-adherence, inadequate self-monitoring behaviors, and family and sociocultural influences emerged as the major challenges affecting diabetes self-management. These findings highlight that glycemic control is shaped by individual behaviors, family dynamics, occupational demands, and community environments.

The findings suggest that future diabetes management programs should incorporate family-centered and community-based approaches that strengthen self-management skills, promote medication adherence, support regular blood glucose monitoring, and address culturally embedded dietary practices. Such interventions may contribute to improved glycemic control, reduced diabetes-related complications, and enhanced quality of life among individuals living with type 2 diabetes in rural communities.

RECOMMENDATIONS

Healthcare providers should develop family-centered diabetes management programs that are culturally appropriate and tailored to the local community context, with an emphasis on promoting regular meal timing, medication adherence, and consistent self-monitoring behaviors. Interventions should be designed to accommodate the lifestyles and occupational demands of rural populations, particularly agricultural and rubber plantation workers whose irregular work schedules may interfere with healthy eating patterns and medication use. In addition, diabetes management strategies should take into account sociocultural factors, family influences, and environmental conditions, such as the hot and humid climate and seasonal variations, which may affect physical activity, dietary choices, and access to healthcare services. Active involvement of family members, community leaders, and village health volunteers may further enhance self-management practices and support sustainable health behavior change. Future research should evaluate the effectiveness of context-specific interventions in larger and more diverse populations to improve the generalizability of the findings.

ETHICAL DECLARATION

This study was approved by the Human Research Ethics Committee (COA No. TSU 2024_262; REC No. 0617) on October 8, 2024. The study adhered to ethical principles, including respect for autonomy, beneficence, non-maleficence, justice, and confidentiality. All participants provided written informed consent prior to participation. Participants were informed of their right to withdraw from the study at any time without any consequences. All data were anonymized to ensure confidentiality throughout the research process.

LIMITATIONS

This study has several limitations. First, it was conducted in a single rural community in Southern Thailand; therefore, the findings may reflect the specific social, cultural, occupational, and healthcare context of the study setting. Second, as a qualitative study, the findings are not intended for statistical generalization. The findings should therefore be interpreted in relation to the context of patients with uncontrolled type 2 diabetes in similar rural settings.

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DETERMINANTS OF SUSTAINABLE FOOD CONSUMPTION AMONG MYANMAR MIGRANTS IN MAE SOT, THAILAND

La Min Thaw, Cheerawit Rattanapan*, Orapin Laosee, Piyapong Jangmaimool
ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, Thailand
****Corresponding Author**: Cheerawit Rattanapan, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand, Email: cheerawit.rat@mahidol.ac.th*

ABSTRACT

Introduction: Food systems significantly contribute to environmental degradation and greenhouse gas emissions, and unhealthy diets are an increasing burden of non-communicable diseases. Sustainable food consumption is essential for both environmental sustainability and population health. Myanmar migrants in Thailand are facing socioeconomic constraints that may influence food-related decision-making. However, evidence regarding behavioral intention for sustainable food consumption among this population remains limited.

Objectives: This study aimed to examine determinants of sustainable food consumption behavioral intention among Myanmar migrants residing in Mae Sot, Thailand.

Methodology: A cross-sectional study was conducted among an interim sample of 230 Myanmar migrants aged ≥18 years, residing in Mae Sot for at least six months, and involved in food purchasing or preparation. This represented an interim sample of a target of 430, as data collection was ongoing at the time of analysis. Sustainable food consumption was operationalized as a behavioral intention to purchase plant-based, locally produced, and minimally processed foods, and measured using a structured questionnaire based on the Theory of Planned Behavior and its extensions. Variables included attitude, subjective norms, perceived behavioral control, perceived value, health consciousness, consumer knowledge, cultural food preference, and behavioral intention. Content validity was assessed by three experts, and most constructs showed acceptable internal consistency (α = 0.724-0.887). Chi-square tests and multiple logistic regression were performed to identify factors associated with behavioral intention.

Results: Among the 230 participants, the largest age group was 18-29 years (28.7%), 62.6% were female, and nearly half had a bachelor's degree or higher (47.4%). The majority (77.8%) reported high behavioral intentions toward sustainable food consumption.

Bivariate analysis showed that attitude, perceived value, cultural food preference, health consciousness, subjective norm, and perceived behavioral control were significantly associated with high behavioral intention ($p < 0.001$), whereas consumer knowledge was not ($p = 0.076$). In multivariable logistic regression, perceived value (AOR = 6.328, 95% CI: 2.796-14.322, $p < 0.001$), attitude (AOR = 5.076, 95% CI: 2.207-11.678, $p < 0.001$), and cultural food preference (AOR = 4.389, 95% CI: 1.772-10.872, $p = 0.001$) remained independently associated with high behavioral intention (Nagelkerke $R^2 = 0.484$).

Conclusion: Attitude, perceived value, and cultural food preference were independently associated with sustainable food consumption behavioral intention among Myanmar migrants. Consumer knowledge was not associated with behavioral intention, suggesting that knowledge alone may be insufficient to promote sustainable food choices. Interventions should strengthen positive attitudes, enhancing the perceived value of sustainable food choices and incorporating culturally appropriate dietary practices into migrant health promotion programs to encourage healthier and sustainable dietary behaviors.

Keywords:
Sustainable Food Consumption; Behavioral Intention; Myanmar Migrants; Theory Of Planned Behavior

INTRODUCTION

Global food systems face significant challenges from unsustainable consumption and production, contributing to climate change, biodiversity loss, and roughly one-third of global greenhouse gas emissions (1,2). At the same time, unhealthy dietary patterns are driving a growing burden of non-communicable diseases (NCDs) worldwide (3). Together, these challenges have increased emphasis on sustainable food consumption as a strategy to support both environmental and human health.

Sustainable food consumption involves choosing foods that support health while reducing environmental impacts and contributing to social and economic sustainability (4). Diets emphasizing plant-based, minimally processed, and locally sourced foods are linked to lower greenhouse gas emissions as well as reduced risks of obesity, cardiovascular disease, and type 2 diabetes (5). Building on this evidence, the present study examines sustainable food consumption through behavioral intention to purchase such foods.

Adopting sustainable food consumption practices can be particularly challenging for vulnerable populations, since food choices are shaped by affordability, cultural preferences, social influences, and food accessibility (6), as well as concerns about personal and family health (7). Among migrant populations, these factors can play a particularly important role in everyday food decisions.

Thailand offers an important setting for examining these dynamics. Urbanization and economic development in Thailand have driven dietary transitions toward processed and animal-based foods, while NCDs remain a major public health challenge (8,9). Within this context, Myanmar migrants represent one of the largest and most vulnerable population groups in the country, with approximately 74,000 residing in Mae Sot District, Tak Province, a major Thailand-Myanmar border area (10). Many face financial insecurity, limited healthcare access, and barriers to healthy eating (11,12), and these circumstances may in turn affect their ability and willingness to engage in sustainable food consumption.

Despite increasing research on sustainable food consumption, evidence regarding the factors influencing sustainable food consumption behavioral intention among vulnerable migrant populations remains limited. Understanding these factors is important for developing interventions that meet the needs and circumstances of migrant communities.

Therefore, this study aimed to examine the determinants of sustainable food consumption behavioral intention among Myanmar migrants residing in Mae Sot, Thailand, using an extended Theory of Planned Behavior framework.

METHODOLOGY

A cross-sectional analytical study using a two-stage cluster sampling design was conducted among Myanmar migrants residing in Mae Sot District, Tak Province, Thailand. Mae Sot is located on the Thailand-Myanmar border and serves as a major hub for cross-border migration (10,11). Data were collected from three public markets in Mae Sot District, namely Pha Charoen Market, Bang Nua Market, and Mae Sot Friday Market, in late May 2026 after obtaining ethical approval. These three markets were selected as the study clusters as they primarily sell fresh food, serve as household food purchasing locations within the Mae Sot District, and have a notable presence of Myanmar migrant shoppers. Within each cluster (market), eligible participants were recruited until the target sample size for that cluster was reached.

The sample size was calculated using Cochran's formula (95% confidence level, 5% margin of error, expected proportion 0.5 as no prior prevalence estimate for this population), yielding a minimum of 384, adjusted to 430 to account for a 10% anticipated non-response rate (13). At the time of analysis, data collection was still ongoing. Hence, 230 completed questionnaires (53.5% of target) were available and included in the present analysis.

Eligible participants were Myanmar migrants aged ≥18 years who had lived in Mae Sot

for at least six months, were involved in household food purchasing or preparation, and provided informed consent; those who did not consent were excluded.

This study was based on the Theory of Planned Behavior (TPB), which proposes that behavioral intention is influenced by attitude, subjective norms, and perceived behavioral control (14), extended here with perceived value, consumer knowledge, health consciousness, and cultural food preference as additional potential determinants.

Data were collected using a structured questionnaire developed based on this extended framework. The questionnaire comprised three sections: (1) sociodemographic characteristics, (2) psychological determinants based on the extended Theory of Planned Behavior (TPB), and (3) sustainable food consumption behavioral intention. Behavioral intention was defined as participants' intention to purchase foods that minimize environmental impacts while supporting health, such as plant-based, minimally processed, and locally sourced foods. Most items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Consumer knowledge was assessed using Yes/No questions, with higher scores indicating greater knowledge. The questionnaire items were adapted from previously validated sustainable food consumption instruments (4,15,16,17,18,19), modified for the Myanmar migrant context, and translated into the Myanmar language.

Content validity was assessed by three experts using the Item-Objective Congruence (IOC) index. Items with an IOC score below 0.50 were revised based on the experts' comments. Reliability was assessed in a pilot study of 30 Myanmar migrants at a market not included in the main study. Internal consistency was satisfactory across all constructs, with Cronbach's alpha coefficients ranging from 0.724 to 0.887.

Three trained research assistants conducted face-to-face interviews using the Myanmar-language questionnaire. Completed questionnaires were reviewed daily for completeness and stored securely, accessible only to the research team.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 31. Descriptive statistics were used to summarize participants' characteristics and study variables. All the variables were presented as frequencies and percentages. All constructs were dichotomized into low and high groups based on the median score. Chi-square tests and bivariate logistic regression were performed to examine associations between independent variables and sustainable food consumption behavioral intention and to estimate crude odds ratios (COR). Variables were subsequently entered simultaneously into a multivariable logistic regression model (Enter method) to estimate adjusted odds ratios (AORs). A reduced final model was then fitted, including only the significant predictors from the full model. Model fit was assessed using the Hosmer–Lemeshow test and Nagelkerke R^2. Statistical significance was set at $p < 0.05$.

RESULTS

Sociodemographic Characteristics

The largest age group was 18-29 years (28.7%), followed by 40-49 years (26.5%), 30-39 years (24.3%), 50-59 years (15.7%), and 60-71 years (4.8%). Most participants were female (62.6%), married (44.8%), and had attained a bachelor's degree or higher (47.4%). Nearly half of the respondents reported a monthly income between 5,001 and 10,000 Thai Baht (48.3%). The largest proportion had resided in Thailand for 3-6 years (39.1%), and the majority lived in rented rooms or apartments (75.2%). Detailed sociodemographic characteristics are presented in Table 1.

Table 1 Sociodemographic characteristics of participants (N = 230)

Variable	Category	n (%)
	18-29 years	66 (28.7)
	30-39 years	56 (24.3)
Age	40-49 years	61 (26.5)
	50-59 years	36 (15.7)
	60-71 years	11 (4.8)
Sex	Male	78 (33.9)
	Female	144 (62.6)
	Other	8 (3.5)
Marital Status	Single	75 (32.6)
	Married	103 (44.8)
	Cohabiting	19 (8.3)
	Divorced	16 (7.0)
	Widowed	17 (7.4)
Education	No formal education	9 (3.9)
	Primary education	9 (3.9)
	Middle school education	38 (16.5)
	High school education	65 (28.3)
	Bachelor's degree or higher	109 (47.4)
Occupation	Factory worker	9 (3.9)
	Service sector	67 (29.1)
	Construction worker	14 (6.1)
	Domestic worker	26 (11.3)
	Agriculture worker	8 (3.5)
	Teacher	14 (6.1)
	Trader	8 (3.5)
	Other*	34 (14.8)
	Unemployed	50 (21.7)
Employment Type	Full-time	61 (26.5)
	Part-time	38 (16.5)
	Daily wage worker	32 (13.9)
	Self-employed	49 (21.3)
	Unemployed	50 (21.7)
Monthly Income	<5,000 THB	88 (38.3)
	5,001-10,000 THB	111 (48.3)
	10,001-15,000 THB	28 (12.2)
	15,001-20,000 THB	3 (1.3)
Length of Stay in Thailand	<1 year	16 (7.0)
	1-3 years	67 (29.1)
	3-6 years	90 (39.1)
	6-10 years	28 (12.2)
	>10 years	29 (12.6)
Housing Type	Rented room/apartment	173 (75.2)
	Shared housing with others	34 (14.8)
	Employer-provided housing	12 (5.2)
	Temporary shelter	4 (1.7)
	Other	7 (3.0)

**The other remaining occupations (e.g., office worker, freelance, student, nurse, reporter, volunteer, kitchen helper, NGO worker, driver, security, tailor, translator, lawyer, etc.).*

Descriptive statistics are presented in Table 2. Most participants (77.8%) reported high behavioral intention (mean = 4.07, SD = 0.44), with attitude showing the highest mean score (4.01) and consumer knowledge the lowest (3.65). The proportion of participants classified as having high scores across the constructs ranged from 54.8% for cultural food preference to 76.1% for consumer knowledge.

Table 2 Descriptive statistics of study variables (N = 230)

Variable	Low n (%)	High n (%)	Mean	SD	Median	Min	Max
Attitude	61 (26.5)	169 (73.5)	4.01	0.43	4.00	2.00	5.00
Subjective Norm	91 (39.6)	139 (60.4)	3.85	0.58	4.00	2.00	5.00
Perceived Behavioral Control	97 (42.2)	133 (57.8)	3.85	0.51	4.00	2.00	5.00
Perceived Value	59 (25.7)	171 (74.3)	4.00	0.48	4.00	2.50	5.00
Health Consciousness	87 (37.8)	143 (62.2)	3.92	0.66	4.00	2.00	5.00
Cultural Food Preference	104 (45.2)	126 (54.8)	3.78	0.59	4.00	2.00	5.00
Consumer Knowledge	55 (23.9)	175 (76.1)	3.65	0.71	4.00	1.00	4.00
Behavioral Intention	51 (22.2)	179 (77.8)	4.07	0.44	4.00	2.50	5.00

Chi-square tests revealed significant associations between behavioral intention and all independent variables ($p < 0.001$), except consumer knowledge ($\chi^2 = 3.196$, $p = 0.074$).

In bivariate logistic regression (Table 3), participants with high attitude scores had significantly higher odds of high behavioral intention than those with low attitude scores (COR = 12.873, 95% CI: 6.247-26.525, $p < 0.001$). Similarly, high scores for subjective norm (COR = 4.805, 95% CI: 2.457-9.395, $p < 0.001$), perceived behavioral control (COR = 4.643, 95% CI: 2.359-9.137, $p < 0.001$), perceived value (COR = 10.788, 95% CI: 5.309-21.922, $p < 0.001$), health consciousness (COR = 6.024, 95% CI: 3.039-11.940, $p < 0.001$), and cultural food preference (COR = 8.806, 95% CI: 4.025-19.269, $p < 0.001$) were each significantly associated with higher odds of high behavioral intention. In contrast, consumer knowledge was not significantly associated with behavioral intention (COR = 1.855, 95% CI: 0.937-3.675, $p = 0.076$).

Table 3 Bivariate logistic regression of factors associated with sustainable food consumption behavioral intention (N = 230)

Variables	Number	Behavioral intention		COR	95% CI		P value
		Low (0)	High (1)		Lower	Upper	
Attitude							
Low (Ref.)	**61**	35 (57.4)	26 (42.6)				
High	**169**	16 (9.5)	153 (90.5)	12.873	6.247	26.525	<0.001*
Subjective Norm							
Low (Ref.)	**91**	35 (38.5)	56 (61.5)				

Variables	Number	Behavioral intention		COR	95% CI		P value
		Low (0)	High (1)		Lower	Upper	
High	**139**	16 (11.5)	123 (88.5)	4.805	2.457	9.395	<0.001*
Perceived Behavioral Control							
Low (Ref.)	**97**	36 (37.1)	61 (62.9)				
High	**133**	15 (11.3)	118 (88.7)	4.643	2.359	9.137	<0.001*
Perceived Value							
Low (Ref.)	**59**	33 (55.9)	26 (44.1)				
High	**171**	18 (10.5)	153 (89.5)	10.788	5.309	21.922	<0.001*
Health Consciousness							
Low (Ref.)	**87**	36 (41.4)	51 (58.6)				
High	**143**	15 (10.5)	128 (89.5)	6.024	3.039	11.940	<0.001*
Cultural Food Preference							
Low (Ref.)	**104**	42 (40.4)	62 (59.6)				
High	**126**	9 (7.1)	117 (92.9)	8.806	4.025	19.269	<0.001*
Consumer Knowledge							
Low (Ref.)	**55**	17 (30.9)	38 (69.1)				
High	**175**	34 (19.4)	141 (80.6)	1.855	0.937	3.675	0.076

Multivariable logistic regression was performed to identify determinants of sustainable food consumption behavioral intention. In the full model (all variables entered simultaneously), the model was statistically significant ($\chi^2 = 91.959$, df = 7, $p < 0.001$), showed good fit (Hosmer-Lemeshow p = 0.673), explained 50.5% of the variance (Nagelkerke $R^2 = 0.505$), and correctly classified 84.8% of participants. After adjustment, only attitude (AOR = 3.685, p = 0.005), perceived value (AOR = 5.531, $p < 0.001$), and cultural food preference (AOR = 3.377, p = 0.013) remained significantly associated with behavioral intention (Table 4).

A final model retaining only these three predictors remained statistically significant ($\chi^2 = 87.350$, df = 3, $p < 0.001$; Hosmer-Lemeshow p = 0.188), explained 48.4% of the variance (Nagelkerke $R^2 = 0.484$), and correctly classified 84.3% of participants. Attitude (AOR = 5.076), perceived value (AOR = 6.328), and cultural food preference (AOR = 4.389) all remained significantly associated with behavioral intention (Table 4).

Table 4 Full and final multivariable logistic regression models for sustainable food consumption behavioral intention

Independent Variables	Sustainable food consumption behavioral intention			
	Full Model		Final Model	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Attitude (Ref: Low)	3.685 (1.491-9.106)	0.005	5.076 (2.207-11.678)	<0.001
Subjective Norm (Ref: Low)	1.323 (0.532-3.285)	0.547		

Independent Variables	Sustainable food consumption behavioral intention			
	Full Model		Final Model	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Perceived Behavioral Control (Ref: Low)	1.099 (0.444-2.721)	0.838		
Perceived Value (Ref: Low)	5.531 (2.320-13.187)	<0.001	6.328 (2.796-14.322)	<0.001
Consumer Knowledge (Ref: Low)	1.751 (0.691-4.439)	0.238		
Health Consciousness (Ref: Low)	2.333 (0.956-5.694)	0.063		
Cultural Food Preference (Ref: Low)	3.377 (1.293-8.823)	0.013	4.389 (1.772-10.872)	0.001

Full model: Omnibus $\chi^2 = 91.959$, $p < 0.001$; Nagelkerke $R^2 = 0.505$; Hosmer-Lemeshow $p = 0.673$; overall classification accuracy = 84.8%.

Final model: Omnibus $\chi^2 = 87.350$, $p < 0.001$; Nagelkerke $R^2 = 0.484$; Hosmer-Lemeshow $p = 0.188$; overall classification accuracy = 84.3%.

DISCUSSION

This study examined the determinants of sustainable food consumption behavioral intention among Myanmar migrants in Mae Sot, Thailand, using the Extended Theory of Planned Behavior (TPB). Bivariate analyses showed that attitude, subjective norm, perceived behavioral control, perceived value, health consciousness, and cultural food preference were significantly associated with behavioral intention, whereas consumer knowledge was not. However, after adjustment in the multivariable logistic regression model, only attitude, perceived value, and cultural food preference remained significant predictors.

Attitude was a significant predictor, and participants with high attitude had approximately five times higher odds of reporting high behavioral intention. This is consistent with prior studies identifying attitude as a key determinant of sustainable food purchasing intention (15,20). Among Myanmar migrants, adapting to a new food environment, financial constraints, and limited food choices may challenge sustainable food choices (12,21). Despite these challenges, positive attitudes toward the health and environmental benefits of sustainable foods may be associated with a greater likelihood of choosing them even under these constraints (15,22).

Perceived value was the strongest predictor in the adjusted model. Participants with a high perceived value score had more than 6 times greater odds of having high behavioral intention. This finding suggests that migrants who perceived sustainable foods as valuable were more likely to intend to purchase them. As migrants often have limited financial resources, perceived value may play an important role in food purchasing decisions, particularly when sustainable foods are viewed as offering health, quality, or environmental benefits (15).

Cultural food preference was also significantly associated with behavioral intention, with higher-scoring participants approximately 4.4 times more likely to report high behavioral intention. This finding suggests that sustainable food choices are more acceptable when aligned with familiar dietary practices and traditional Myanmar foods, highlighting the importance of incorporating cultural preferences into sustainable nutrition interventions (23).

Although subjective norm, perceived behavioral control, and health consciousness were significantly associated with behavioral intention in chi-square and bivariate analyses, they were no longer significant after adjustment for other predictors. This suggests that their associations may be explained by shared relationships with attitude, perceived value, or

cultural food preference (15,20). Among Myanmar migrants, adapting to a new food environment often involves financial constraints, changes in food availability, and the need to balance cultural food preferences with available food choices (12,22). These contextual factors may increase the importance of migrants' personal evaluations of sustainable foods and the value they perceive in them when making purchasing decisions (15).

Consumer knowledge was not significantly associated with behavioral intention in any analysis, suggesting knowledge alone may be insufficient to motivate sustainable food consumption. Individuals may have adequate knowledge but still face financial constraints, limited availability, cultural influences, or other barriers preventing knowledge from translating into behavioral intention (22).

These findings differ from a cross-national meta-analysis of the Theory of Planned Behavior, which found attitude, subjective norms, and perceived behavioral control to be strongly associated with sustainable food purchase intention (20). Among lower-SES parents in Belgium, price was a major determinant of food choices, highlighting the importance of economic considerations among socioeconomically vulnerable groups (24). Similarly, a study in a Myanmar refugee camp near Mae Sot reported limited availability of culturally important vegetables and legumes and loss of traditional food knowledge (25). These findings suggest that economic and cultural food environments may shape sustainable food-related decisions among vulnerable populations.

CONCLUSION

Overall, attitude, perceived value, and cultural food preference were the key determinants of sustainable food consumption behavioral intention among Myanmar migrants in Mae Sot, indicating the importance of psychological and cultural factors in promoting sustainable food choices.

RECOMMENDATION

Community-based interventions should encourage positive attitudes toward sustainable foods through culturally appropriate campaigns, delivered in the Myanmar language via trusted community channels such as migrant worker networks, religious organizations, and market-based outreach, emphasizing the health and environmental benefits of sustainable food choices. Policymakers and local health authorities should improve the affordability and accessibility of sustainable food options for migrant communities, while promoting the quality and health benefits of these foods to enhance perceived value. Sustainable food promotion programs should incorporate familiar Myanmar dietary practices that adapt traditional dishes by using more sustainable ingredients to improve cultural acceptance, and should be integrated into existing migrant health promotion services (e.g., migrant health volunteer programs) rather than delivered as knowledge-based education, given that consumer knowledge alone was not associated with behavioral intention in this study.

ETHICAL DECLARATION

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (COA No. MU-CIRB 2026/093.2805) on 28 May 2026. Permission was also obtained from the Mae Sot City Municipality. Written informed consent was obtained from all participants prior to data collection, and responses were recorded anonymously to protect privacy and confidentiality.

LIMITATIONS

This study has several limitations. First, the analysis was based on an interim sample of 230 participants out of the planned 430, as data collection was still ongoing at the time of analysis. The smaller sample size may have limited the statistical power to detect weaker associations and may have introduced selection bias if early participants differed systematically from those recruited later. Therefore, the findings

should be considered preliminary until the full dataset is analyzed.

Second, the cross-sectional design also limits the ability to establish causal relationships between the examined factors and sustainable food consumption behavioral intention, as all variables were measured at a single point in time.

Third, the outcome measured was behavioral intention rather than actual sustainable food purchasing behavior, and given the well-documented intention-behavior gap, high behavioral intention may not always translate into corresponding actual practice.

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DIETARY BEHAVIORS AND CULTURAL FOOD PRACTICES AMONG OLDER ADULTS WITH UNCONTROLLED HYPERTENSION IN RURAL SOUTHERN THAILAND: A QUALITATIVE STUDY

Wannapa Bunsong[1], Dusanee Suwankhong[1*], Tum Boonrod[1], Witchada Simla[1], Chararat Sathirapanya[2]

[1]Master of Public Health Program, Thaksin University, Phatthalung, 93210, Thailand
[2]Department of Family Medicine and Preventive Medicine, Faculty of Medicine, Prince of Songkla University, 90110, Thailand
***[*]Corresponding author:** Dusanee Suwankhong,*
Thaksin University, Phatthalung Province 93210, Thailand. E-mail: dusanee.s@tsu.ac.th

ABSTRACT

Introduction: Uncontrolled hypertension is a major public health challenge among older adults in rural Southern Thailand. Dietary behaviors and culturally embedded food practices, including seasoning and household meal preparation, are modifiable factors that may influence blood pressure control.

Objectives: To explore dietary behaviors, food consumption patterns, seasoning practices, food sources, and household food preparation roles among older adults with uncontrolled hypertension in Khuan Mao Subdistrict, Ratsada District, Trang Province, Thailand.

Methodology: A qualitative descriptive study was conducted among 37 older adults with diagnosed uncontrolled hypertension, defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. Participants were purposively recruited to share their dietary practices and related experiences. Data were collected through semi-structured in-depth interviews and participant observations. Interviews continued until data saturation was reached. Data were analyzed using thematic analysis.

Results: Thematic analysis identified four themes: (1) preference for highly seasoned foods; (2) persistence of traditional high-sodium dietary practices; (3) inadequate consumption of fruits and vegetables; and (4) family and cultural influences on food choices and meal preparation. Participants frequently used sodium-rich condiments, including fish sauce, salt, shrimp paste, soy sauce, monosodium glutamate, and seasoning powders. Commonly consumed foods included coconut milk–based dishes, chili paste, salted fish, and processed foods. Although some participants reported regular fruit and vegetable consumption, intake was generally insufficient to meet recommended fruit and vegetable intake guidelines for older adults. Local grocery stores, convenience stores, and fresh markets were the primary food sources. Spouses and adult children played important roles in meal preparation and dietary decision-making. Overall, dietary behaviors were strongly influenced by cultural food preferences, habitual seasoning practices, and family contexts.

Conclusion: Unhealthy dietary behaviors among older adults with uncontrolled hypertension were strongly influenced by traditional food culture and family environments. These findings highlight the importance of culturally tailored nutrition education, family-centered dietary interventions, and community-based sodium reduction programs. Incorporating local food practices and engaging family caregivers may help promote sustainable dietary behavior change and improve blood pressure management among older adults in rural communities.

Keywords:
Uncontrolled Hypertension; Dietary Behavior; Sodium Intake Traditional Dietary Practice; Rural Community

INTRODUCTION

Hypertension remains one of the leading public health challenges worldwide and is a major contributor to cardiovascular disease, stroke, and premature mortality (1). The burden of hypertension is particularly evident among older adults, who experience age-related physiological changes and often have multiple chronic conditions that complicate blood pressure management (2,3). In Thailand, hypertension prevalence continues to increase with population ageing, and a substantial proportion of older adults are unable to achieve optimal blood pressure control despite receiving regular treatment (1). Such dietary behaviors as excessive sodium intake have been consistently identified as major modifiable risk factors associated with uncontrolled hypertension and cardiovascular complications (4,5).

Dietary practices among older adults are influenced not only by individual knowledge and preferences but also by social, cultural, and environmental factors (6). Previous qualitative studies have demonstrated that food choices and dietary adherence among individuals with hypertension are shaped by taste preferences, cultural norms, family influences, economic conditions, and accessibility of healthy foods (7–10). Although many patients recognize the importance of dietary modification for blood pressure control, translating knowledge into sustained behavioral change remains challenging (11–13).

In many Asian countries, including Thailand, traditional dietary patterns are characterized by the frequent use of sodium-rich condiments and preserved foods. Southern Thai cuisine, in particular, commonly incorporates fish sauce, shrimp paste, soy sauce, fermented products, and ready-made seasonings, which contribute substantially to daily sodium intake. Such culturally embedded dietary practices may increase the risk of excessive sodium consumption and hinder adherence to dietary recommendations for hypertension management (4,8,14). Similar findings have been reported among older adults with hypertension in China, where cultural food preferences and habitual seasoning practices strongly influenced dietary behavior (14).

Another important but often overlooked factor is the role of family members and caregivers in food preparation. Among older adults living in rural communities, meals are frequently prepared by spouses, children, or other household members. Dietary intake may be influenced not only by the older adults' own preferences but also by the knowledge, attitudes, and cooking practices of family caregivers (6,15). Previous qualitative studies have highlighted the importance of social support and family involvement in hypertension self-management and nutrition-related behaviors (2,15).

Although previous studies have explored patients' experiences with hypertension, barriers to treatment adherence, and dietary self-management in various countries (3,11,12), limited evidence is available regarding the influence of cultural food practices, household food preparation, and seasoning behaviors among older adults with uncontrolled hypertension in Thailand. Little is known about how local food culture and family food environments shape dietary behaviors in Khun Moa Subdistrict, Ratsada District, Trang Province, southern Thailand.

Therefore, this qualitative study aimed to explore dietary behaviors, food consumption patterns, seasoning practices, food sources, and household food preparation roles among older adults with uncontrolled hypertension in this area. Understanding these contextual factors may provide valuable insights for developing culturally appropriate and family-centered dietary interventions to improve blood pressure control among older adults.

METHODOLOGY

Study Design and Setting

This qualitative descriptive study was conducted in Khuan Mao Subdistrict, Ratsada District, Trang Province, Southern Thailand. The rural subdistrict comprises 15 villages and is characterized by dispersed settlements and an

agricultural economy based mainly on rubber, oil palm, and fruit production.

Participants

The participants comprised 37 older adults aged 60 years and above with uncontrolled hypertension who resided in the study area. Uncontrolled hypertension was defined as systolic blood pressure >=140 mmHg and/or diastolic blood pressure >=90 mmHg. A purposive sampling method was used to recruit eligible participants. Inclusion criteria were: 1) age 60 years or older; 2) a diagnosis of hypertension with blood pressure meeting the study definition of uncontrolled hypertension; 3) ability to communicate and provide relevant information; and 4) willingness to participate in the study. Individuals were excluded if they had severe physical illness or disability that impaired communication or participation in the interview process (advanced stroke, severe hearing impairment, terminal illness, or hospitalization), or cognitive impairment (dementia or significant memory problems).

Data Collection

Data were collected using a semi-structured interview guide consisting of open-ended questions developed from a review of the literature on dietary behaviors and hypertension management among older adults, particularly previous qualitative studies exploring factors influencing dietary behaviors in older adults with hypertension (7,8,14). The research team reviewed and refined the content, wording, and sequence of the questions to ensure clarity, relevance to the study objectives, and appropriateness for the participants' sociocultural context. The interview guide remained flexible, allowing probing questions to explore emerging issues in greater depth. Interviews continued until data saturation was reached. Participant observations were conducted during home visits to provide contextual information on household food availability, sodium-rich condiments, meal preparation practices, and the roles of family members in food preparation. The interview guide is presented in Table 1.

Table 1. Semi-structured interview guide.

No.	Questions
1	**General characteristics**: Age, sex, living status, income, education, and body mass index (BMI).
2	**Dietary behaviors**: How many meals do you usually consume per day, and what types of foods and cooking methods do you typically use?
3	**Seasoning use**: Can you describe your use of condiments, such as fish sauce, soy sauce, shrimp paste, or seasoning powders, in your daily meals, including whether you add them during cooking or before eating? Why?
4	**Food sources and meal preparation roles**: Do you usually cook at home or buy prepared foods? Who is mainly responsible for preparing meals in your family?

Data Analysis

All interviews were audio-recorded and transcribed verbatim in Thai by the first author. Data were analyzed using thematic analysis. The analysis followed six steps (16): 1) familiarization with the data through repeated reading of transcripts; 2) generation of initial codes by identifying meaningful units related to dietary behaviors and hypertension management; 3) searching for patterns and grouping similar codes into potential themes; 4) reviewing and refining themes to ensure coherence and consistency across the dataset; 5) defining and naming themes; and 6) selecting representative quotations to illustrate participants' perspectives. The first and second authors independently

reviewed and coded the transcripts. Regular discussions were conducted among the research team to compare interpretations and resolve discrepancies. Interview findings were compared with participant-observation findings as a form of data-source triangulation, strengthening credibility. Representative quotations were translated from Thai into English for reporting and are presented using consistent participant codes to protect identity.

RESULTS

Characteristics of Study Participants

The study included 37 older adults with uncontrolled hypertension aged 60–81 years; more than half were female. Most had primary school education and low to moderate household income, and approximately two-thirds lived with spouses or children. Many had hypertension for more than five years and attended regular follow-up at local healthcare facilities.

Theme 1: Preference for Highly Seasoned Foods

Participants commonly consumed three meals per day and described a strong preference for salty, highly seasoned foods. Fish sauce was most frequently mentioned, followed by salt, shrimp paste, and oyster sauce; MSG, soy sauce, and ready-made seasoning powders were also used. P01 stated, "If I don't add fish sauce, the food does not taste delicious." P02 explained, "I usually add seasoning powder and soy sauce when cooking because my family likes strong flavors."

Participant observations supported these interview findings. During home visits, bottles of fish sauce, soy sauce, shrimp paste, seasoning powder, and monosodium glutamate were commonly observed in household kitchens. Several participants were also observed adding fish sauce or other condiments during meal preparation and immediately before eating.

Theme 2: Persistence of Traditional High-Sodium Dietary Practices

Participants commonly preferred sweet, spicy, and salty foods, reflecting familiar local flavor profiles and long-established eating habits. P05 stated, "I usually eat salty and spicy food every day because that is how people in my family cook."

Boiling was common, with frying and stir-frying also used. Traditional Southern Thai dishes included coconut milk-based curries, spicy curries, and Kaeng Som (Thai sour curry). P09 stated, "I cook curry very often because my family enjoys coconut milk curry dishes."

Common foods included curries, stir-fried vegetables, chili paste with vegetables, salted fish, and processed foods. P10 said, "I often eat salted fish with rice because it is convenient and it can be kept for a long time." P12 added, "Sometimes I buy processed food because it is easy and cheaper than cooking."

Participant observations further supported these dietary practices. Traditional Southern Thai dishes, including coconut milk curries, chili paste, salted fish, and preserved foods, were frequently present on dining tables during household visits. Multiple sodium-rich condiments were also observed in household kitchens and during meal preparation.

Theme 3: Inadequate Consumption of Fruits and Vegetables

Coconut milk-based dishes were commonly consumed about once per week and were valued for their familiar flavor and richness. P07 explained, "I cook coconut milk curry almost every week because my family enjoys it a lot."

Participants consumed various locally available fruits, but fruit and vegetable intake varied from daily to occasional and depended on availability and affordability. P13 explained, "I try to eat vegetables every day because the doctor told me they are good for my blood pressure, although they are sometimes expensive, so I do not buy them often."

From participant observation, we found that fresh vegetables and fruits were not consistently available in all households. In several homes, processed foods, dried fish, or ready-to-eat dishes were more readily available than fresh produce, supporting participants' reports

regarding limited access and inconsistent consumption of fruits and vegetables.

Theme 4: Family and Cultural Influences on Food Choices and Meal Preparation

Food was obtained mainly from local grocery and convenience shops and fresh markets; some participants used home-grown vegetables and herbs. Choices were shaped by availability, accessibility, and affordability. P16 noted, "When I feel tired, I buy ready-made food from the local shop instead of cooking."

Spouses were commonly identified as the main household food preparers, followed by adult children. P19 stated, "My daughter helps prepare meals and reminds me not to eat too much salty food, although I sometimes ignore her advice." Family members influenced food selection, seasoning, and cooking methods.

Household observations also demonstrated that spouses and adult children frequently prepared meals for older adults. During several home visits, family members were observed cooking, serving meals, or selecting food ingredients while older adults had limited involvement in meal preparation, confirming the important influence of family on daily dietary practices.

DISCUSSION

This study shows that dietary behavior among older adults with uncontrolled hypertension was shaped by individual preferences, cultural traditions, habitual seasoning, local food access, and family food-preparation roles. These behaviors were embedded in household routines, suggesting that dietary recommendations may be difficult to sustain when social and cultural meal contexts are overlooked.

Family members and caregivers played a central role in food preparation, consistent with evidence that older adults' dietary behavior is strongly influenced by social and family contexts (2,6,15). Household preferences and cooking practices can determine both foods served and use of sodium-rich seasonings. Dietary interventions should therefore involve family food preparers in education, low-sodium cooking, and household monitoring (2,15). Interview accounts and household observations converged, strengthening credibility through data-source triangulation. Observations confirmed routine availability of sodium-rich condiments, traditional Southern Thai dishes, and family involvement in meal preparation.

The widespread use of fish sauce, soy sauce, shrimp paste, and commercial flavor enhancers is consistent with Asian studies showing that traditional seasoning practices contribute to excessive sodium intake (14). Excess sodium is a major determinant of elevated blood pressure and cardiovascular risk (4,5), yet long-established taste preferences and cultural habits can sustain sodium-rich diets (8,11,12,14).

The findings also reveal a gap between dietary knowledge and practice. Similar studies of DASH adherence identified salty-food preferences, family eating patterns, limited food choices, and difficulty maintaining restrictions as barriers (7,10). Knowledge alone may therefore be insufficient; interventions should also address cultural, environmental, and behavioral determinants.

Participants reported vegetables but also frequently consumed coconut milk dishes and sodium-rich condiments, suggesting partial adherence to healthy eating recommendations. Evidence-based approaches such as DASH emphasize fruits, vegetables, whole grains, and lower sodium and saturated fat intake (17,18), but full adherence may be difficult within established Southern Thai food practices.

Fruit and vegetable intake was often inconsistent and influenced by availability, affordability, seasonality, and household preferences. Interventions should therefore improve access to produce and engage family members in making fruits and vegetables more available in daily meals.

The findings may also be interpreted through Bandura's self-efficacy theory (19), which proposes that confidence in one's ability to perform a behavior influences behavioral

adoption and maintenance. Because food preparation decisions were often influenced by caregivers and family members, their confidence and practical skills in preparing lower-sodium meals may affect the dietary environment of older adults. Future interventions should therefore combine nutrition knowledge with practical cooking skills, goal setting, and family support to strengthen confidence in maintaining lower-sodium food preparation.

Overall, the findings extend qualitative evidence by showing how cultural food practices, seasoning, food access, and family environments interact in everyday hypertension management (11–14). Community-based strategies involving primary care, community health volunteers, and family caregivers could preserve familiar foods while gradually reducing sodium-rich condiments and increasing healthier preparation and produce availability.

CONCLUSION

This study demonstrated that dietary behaviors among older adults with uncontrolled hypertension in rural Southern Thailand were strongly influenced by traditional food culture, habitual seasoning practices, local food access, and family food environments. Participants commonly consumed highly seasoned and high-sodium foods and described inconsistent fruit and vegetable consumption. Family members, particularly spouses and adult children, played important roles in food preparation and dietary decision-making.

These findings highlight the importance of culturally tailored nutrition education, family-centered dietary interventions, and community-based sodium-reduction programs. Incorporating local food practices and actively engaging family caregivers may support more sustainable dietary behavior change. The findings also indicate that community-level hypertension programs should address the household food environment rather than focusing only on individual knowledge.

RECOMMENDATIONS

Culturally appropriate and family-centered nutrition programs should be strengthened to support sodium reduction among older adults with hypertension in Thailand. Primary care services and community health volunteers can involve family food preparers in practical education on reducing fish sauce, shrimp paste, soy sauce, seasoning powders, salted foods, and processed foods while maintaining acceptable local flavors. Community initiatives should also promote affordable access to fruits and vegetables and encourage household or community food growing where feasible. At the local policy level, health-promotion activities for older adults should explicitly include family caregivers and household food environments in hypertension prevention and control. Collaboration among healthcare providers, local administrative organizations, community health volunteers, family caregivers, and older adults may improve the feasibility and sustainability of dietary change in rural communities. At the policy level, sodium-reduction strategies should be integrated into Thailand's community-based NCD prevention programs, with local administrative organizations and primary care services supporting family-centered nutrition education and healthier local food environments.

ETHICAL DECLARATION

The study was approved by the Human Research Ethics Committee of Thaksin University (COA No. TSU 2024_018, REC No. 0013).

LIMITATIONS

Several limitations should be considered when interpreting the findings. First, the study was conducted in a single rural district in Southern Thailand, which may limit the transferability of the findings to other settings. Second, the findings were based primarily on self-reported dietary practices and experiences, which may be subject to recall bias and social desirability bias. Third, as a qualitative study, the findings provide in-depth contextual understanding

but do not allow causal inference regarding dietary behaviors and blood pressure outcomes. Future studies should include diverse community settings and mixed-method approaches to further explore factors influencing dietary behaviors among older adults with hypertension.

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FACTORS ASSOCIATED WITH DIETARY DIVERSITY AMONG PREGNANT MYANMAR MIGRANT WOMEN IN MAE SOT, THAILAND

Kyaw Zin Htut[1], Seema Vijay Medhe[1]*, Orapin Laosee[1], Cheerawit Rattanapan[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand
***Corresponding author:** Seema Vijay Medhe, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom 73170, Thailand, Email: seema.med@mahidol.ac.th*

ABSTRACT

Introduction: Adequate dietary diversity during pregnancy is essential for maternal health and fetal growth. Pregnant migrant women often face barriers related to nutrition information, financial resources, cultural beliefs, and healthcare access, which may influence dietary practices. Despite the large Myanmar migrant population in Thailand, evidence on dietary diversity and its associated factors among pregnant Myanmar migrant women remains limited.

Objectives: (1) To identify the level of dietary diversity among Myanmar migrant pregnant women in Mae Sot, (2) To describe the intrapersonal, interpersonal, community level and institutional level determinants of dietary diversity among Myanmar migrant pregnant women in Mae Sot, and (3) To investigate the factors associated with dietary diversity among Myanmar migrant pregnant women in Mae Sot.

Methodology: A community-based cross-sectional study was conducted among pregnant Myanmar migrant women in Mae Sot, Thailand. The preliminary analysis included 200 participants from a larger study of 405 women, recruited through community-based convenience sampling. Data were collected using a structured interviewer-administered questionnaire. Dietary diversity was assessed using the FAO MDD-W indicator, based on 10 food groups consumed in the previous 24 hours, with ≥5 food groups considered adequate. Descriptive, bivariate, and multivariable binary logistic regression analyses were conducted to identify factors associated with adequate dietary diversity.

Results: Among 200 pregnant Myanmar migrant women, 25.5% had inadequate dietary diversity. Age, education, parity, nutrition perception, household income, ANC attendance, and nutrition counselling were significantly associated with dietary diversity. After adjustment, older age (≥29 years) and higher nutrition perception remained independently associated with adequate dietary diversity. Women aged ≥29 years had approximately 2.7 times the adjusted odds of adequate dietary diversity (AOR = 2.688, 95% CI: 1.304–5.540; p = 0.007), while women with higher nutrition perception had approximately 3.8 times the adjusted odds (AOR = 3.806, 95% CI: 1.681–8.616; p = 0.001). Higher household income showed a positive but borderline association with adequate dietary diversity (AOR = 3.593, 95% CI: 0.984–13.118; p = 0.050).

Conclusion: Approximately one-quarter of pregnant Myanmar migrant women had inadequate dietary diversity. Older maternal age and higher nutrition perception were independently associated with adequate dietary diversity, while household income showed a borderline positive association. The findings emphasize the need to address nutrition awareness, socioeconomic conditions, and migrant-specific barriers in maternal nutrition services. Due to the study design and sampling limitations, the findings indicate associations rather than causal relationships.

Implication of this study: Strengthen culturally appropriate, multilingual, and migrant-responsive nutrition counselling through ANC services, with practical guidance on affordable, locally available nutritious foods. Prioritize younger women and low-income or low-nutrition-perception groups, while using community-based partnerships to improve access and continuity of care. Nutrition interventions should address both nutrition education and economic barriers, These integrated strategies could contribute directly to the achievement of Sustainable Development Goal (SDG) 2 (Zero Hunger) through

improved access to adequate and nutritious diets and SDG 3 (Good Health and Well-being) through improved maternal health and antenatal care.

Keywords:
Dietary Diversity; Pregnancy; Myanmar Migrants; Maternal Nutrition; Thailand

INTRODUCTION

Maternal nutrition during pregnancy plays a fundamental role in promoting maternal health, fetal growth, and favorable pregnancy outcomes (1). Adequate intake of macro- and micronutrients supports placental development, fetal organ formation, and maternal physiological adaptation throughout pregnancy (1, 2). Conversely, inadequate dietary intake is associated with maternal anemia, low birth weight, preterm birth, intrauterine growth restriction, and increased neonatal morbidity (3, 4). Dietary diversity has become an internationally recognized indicator of maternal diet quality because it reflects micronutrient adequacy better than total energy intake alone (5, 6). The Food and Agriculture Organization recommends the Minimum Dietary Diversity for Women (MDD-W), whereby women consuming at least five of ten predefined food groups within the previous 24 hours are considered more likely to meet their micronutrient requirements (6).

Myanmar migrant pregnant women living along the Thailand–Myanmar border may experience financial insecurity, food insecurity, language barriers, unstable employment, limited access to health services, and culturally influenced food practices that can affect dietary choices during pregnancy (7). Previous studies have reported concerns regarding maternal nutrition among migrant women in this region; however, quantitative evidence on dietary diversity and its associated factors remains limited. Understanding these associations can help inform culturally appropriate maternal nutrition services and migrant-friendly antenatal care. Therefore, this study aimed to determine the prevalence of adequate dietary diversity and examine individual, household, obstetric, nutrition-related, and health-service characteristics associated with dietary diversity among pregnant Myanmar migrant women in Mae Sot District, Thailand.

METHODOLOGY

This cross-sectional study examined factors associated with dietary diversity among pregnant Myanmar migrant women aged 18–49 years in Mae Sot District, Thailand.

Study population and analytic sample

The study presents a preliminary analysis of 200 participants from a larger cross-sectional study of 405 pregnant Myanmar migrant women. The 200 participants were an initial analytic subset rather than a separately calculated or probability-based sample. Therefore, potential selection bias cannot be excluded, and the findings should be considered preliminary and not fully representative of all pregnant Myanmar migrant women in Mae Sot.

Study setting and recruitment

Mae Sot was purposively selected due to its large Myanmar migrant population and border location. Participants were recruited through convenience sampling from health and community settings; therefore, findings should be interpreted cautiously and may not be representative of all pregnant Myanmar migrant women in Mae Sot.

Sample-size consideration

The sample size was calculated for the larger parent study using Cochran's formula, requiring approximately 384 participants. The study ultimately recruited 405 women. The present conference paper analyzes the first 200 participants as a preliminary dataset, and this sample was not based on a separate sample-size calculation.

Data collection procedure

Data were collected through a culturally adapted, Myanmar-translated structured questionnaire administered by trained interviewers, covering sociodemographic, obstetric, nutrition, household, community, and health-service factors. The analysis included the first 200 of 405 participants. Dietary diversity was assessed using the FAO MDD-W 24-hour recall, with ≥5 food groups classified as adequate. Data quality was maintained through standardized training, locally adapted food lists, and daily checks. Nutrition perception was measured using a 12-item Health Belief Model-based instrument, categorized by the sample median, with high internal consistency (Cronbach's α = 0.951–0.960).

Statistical analysis

For data analysis, dietary diversity was categorized as adequate or inadequate according to the FAO standard cut-off (6). Age, education, parity, and nutrition perception were dichotomized using the median as the cut-off because the data were not normally distributed. Monthly household income was categorized as low or high based on the average monthly household income reported in the Thailand Statistical Yearbook 2025 (8). ANC attendance and nutrition counselling were categorized into two groups based on evidence from previous literature (9-11). Descriptive statistics and Chi-square tests were used to assess participant characteristics and bivariate associations with dietary diversity. Variables showing potential associations were entered into a multivariable logistic regression model. A full multivariable logistic regression model was initially fitted to estimate adjusted odds ratios (AORs) with 95% confidence intervals (CIs). The model was then reduced using the backward Wald elimination method to obtain the final model. Dietary diversity was categorized as inadequate (<5 food groups) or adequate (≥5 food groups), with predefined reference categories. Statistical significance was set at $p < 0.05$. Given the preliminary sample of 200 participants, multivariable findings were interpreted cautiously, considering both the magnitude and precision of associations.

RESULTS

Among the 200 participants, 74.5% had adequate dietary diversity, while 25.5% had inadequate dietary diversity. Most were aged ≥29 years (58.0%), had higher education (64.5%), and had lower household income (72.5%). About half were multiparous (52.0%) and had attended ≥4 ANC visits (52.0%), while 49.5% had higher nutrition perception and 48.5% received ≥4 nutrition counselling sessions.

Table 1 Descriptive characteristics of pregnant Myanmar migrant women included in the current analysis (N=200)

Variables	Category	n=200	%
Dietary diversity level	Inadequate (<5 food groups)	51	25.5
	Adequate (≥5 food groups)	149	74.5
Age	<29 years	84	42
	≥29 years	116	58
Education	Low	71	35.5
	High	129	64.5

Variables	Category	n=200	%
Parity	P (0)	96	48
	P (1–4)	104	52
Perception of nutrition	Low	101	50.5
	High	99	49.5
Monthly household income (THB)	Low	145	72.5
	High	55	27.5
ANC visits	<4 visits	96	48
	≥4 visits	104	52
Nutrition counselling	<4 times	103	51.5
	≥4 times	97	48.5

n = number of respondents, ANC visit = number of antenatal care visit,
THB = Thai Baht

Education (Median) = Lower education; below secondary education
Higher education; secondary education or above
Perception of nutrition (Median) = low; total score below the median value of the analytic sample; high; total score at or above the median value.
Monthly household income (Thailand = low; below average monthly household income
Statistic National Year Book, 2025) (8) High; at or above average monthly household income (29,000 THB)

Table 2 presents bivariate associations between participant characteristics and dietary diversity among the 200 women included in the preliminary data analysis. Perception of nutrition demonstrated a strong association with dietary diversity (χ^2 = 24.470, p < 0.001). Women with high nutrition perception had a markedly higher prevalence of adequate dietary diversity (89.9%) compared with those with low nutrition perception (59.4%). Monthly household income was also significantly associated with dietary diversity (p < 0.001). Monthly household income was significantly associated with dietary diversity in the bivariate analysis. Adequate dietary diversity was observed among 94.5% of women in the higher-income category compared with 66.9% of women in the lower-income category (p < 0.001).

Attendance at antenatal care (ANC) visits was significantly related to dietary diversity (χ^2 = 22.231, p < 0.001). Women who attended at least four ANC visits were more likely to have adequate dietary diversity (88.5%) than those with fewer than four visits (59.4%). Similarly, exposure to nutrition counselling was significantly associated with dietary diversity (χ^2 = 19.878, p < 0.001). Women who received nutrition counselling four or more times had a higher prevalence of adequate dietary diversity (88.7%) compared with those who received counselling fewer than four times (61.2%).

Bivariate analysis showed that age, education, parity, nutrition perception, household income, ANC attendance, and nutrition counselling were significantly associated with dietary diversity (all p < 0.05). Adequate dietary diversity was more common among women with older age, higher education, multiparity, higher nutrition perception and income, and greater ANC and nutrition-counselling exposure. These were unadjusted associations and were further assessed in multivariable analysis.

Table 2 Association between participant characteristics and dietary diversity level among pregnant women (N=200)

Variables	Category	Inadequate n (%)	Adequate n (%)	Total n (%)	χ^2	p-value
Age	<29 years	34 (40.5)	50 (59.5)	84 (42)	17.098	<0.001**
	≥29 years	17 (14.7)	99 (85.3)	116 (58)		
Education	Low	32 (45.1)	39 (54.9)	71 (35.5)	22.192	<0.001**
	High	19 (14.7)	110 (85.3)	129 (64.5)		
Parity	P (0)	32 (33.3)	64 (66.7)	96 (48)	5.963	0.016*
	P (1–4)	19 (18.3)	85 (81.7)	104 (52)		
Perception of nutrition	Low	41 (40.6)	60 (59.4)	101 (50.5)	24.470	<0.001**
	High	10 (10.1)	89 (89.9)	99 (49.5)		
Monthly Household Income (THB)	Low	48 (33.1)	97 (66.9)	145 (72.5)	16.046	<0.001**
	High	3 (5.5)	52 (94.5)	55 (27.5)		
ANC	< 4 Visits	39 (40.6)	57 (59.4)	96 (48)	22.231	<0.001**
	≥ 4 Visits	12 (11.5)	92 (88.5)	104 (52)		
Nutrition Counselling Exposure	< 4 Times	40 (38.8)	63 (61.2)	103 (51.5)	19.878	<0.001**
	≥ 4 Times	11 (11.3)	86 (88.7)	97 (48.5)		

χ^2 = Chi-square test
$p < 0.05$ = *, $p < 0.001$ = **, ANC = Antenatal care, THB = Thai Baht

All participants consumed grains, roots, and tubers (100%), making them the most universally consumed food group. High consumption was also observed for other vegetables (90.5%), dark green leafy vegetables (88.5%), eggs (86.5%), meat, poultry, and fish (81.0%), and vitamin A-rich fruits and vegetables (77.0%). In contrast, pulses (42.0%) and nuts and seeds (36.5%) were the least consumed food groups. Overall, staple foods, vegetables, and animal-source foods were commonly consumed, whereas the intake of pulses and nuts and seeds remained relatively low.

Table 3 Responses to Dietary Diversity Items (N=200)

Variables	Category	Frequency	Percentage
Grains, roots, tubers	No	0	0
	Yes	200	100
Pulses	No	116	58
	Yes	84	42
Nuts and seeds	No	127	63.5
	Yes	73	36.5
Dairy products	No	70	35
	Yes	130	65
Meat, poultry, fish	No	38	19
	Yes	162	81

Variables	Category	Frequency	Percentage
Eggs	No	27	13.5
	Yes	173	86.5
Dark green leafy vegetables	No	23	11.5
	Yes	177	88.5
Vitamin A–rich fruits and vegetables	No	46	23
	Yes	154	77
Other vegetables	No	19	9.5
	Yes	181	90.5
Other fruits	No	69	34.5
	Yes	131	65.5

Table 4 presents the final multivariable logistic regression model for adequate dietary diversity. After adjustment for the other variables retained in the model, women aged ≥29 years had higher odds of achieving adequate dietary diversity compared with women aged <29 years (AOR = 2.688, 95% CI: 1.304–5.540; p = 0.007). Women with higher nutrition perception also had higher adjusted odds of adequate dietary diversity than women with lower nutrition perception (AOR = 3.806, 95% CI: 1.681–8.616; p = 0.001). Higher household income showed a positive but borderline association with adequate dietary diversity (AOR = 3.593, 95% CI: 0.984–13.118; p = 0.050).

Table 4 Multivariable logistic regression analysis of factors associated with adequate dietary diversity among pregnant Myanmar migrant women (N=200)

Variables	Adequate Dietary Diversity			
	Full model		Final model	
	p-value	aOR (95%CI)	p-value	aOR (95%CI)
Age				
<29 years		(Ref)		
≥29 years	0.076	2.049 (0.928-4.521)	0.007*	2.688 (1.304-5.540)
Education				
Low		(Ref)		
High	0.591	1.612 (0.283-9.194)		—
Parity				
P (0)		(Ref)		
P (1–4)	0.095	1.968 (0.890-4.351)		—
Perception of nutrition				
Low		(Ref)		
High	<0.001*	4.135 (1.776-9.628)	0.001*	3.806 (1.681-8.616)

Variables	Adequate Dietary Diversity			
	Full model		Final model	
	p-value	aOR (95%CI)	p-value	aOR (95%CI)
Monthly household income				
Low		(Ref)		
High	0.055	3.588 (0.974-13.217)	0.05*	3.593 (0.984-13.118)

— = variable not retained in the final model.

DISCUSSION

The study found that approximately one-quarter (25.5%) of Myanmar migrant pregnant women had inadequate dietary diversity, indicating that one in four women consumed fewer than five of the recommended food groups and may therefore have been at increased risk of inadequate micronutrient intake during pregnancy. This finding is particularly important in the context of migrant health, where dietary practices are shaped not only by individual knowledge and preferences but also by socioeconomic insecurity, mobility, access to health services, and the availability and affordability of nutritious foods. Myanmar migrant women living along the Thailand–Myanmar border may experience additional vulnerabilities related to unstable employment, limited household resources, language and cultural barriers, and difficulties accessing formal health and social protection systems. These structural conditions may influence their ability to obtain a sufficiently diverse diet during pregnancy.

The findings are consistent with previous studies showing that maternal age, nutrition-related knowledge or perception, and household economic status are associated with dietary diversity. A study conducted in Nepal reported that women from wealthier households were more likely to achieve adequate dietary diversity (aOR = 5.1, 95% CI = 2.7–9.3), while women with adequate nutrition knowledge also had higher odds of achieving dietary diversity (aOR = 1.9, 95% CI = 1.1–3.4) (9). Similarly, a cross-sectional study in Southwest Ethiopia found that women aged 25–34 years were significantly associated with minimal dietary diversity (aOR = 3.624, 95% CI = 1.315–10.269) (10). Furthermore, a study in Central South Africa demonstrated a significant association between monthly household income and adequate maternal nutrition during pregnancy ($p < 0.01$); compared with women earning more than USD 359 per month, those earning USD 7–72 (aOR = 0.18, 95% CI = 0.08–0.41, $p < 0.001$), USD 72–216 (aOR = 0.50, 95% CI = 0.32–0.79, $p = 0.003$), and USD 216–359 (aOR = 0.51, 95% CI = 0.32–0.80, $p = 0.003$) were less likely to achieve adequate maternal dietary intake (11).

The findings underscore the importance of addressing both individual and structural determinants of maternal nutrition among Myanmar migrant women. Mobility across borders, changes in residence or employment, and language and administrative barriers may disrupt continuity of antenatal care and nutrition counselling. Therefore, strengthening culturally and linguistically appropriate, accessible, and continuous antenatal nutrition services is essential. Interventions should prioritize vulnerable groups, including younger women and those with lower education, household income, or antenatal care attendance, while addressing food insecurity and economic barriers alongside nutrition education. Community-based and cross-border collaboration among migrant health organizations, community leaders, and health facilities may further improve continuity of nutrition support and dietary diversity among mobile and underserved pregnant women. These actions are consistent with global priorities for improving maternal nutrition, reducing health inequities, and ensuring universal access to

essential health services, and contribute directly to the achievement of Sustainable Development Goal (SDG) 2 (Zero Hunger) through improved access to adequate and nutritious diets and SDG 3 (Good Health and Well-being) through improved maternal health and antenatal care.

CONCLUSION

Approximately one-quarter of pregnant Myanmar migrant women had inadequate dietary diversity. Older maternal age and higher nutrition perception were independently associated with adequate dietary diversity, while household income showed a borderline positive association. The findings emphasize the need to address nutrition awareness, socioeconomic conditions, and migrant-specific barriers in maternal nutrition services. Due to the study design and sampling limitations, the findings indicate associations rather than causal relationships.

RECOMMENDATIONS

Recommendations emphasize improving dietary diversity and health equity by prioritizing younger women and socioeconomically vulnerable groups, while strengthening affordable, culturally appropriate nutrition guidance and continuous antenatal nutrition services through health facilities and migrant organizations.

At the community and policy levels, collaboration among Thai health authorities, migrant health organizations, community leaders, and cross-border partners should be strengthened to improve access to maternal nutrition information and reduce socioeconomic and health-system barriers to nutritious food and antenatal care.

The findings emphasize migrant health and health equity by addressing barriers such as mobility, unstable employment, language, administrative constraints, and limited healthcare access. Culturally appropriate nutrition services, community education, and stronger community–health facility links are recommended to support SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being).

ETHICAL DECLARATION

Ethical approval was obtained from MUCIRB on 12th June 2026 (COA No. MU-CIRB 2026/273.1206), and written informed consent in Myanmar language was obtained from all participants prior to data collection.

LIMITATIONS

The study has several limitations: cross-sectional design prevents causal interpretation, while a single 24-hour dietary recall and self-reported data may be affected by recall, social-desirability, and day-to-day variation. Convenience sampling may have excluded more mobile or less healthcare-connected women, limiting generalizability. The analysis of only 200 of 405 participants may reduce precision and introduce selection bias. Dichotomizing variables may also reduce information, and failure to adjust for gestational age may have caused residual confounding. Future analyses should use the full sample and more comprehensive confounder adjustment.

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FACTORS ASSOCIATED WITH HYPERTENSION HEALTH LITERACY AMONG EARLY-ADULT MYANMAR MIGRANT WORKERS IN TAK PROVINCE, THAILAND: PRELIMINARY FINDINGS

Htin Kyaw Soe[1*], Htet Zaw Shein[1], Wandee Sirichokchatchawan[1]

[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.

*[*] **Corresponding Author**:Htin Kyaw Soe, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: htinkyawsoee@gmail.com, 6874011553@student.chula.ac.th*

Abstract

Introduction: Migrant workers often face language barriers, insecure employment, limited familiarity with healthcare systems, and restricted access to regular healthcare, which can affect their access to hypertension information and preventive care. Hypertension health literacy—the ability to access, understand, appraise, and apply hypertension-related information—may support informed health decisions among migrant populations, yet evidence among early-adult Myanmar migrant workers in Thailand remains limited.

Objective: This study aimed to examine factors associated with hypertension health literacy among early-adult Myanmar migrant workers in Mae Sot District, Tak Province, Thailand.

Methodology: A cross-sectional study was conducted among Myanmar migrant workers aged 18–45 years who had resided in Mae Sot District for at least six months, between 21 May and 7 June 2026. This preliminary analysis included 191 of a planned 340 participants. Data were collected through face-to-face interviews using a structured, translated Burmese-language questionnaire. Hypertension health literacy was assessed with a validated 24-item instrument (score range 0–50; ≤33 = limited, >33 = adequate). Predisposing, enabling, need-related, and behavioral factors were examined using chi-square/Fisher's exact tests and univariable binary logistic regression, with significance set at $p<0.05$.

Results: Of 191 participants, 143 (74.9%) had adequate hypertension health literacy (mean score 35.41±5.79). Health literacy was significantly associated with age group, health insurance, comorbidity, family history of hypertension, self-rated health, alcohol and tobacco use, and reported fat, sugar, and sodium consumption (all $p<0.05$).Participants with health insurance (COR=3.47, 95%CI 1.73–6.94), without comorbidity (COR=9.20), without family history of hypertension (COR=4.22), reporting good/very good self-rated health (COR=4.92), non-drinkers (COR=2.05), and non-smokers (COR=2.36) had higher crude odds of adequate health literacy; lower reported fat, sugar, and sodium consumption was also associated with higher crude odds.

Conclusion: In this preliminary sample, approximately three-quarters of early-adult Myanmar migrant workers had adequate hypertension health literacy. Healthcare access, health status, and behavioral characteristics were associated with health literacy in unadjusted analyses, but causal or independent effects cannot be inferred. Completion of recruitment and adjusted multivariable analyses are needed to confirm these preliminary findings and to inform culturally and linguistically appropriate hypertension education for migrant workers.

Keywords:

Hypertension; Health Literacy; Myanmar Migrant Workers; Cross-Sectional Study; Thailand

INTRODUCTION

Migrant workers may encounter circumstances that affect their access to hypertension information and preventive healthcare, including language barriers, insecure employment, limited familiarity with the healthcare system, financial constraints, and restricted access to regular healthcare services (1). These circumstances may be particularly important for Myanmar migrants living in border areas such as Mae Sot, where migrant populations are diverse in migration status,

socioeconomic conditions, healthcare coverage, and duration of residence in Thailand(10). Hypertension health literacy—the ability to access, understand, appraise, and apply information related to hypertension prevention and management—may therefore play an important role in supporting informed health decisions among migrant workers(6).

The variables examined in this study were organized into predisposing, enabling, need-related, and behavioral factors (2). Predisposing factors included demographic and migration-related characteristics that may influence an individual's previous exposure to health information. Enabling factors included socioeconomic resources, migration documentation, health insurance, and access to healthcare services. Need-related factors included self-reported health status, comorbidity, and family history of hypertension, which may affect perceived need for hypertension information. Tobacco use, alcohol consumption, and dietary practices were examined as behavioral factors that may be associated with health knowledge and engagement with preventive health information. These variables were selected to examine a broad range of circumstances potentially associated with hypertension health literacy; however, the cross-sectional design does not establish that they cause differences in health literacy.

Previous studies have examined hypertension prevalence, cardiovascular risk, and general health literacy among Myanmar migrants and other adult populations (3,4). However, evidence on hypertension-specific health literacy among early-adult Myanmar migrant workers remains limited, particularly in Tak Province. In addition, few studies have simultaneously examined demographic, migration-related, healthcare-access, health-status, and behavioral factors in relation to hypertension health literacy in this population (1). Understanding these associations may provide preliminary evidence for designing future culturally and linguistically appropriate health education and migrant health research. It may also help identify groups and contextual factors that warrant further investigation using adequately powered multivariable and longitudinal studies.

Therefore, this study aimed to examine factors associated with hypertension health literacy among early-adult Myanmar migrant workers in Mae Sot District, Tak Province, Thailand. The analysis focused on associations between hypertension health literacy and selected predisposing, enabling, need-related, and behavioral characteristics.

METHODOLOGY

Study design and preliminary sample

A cross-sectional study was conducted among Myanmar migrant workers in Mae Sot District, Tak Province, Thailand, between 21 May and 7 June 2026. Eligible participants were Myanmar migrant workers aged 18–45 years who had resided in Mae Sot District for at least six months. The target sample size was 340 participants, calculated using Cochran's formula based on a previous study. At the time of conference abstract submission, 191 participants had completed the questionnaire and were included in this preliminary analysis. The findings should therefore be interpreted as preliminary and may differ from those obtained after completion of the planned recruitment.

Participant recruitment and data collection

Participants were recruited from residential areas, worker accommodations, and community religious settings in Mae Sot District. Data were collected through face-to-face interviews conducted by trained research assistants using a structured Burmese-language questionnaire. Interviews were conducted in a private setting whenever feasible to protect participant privacy and confidentiality. Blood pressure and anthropometric measurements were not included in the analysis reported in this proceeding.

Overview of variables

Hypertension health literacy was the outcome variable. The independent variables included predisposing factors—age, sex, education, marital status, ethnicity, and duration of residence in Thailand; enabling factors—monthly income, health insurance, and regular source of healthcare; need-related factors—self-reported comorbidity, family history of hypertension, and self-rated health; and behavioral factors—tobacco use, alcohol consumption, and reported fat, sugar, and sodium consumption.

Hypertension health literacy instrument

Hypertension health literacy was assessed using a 24-item hypertension-specific health literacy questionnaire previously developed and validated among adults in Myanmar and subsequently applied among Myanmar migrant populations. The instrument was developed from the Health Literacy Survey–European Union framework and assesses participants perceived ability to access, understand, appraise, and apply hypertension-related health information (5, 6). The total score ranges from 0 to 50. In accordance with the scoring criteria of the original instrument, scores of 33 or lower were classified as limited hypertension health literacy, whereas scores greater than 33 were classified as adequate hypertension health literacy. Each item was rated on a 4-point Likert scale, and the mean score was transformed to a 0-50 scale using the formula HHL-24 score = (Mean score - 1) x (50/3).

Language and cultural adaptation

The questionnaire was administered in Burmese. The study instruments underwent forward–backward translation by a translator who is currently working in public health profession. Differences between the original and back-translated versions were reviewed and resolved by two Myanmar public health experts. Technical hypertension-related terms were reviewed for comprehensibility and cultural appropriateness for Myanmar migrant workers. The translated questionnaire was pilot tested among 37 Myanmar migrants with characteristics similar to the study population. The hypertension health literacy scale demonstrated a Cronbach's alpha coefficient of 0.7.

Dietary measurement

Dietary practices were assessed using a five-item structured questionnaire adapted from the Diabetes, Thyroid, and Endocrine Clinic, Siriraj Piyamaharajkarun Hospital. The items assessed the reported frequency of Sugar, Fat, and sodium consumption. Responses were recorded using a three-category frequency scale: 1 = every day or almost every day, 2 = three to four times per week, and 3 = rarely or never. Sugar consumption was derived from 5 items, Fat consumption from 5 items, and sodium consumption from 5 items, respectively. Each consumption is classified as a total score of 5 is low consumption, 6 to 9 is moderate consumption, and 10 to 15 is high consumption. These categories reflected reported consumption frequency rather than objectively measured nutrient intake. The current response does not explain how one five-item questionnaire generated three separate dietary variables or how categories were defined.

Family history of hypertension

Family history of hypertension was assessed by asking: "Has any of your first-degree relatives, including your father, mother, or siblings, ever been diagnosed with high blood pressure or hypertension by a physician or health professional?" Responses were recorded as yes or no.

Participants' hypertension status

Participants' current blood pressure and personal history of diagnosed hypertension were not assessed as part of the analysis reported in this proceeding.

Comorbidity

Comorbidity was assessed by asking participants whether they had previously been

diagnosed by a healthcare professional with any of the following chronic conditions: Diabetes Mellitus, Cardiovascular diseases, kidney diseases, respiratory diseases, Dyslipidemia, other (specify). Participants reporting at least one condition were categorized as having a comorbidity, while those reporting none were categorized as not having a comorbidity. Comorbidity status was self-reported and was not verified using medical records.

Regular source of healthcare

A regular source of healthcare was assessed by asking participants whether they had a particular clinic, hospital, healthcare facility, physician, or healthcare provider that they usually consulted when they needed health advice or treatment. Responses were categorized as yes or no.

Other behavioral variables

Tobacco use was categorized as current smoker (within the last 30 days) or former smoker versus non-smoker. Alcohol consumption was categorized as drinker versus non-drinker (never drank alcohol).

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0. Frequencies and percentages were used to summarize categorical variables. Means and standard deviations were reported only for variables originally measured on a continuous scale when these statistics were considered informative. Pearson's chi-square test, or Fisher's exact test where expected cell counts were small, was used to examine associations between categorical independent variables and hypertension health literacy. Univariable binary logistic regression was used to estimate crude odds ratios and 95% confidence intervals for selected associations. In the logistic regression analysis, adequate hypertension health literacy was coded as 1 and limited hypertension health literacy as 0. All reported odds ratios were unadjusted; therefore, the findings do not represent independent effects or adjusted determinants. Statistical significance was defined as $p < 0.05$. Multivariable regression was not performed in this preliminary proceeding. Consequently, potential confounding and interrelationships among the independent variables were not controlled.

RESULTS

A total of 191 Myanmar migrant workers were included in this preliminary analysis. Most participants were female, had completed high school or higher education, had migration documentation, and had health insurance. Approximately three-quarters of participants were classified as having adequate hypertension health literacy. Because recruitment had not reached the planned sample size, all estimates should be interpreted as preliminary

Hypertension Health Literacy

Among the 191 participants, 143 participants (74.9%) were classified as having adequate hypertension health literacy, while 48 participants (25.1%) had limited hypertension health literacy. The mean hypertension health literacy score was 35.41 ± 5.79, with observed scores ranging from 16.66 to 50.00. Although the mean score is reported to describe the underlying continuous measure, the association analyses used the dichotomized health literacy outcome.

Table 1 General Characteristics of study participants, 2026 (n = 191)

Characteristics	Frequency (Percentage)
Sociodemographic Characteristics	
Age Group	
20 years and below	13 (6.8)
21-30	77 (40.3)

Characteristics	Frequency (Percentage)
31-40	61 (31.9)
41 years and above	40 (20.9)
Gender	
Male	53 (27.7)
Female	138 (72.3)
Education Level	
Primary School	8 (4.2)
Middle School	46 (24.1)
High School	77 (40.3)
College/University	60 (31.4)
Marital Status	
Single	92 (48.2)
Married	97 (50.8)
Widowed	2 (1.0)
Ethnicity	
Burmese	122(63.9)
Karen	46 (24.1)
Kachin	8 (4.1)
Other	15 (7.9)
Duration of Stay in Thailand	
Below median (<24 months)	70(36.6)
At or above median (≥ 24 months)	121(63.4)
Monthly Income Level	
< 6000 Baht	66 (34.6)
≥ 6000 Baht	125 (65.4)
Health Insurance	
Yes	138 (72.3)
No	53 (27.7)
Other Comorbidity	
No	174 (91.1)
Yes	17 (8.9)
Regular Healthcare Source	
Yes	107(56)
No	84(44)
Family History of Hypertension	
Yes	67(35.1)
No	124(64.9)
Self-Rated Health Status	
Very Good	9 (4.7)
Good	76 (39.8)
Fair	101 (52.9)
Poor	5 (2.6)
Tobacco Use	
Current and Former Smoker	27(14.1)
Non-Smoker	164(85.9)
Alcohol	
Drinker	57(29.8)
Nondrinker	134(70.2)
Fat Consumption	
Low	79(41.4)
Moderate	90(47.1)

Characteristics	Frequency (Percentage)
High	22(11.5)
Sugar Consumption	
Low	26(13.6)
Moderate	140(73.3)
High	(25(13.1)
Sodium Consumption	
Low	8(4.2)
Moderate	136(71.2)
High	47(24.6)
Hypertension Health Literacy	
Limited health literacy	48 (25.1)
Adequate health literacy	143(74.9)
Mean SD	35.41 +- 5.79
Min - Max	16.66 - 50

Table 2 Bivariate Analysis of the Determinants of Hypertension Health Literacy Among Myanmar Migrant Workers in Early Adulthood in Tak Province, Thailand, 2026 (n = 191)

	Hypertension Health Literacy		Pearson Chi-square		Binary Logistic Regression		
Characteristics	**limited**	**Adequate**	X^2	***p*-value**	**COR[a]**	**(95% CI[b]) LL-UL**	***p*-value**
Age Group							
20 years and below	3(23.1)	10(76.9)	17.443	<.001**	Ref		
21-30 years	16(20.8)	61(79.2)			1.144	.281 – 4.651	0.851
31-40 years	9(14.8)	52(85.2)			1.733	.398 – 7.500	0.464
41 years and above	20(50)	20(50)			.300	.072 – 1.255	0.099
Gender							
Male	17(32.1)	36(67.9)	1.88	.170			
Female	31(22.5)	107(77.5)					
Education							
Higher education	10(16.7)	50(83.3)	3.331	.068			
Lower education	38(29)	93(71)					
Marital Status							
Married	25(25.8)	72(74.2)	.043	.835			
Other	23(24.5)	71(75.5)					
Ethnicity							
Burmese	25 (20.5)	97 (79.5)	3.863	0.073			
Other	23 (33.3)	46 (66.7)					
Monthly Income Level							
6,000 Baht and above	26(20.8)	99(79.2)	3.606	0.058			
Below 6,000 Baht	22(33.3)	44(66.7)					
Duration of Stay in Thailand							
24 months and above	14(20)	56(80)	1.546	.214			
Less than 24 months	34(28.1)	87(71.9)					
Health Insurance							
No	23(43.4)	30(56.6)	13.007	<.001**	Ref		
Yes	25(18.1)	113(81.9)			3.465	1.730-6.942	<.001**

Characteristics	Hypertension Health Literacy		Pearson Chi-square		Binary Logistic Regression		
	limited	Adequate	X^2	*p*-value	COR[a]	(95% CI[b]) LL-UL	*p*-value
HealthCare Source							
Yes	27(25.2)	80(74.8)	.001	.971			
No	21(25)	63(75)					
Comorbidity							
Yes	12(70.6)	5(29.4)	20.494	<.001**	Ref		
No	36(20.7)	138(79.3)			9.200	3.044 – 27.801	<.001**
Family History of Hypertension							
Yes	29(43.3)	38(56.7)	18.074	<.001**	Ref		
No	19(15.3)	105(84.7)			4.217	2.121 – 8.385	<.001**
Self-Rated Health Status							
Poor – fair	39(36.8)	67(63.2)	17.216	<.001**	Ref		
Good – Very Good	9(10.6)	76(89.4)			4.915	2.218 – 10.893	<.001**
Alcohol Consumption							
Drinker	20(35.1)	37(64.9)	4.281	.039*	Ref		
Non-Drinker	28(20.9)	106(79.1)			2.046	1.031 – 4.060	.041*
Tobacco Consumption							
Current & Former Smoker	11(40.7)	16(59.3)	4.072	.044*	Ref		
Non-Smoker	37(22.6)	127(77.4)			2.360	1.008 – 5.524	.048*
Fat Consumption							
High	15(68.2)	7(31.8)	40.985	<.001**	Ref		
Moderate	29(32.2)	61(67.8)			4.507	1.658 – 12.254	.003*
Low	4(5.1)	75(94.9)			40.179	10.439 – 154.639	<.001**
Sugar Consumption							
High	17(68)	8(32)	28.413	<.001**	Ref		
Moderate	25(17.9)	115(82.1)			9.775	3.799 – 25.152	<.001**
Low	6(23.1)	20(76.9)			7.081	2.049 – 24.486	.002*
Sodium Consumption							
High	29(61.7)	18(38.3)	44.314	<.001**	Ref		
Low & Moderate	19(13.2)	125(86.8)			10.599	4.953 – 22.682	<.001**

[a] Crude Odds Ratio; [b] Confidence Interval; * Significant at $p < 0.05$; ** Significant at $p < 0.01$

Bivariate associations

In the bivariate analyses, hypertension health literacy was statistically associated with age group, health insurance, comorbidity, family history of hypertension, self-rated health, alcohol consumption, tobacco use, and reported fat, sugar, and sodium consumption. No statistically significant associations were observed for sex, education, marital status, ethnicity, monthly income, duration of residence, or regular source of healthcare.

Univariable logistic regression findings

Univariable logistic regression showed that participants with health insurance had higher crude odds of adequate hypertension health literacy than those without insurance. Higher crude odds were also observed among participants without self-reported comorbidity, without a family history of hypertension, with good or very good self-rated health, and among non-drinkers and non-smokers. Reported lower or moderate consumption of fat, sugar, and sodium was also associated with higher crude odds of adequate hypertension health literacy compared with the respective high-consumption categories. Dietary associations produced large crude odds ratios with wide confidence intervals, particularly for the low-fat category. These estimates should be interpreted cautiously because some categories contained relatively small numbers of participants, and the models did not adjust for potential confounding. These estimates were unadjusted, and some had wide confidence intervals, indicating considerable statistical imprecision.

DISCUSSION

In this preliminary sample, approximately three-quarters of early-adult Myanmar migrant workers were classified as having adequate hypertension health literacy. Health insurance, self-reported health status, comorbidity, family history of hypertension, alcohol and tobacco use, and reported dietary practices were associated with hypertension health literacy in unadjusted analyses. Because the estimates were based on crude associations, they should not be interpreted as independent determinants or causal effects.

Comparison with previous prevalence

The proportion of participants with adequate hypertension health literacy was higher than that reported in a previous study of Myanmar migrant workers in Thailand (1). Differences between the studies may reflect variation in participant age, education, location, recruitment procedures, healthcare exposure, or application of the scoring criteria. However, these explanations remain speculative because the present study did not formally test the reasons for differences between populations.

Health Insurance

Participants with health insurance had higher crude odds of adequate hypertension health literacy than those without insurance. Insurance coverage may be associated with more frequent contact with healthcare services, greater exposure to health information, or better familiarity with the healthcare system (7). However, reverse directionality is also possible: individuals with greater health literacy may be more capable of understanding insurance benefits or navigating enrollment procedures. Because the association was unadjusted, differences in education, income, migration status, or healthcare use may also partly explain the finding.

Comorbidity

Participants without self-reported comorbidity had higher crude odds of adequate hypertension health literacy than those reporting at least one comorbid condition. One possible explanation is that people living with multiple chronic conditions may face more complex health information and healthcare-management demands (7). Nevertheless, individuals with chronic diseases may also have greater contact with healthcare providers and potentially greater exposure to health information. The observed association should therefore be interpreted

cautiously, particularly because comorbidity was self-reported, the number of participants with comorbidity was small, and the analysis did not control for age or other potential confounders.

Family history of hypertension

Participants without a family history of hypertension had higher crude odds of adequate hypertension health literacy than participants reporting an affected first-degree relative. This finding may appear counterintuitive because family exposure to hypertension could increase awareness and knowledge (6). Possible explanations include differences in the quality of information available within families, limited communication about chronic disease, socioeconomic disadvantage shared among family members, or measurement error in self-reported family history. The cross-sectional analysis cannot determine why the association occurred(15).

Self-rated health

Participants reporting good or very good health had higher crude odds of adequate hypertension health literacy than those reporting poor or fair health. Better self-rated health may be associated with greater access to health resources, healthier behaviors, or more confidence in navigating health information(11). Conversely, individuals with greater health literacy may be more likely to engage in health-promoting behaviors and report better health. The temporal direction of the association cannot be determined from the cross-sectional design(12).

Tobacco and alcohol

Non-smokers and non-drinkers had higher crude odds of adequate hypertension health literacy than smokers and drinkers. Previous research has reported associations between health literacy and health-related behaviors, but the direction and mechanisms of these relationships are not necessarily causal (8). Greater health literacy may support informed behavioral decisions, while healthier individuals may also have greater access to education, social support, or healthcare information. Residual confounding by education, income, occupation, or other characteristics remains possible.

Dietary practices

Participants reporting lower fat, sugar, and sodium consumption had higher crude odds of adequate hypertension health literacy. However, previous evidence on relationships between health literacy and dietary behavior has been inconsistent, particularly for fat and sodium intake (9, 13, 14). The present dietary variables were based on self-reported consumption frequency rather than quantitative nutrient assessment, and some categories contained small numbers of participants. The large odds ratios and wide confidence intervals may therefore reflect sparse data, category construction, unmeasured confounding, or imprecision. These findings should be considered exploratory and require confirmation using validated dietary assessment methods and adjusted analyses.

Overall interpretation

Overall, the findings indicate that hypertension health literacy was associated with healthcare access, health status, and behavioral characteristics in this preliminary sample. The results do not establish that these factors independently determine health literacy. The observed relationships may be bidirectional or may reflect underlying differences in education, socioeconomic position, migration circumstances, access to information, or healthcare engagement.

Public health implications

The findings may help identify topics and population groups for further assessment when developing migrant health education programs. Future formative research could explore how Myanmar migrant workers obtain hypertension information, understand technical terms, navigate insurance and healthcare services, and apply dietary recommendations. Any educational intervention should be developed collaboratively

with migrant communities and evaluated for comprehensibility, cultural relevance, feasibility, and effectiveness. The present study does not demonstrate that providing insurance or changing health behaviors will directly improve hypertension health literacy.

This study provides preliminary evidence on hypertension-specific health literacy among early-adult Myanmar migrant workers in Mae Sot District, a population and setting that remain relatively underrepresented in the literature. It examined healthcare access, health status, migration-related, and behavioral characteristics within the same study and used a hypertension-specific health literacy instrument previously developed for a Myanmar population. Face-to-face administration in Burmese may also have enabled participation by individuals who might have difficulty completing a Thai- or English-language questionnaire independently.

CONCLUSION

In this preliminary sample of early-adult Myanmar migrant workers in Mae Sot District, approximately three-quarters of participants were classified as having adequate hypertension health literacy. Health insurance, self-reported comorbidity, family history of hypertension, self-rated health, tobacco and alcohol use, and reported dietary practices were associated with hypertension health literacy in unadjusted analyses. These findings identify factors that warrant further investigation but do not establish independent determinants or causal relationships. Completion of the planned recruitment and appropriately specified multivariable analyses are needed to determine whether the observed associations remain after accounting for potential confounding.

RECOMMENDATION

Future migrant health programs may consider providing hypertension information in accessible Burmese language and through trusted community, workplace, and healthcare channels. Program development should be informed by further assessment of migrants' information needs, healthcare access, cultural context, and understanding of hypertension-related terminology. Interventions should be evaluated before conclusions are drawn regarding their effects on hypertension health literacy, preventive behaviors, or health outcomes.

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Research Ethics Review Committee for Research Involving Human Participants, Group 1, Chulalongkorn University, COA No. 184/69.

LIMITATIONS

Several limitations should be considered. First, the cross-sectional design cannot establish temporal order or causal relationships. Second, this proceeding reports a preliminary analysis of 191 participants before the planned sample size was reached; therefore, the final results may change after recruitment is completed. Third, only unadjusted associations and crude odds ratios were reported, so potential confounding by age, education, income, occupation, migration circumstances, and healthcare access was not controlled. Fourth, participants were recruited from selected community settings in Mae Sot District, limiting generalizability to all Myanmar migrant workers in Tak Province or elsewhere in Thailand. Fifth, hypertension health literacy, comorbidity, family history, tobacco use, alcohol use, and dietary practices were self-reported and may be subject to recall error, social desirability bias, or misunderstanding. Sixth, dietary categories were based on reported consumption frequency rather than objective nutrient assessment. Seventh, blood pressure and hypertension status were not assessed, preventing comparison between participants with and without hypertension. Finally, small numbers in several categories produced large crude odds ratios and wide confidence intervals that should be interpreted cautiously.

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FACTORS ASSOCIATED WITH SEDENTARY BEHAVIOUR AMONG MYANMAR MIGRANT SEWING WORKERS IN MAE SOT, THAILAND

Khant Kyaw Kyaw Htet[1], Cheerawit Rattanapan[1*], Orapin Laosee[1], Tarinee Buadit[1]
[1]ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhon Pathom, 73710, Thailand
[*]Corresponding Author: *Cheerawit Rattanapan, ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, 73710, Thailand. E- mail:Cheerawit.rat@mahidol.ac.th*

ABSTRACT

Introduction: Sedentary behaviour refers to any waking behaviour performed in a sitting, reclining, or lying posture that requires very little energy expenditure. Prolonged sedentary behaviour is linked to adverse health outcomes, including cardiometabolic diseases and musculoskeletal disorders. Myanmar migrant workers in Thailand's garment industry represent a vulnerable population facing significant occupational health risks. However, evidence regarding sedentary behaviour and its associated factors in this specific workforce remains limited.

Objectives: This study aimed to assess sedentary behaviour and identify its associated factors among Myanmar migrant sewing workers in Mae Sot, Thailand.

Methodology: A cross-sectional analytical study was conducted among a preliminary dataset of 200 Myanmar migrant sewing workers from three garment factories in Mae Sot. Participants were selected using proportionate stratified and simple random sampling. Data were collected via interviewer-administered questionnaires adapted from validated instruments (OSPAQ, WSQ, SBQ, and NMQ). A pretest (n=30) yielded a Cronbach's alpha of 0.78. Descriptive statistics and bivariate analyses (chi-square tests and Likelihood Ratio tests) were performed using SPSS version 31, with statistical significance set at $p < 0.05$.

Results: Among 200 participants (mean age 32.4 ± 8.2 years), the mean daily sitting time was 12.9 ± 2.05 hours. Sedentary behaviour was categorized into low (25%), moderate (52%), and high (23%) levels. Bivariate analyses revealed that levels of sedentary behaviour were significantly associated with socio-demographic factors (age group, gender, and household size), work pressure, residential environmental factors (type of living space, living environments promoting sitting, availability of activity places, and physical activity place utilization), and musculoskeletal disorders affecting the neck and wrists/hands.

Conclusion: Sedentary behaviour was highly prevalent among this vulnerable migrant workforce. Socio-demographic factors, work pressure, restrictive residential environments, and localized musculoskeletal disorders were significantly associated with prolonged sitting. Workplace health promotion programs that incorporate ergonomic interventions and structured movement breaks, alongside community-level initiatives improving access to safe physical activity spaces, are recommended to reduce sedentary time and enhance migrant occupational health.

Keywords:
Occupational Health; Sedentary Behaviour; Migrant Workers; Workplace Safety; Border Health

INTRODUCTION

Sedentary behaviour refers to any waking activity performed while sitting, reclining, or lying down with low energy expenditure (1, 2). Prolonged sedentary behaviour is a growing global public health challenge, strongly associated with cardiovascular disease, type 2 diabetes, musculoskeletal disorders, and premature mortality (3, 4). Notably, these health risks persist even among individuals who achieve recommended physical activity levels (5, 6).

Occupational sedentary behaviour is highly prevalent in the garment industry, a major manufacturing sector in Thailand (7, 8). Sewing workers typically operate machines in fixed sitting positions for extended periods. High

production targets, repetitive tasks, and limited break opportunities further exacerbate their daily sedentary time (9-11).

Thailand is a primary destination for migrant workers from Myanmar, particularly in border areas like Mae Sot District, Tak Province (12, 13). These workers often face significant health inequities, including demanding working conditions, socioeconomic hardships, and limited access to Universal Health Coverage (UHC) (14). Such vulnerabilities not only increase occupational health risks but also highlight the pressing need for targeted interventions to achieve the Sustainable Development Goals (SDGs) related to decent work and health equity.

Despite these recognized risks, evidence regarding sedentary behaviour among migrant factory workers remains scarce (3, 7). Previous studies in the garment sector have primarily focused on ergonomic hazards, leaving a critical knowledge gap regarding the determinants of sedentary behaviour among Myanmar migrant sewing workers (9, 10).

Therefore, this study aimed to assess sedentary behaviour and identify its associated factors among Myanmar migrant sewing workers in Mae Sot, Thailand. The findings are intended to inform workplace policies and health promotion programs to reduce prolonged sitting and improve the occupational health and well-being of vulnerable migrant populations.

METHODOLOGY

Study Design and Study Area

A cross-sectional analytical study was conducted among Myanmar migrant sewing workers in Mae Sot District, Tak Province, Thailand. Data were collected in May 2026 after obtaining MUCIRB approval. Mae Sot is a major border district between Thailand and Myanmar and employs many migrant workers in the garment industry.

Study Population and Sample Size

The study population consisted of Myanmar migrant sewing workers employed in three garment factories in Mae Sot District. Participants were eligible if they were Myanmar migrants, aged 18 years or older, had worked as sewing workers for at least six months, and were able to communicate in the Myanmar (Burmese) language. This language requirement was set because Burmese is the common language used in the factories, ensuring that participants fully understood the questionnaires. Workers who were pregnant or had physical disabilities limiting their daily activities were excluded.

The sample size was calculated using Cochran's formula for estimating a proportion in a cross-sectional study:

$$n_0 = \frac{Z^2 p(1-p)}{d^2}$$

Where:
n_0 = initial sample size
Z = Z value corresponding to the desired confidence level (1.96)
p = Estimated population proportion (0.5, used to maximize sample size)
d = Margin of error (0.05).

After adding a 10% allowance for non-response, the minimum required sample size was 420 participants. For this proceedings paper, data from the first 200 participants were analysed as a preliminary dataset to evaluate the study instruments and analytical approach and to generate initial findings. Recruitment and data collection are ongoing, and the final analysis will be conducted after the target sample size has been achieved.

Sampling Procedure

Three garment factories were purposively selected based on their willingness to participate. Proportionate allocation was used to determine the number of participants from the sewing sections of each factory. Eligible workers were then selected using simple random sampling without replacement. This was conducted by obtaining employee rosters from the factory supervisors to construct a sampling frame, removing ineligible workers, and assigning a sequential identification number to

each remaining worker. Identical folded slips bearing these numbers were placed into an opaque container, shaken, and drawn one at a time until the allocated sample size for each factory was reached.

Data Collection and Study Instruments

Data were collected using a structured interviewer-administered questionnaire developed by adapting items from previously validated instruments (OSPAQ, WSQ, SBQ, and NMQ). The questionnaire also included items on socio-demographic characteristics, work-related factors, environmental factors, knowledge regarding sedentary behaviour, and body mass index (BMI) (15-18). The knowledge section was adapted from previously published occupational health and ergonomic knowledge questionnaires (19, 20). The questionnaire, along with the participant information sheets and consent forms, was translated into the Myanmar language and validated through back-translation. To ensure data quality and standardization, interviews were conducted entirely in the Myanmar language by a team of bilingual research assistants who underwent standardized training on the data collection protocols. The questionnaire was reviewed by three experts to assess content validity, with item-objective congruence (IOC) values ranging from 0.67 to 1.00. Items with an IOC value of 0.67 were revised according to the experts' recommendations. A pretest among 30 Myanmar migrant sewing workers yielded an acceptable internal consistency, with an overall Cronbach's alpha coefficient of 0.78.

Statistical Analysis

Data were entered and analysed using IBM SPSS Statistics version 31. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize participants' characteristics and sedentary behaviour. Total daily sitting time was categorized into low, moderate, and high levels using tertile cut-off points to ensure approximately equal numbers of participants in each category. Associations between sedentary behaviour levels and independent variables were examined using Pearson's Chi-square test. Statistical significance was set at $p < 0.05$.

RESULTS

Socio-demographic Characteristics of Participants

Table 1 presents the socio-demographic characteristics of the 200 Myanmar migrant sewing workers. The study population was predominantly female (97.0%), and the vast majority belonged to the lower-income group (87.5%). Participants were relatively evenly distributed regarding age group, marital status, and household size.

Table 1 Socio-demographic Characteristics of Participants (n = 200)

Characteristic	Frequency (n)	Percentage (%)
Age Group		
Younger Age (≤31 yrs)	102	51.0
Older Age (>32 yrs)	98	49.0
Gender		
Male	6	3.0
Female	194	97.0
Marital Status		
Not currently partnered	103	51.5
Married or partnered	97	48.5

Characteristic	Frequency (n)	Percentage (%)
Household Size		
Smaller Household Size	98	49.0
Larger Household Size	102	51.0
Education Level		
Low education	51	25.5
Middle education	68	34.0
High education	81	40.5
Monthly Household Income		
Lower Income	175	87.5
Higher Income	25	12.5

Sedentary Behaviour and Health-related Characteristics

Table 2 summarizes the participants' sedentary behaviour, knowledge level, body mass index (BMI), and prevalence of musculoskeletal disorders. Over half of the participants exhibited moderate sedentary behaviour (52.0%), while 23.0% showed high sedentary behaviour. The majority possessed a lower level of knowledge regarding the risks of sedentary behaviour (65.5%). Regarding BMI, the largest proportion had a normal weight (38.5%), though nearly a third were classified as obese (32.0%). The most frequently reported musculoskeletal disorders were in the lower back (63.0%) and upper back (57.5%).

Table 2 Sedentary Behaviour, Knowledge Level, and BMI of participants (n = 200)

Characteristic	Frequency (n)	Percentage (%)
Level of Sedentary Behaviour		
Low Sedentary Behaviour	50	25.0
Moderate Sedentary Behaviour	104	52.0
High Sedentary Behaviour	46	23.0
Knowledge Level		
Lower knowledge (≤ 13)	131	65.5
Higher knowledge (> 13)	69	34.5
BMI Category		
Underweight	25	12.5
Normal weight	77	38.5
Overweight	34	17.0
Obese	64	32.0
Musculoskeletal Disorders (Reported "Yes")		
Neck	68	34.0
Shoulder	100	50.0
Upper Back	115	57.5
Lower Back	126	63.0
Elbows	36	18.0
Wrist/Hands	78	39.0
Hips/Thighs	81	40.5
Knees	79	39.5
Ankles/Feet	79	39.5

Work-Related Characteristics

Regarding the daily production targets, the number of daily quotas was not normally distributed, so it is represented by the median and interquartile range (IQR). The median daily production quota was high at 900 pieces per day (IQR = 220). Table 3 presents the remaining categorical work-related characteristics of the participants.

Table 3 Work-Related Characteristics of Participants (n = 200)

Characteristic	Frequency (n)	Percentage (%)
Work Pressure		
Lower work pressure	108	54.0
Higher work pressure	92	46.0
Break Skip		
Never Skips	59	29.5
Skips	141	70.5
Work Experience		
Lower experience (≤ 6 years)	102	51.0
Higher experience (> 6 years)	98	49.0

Environmental Characteristics of Participants (n = 200)

Table 4 displays the environmental characteristics of the participants' residential areas. A significant majority resided in small, rented rooms (79.5%) and reported living in smaller spaces (≤ 10ft x 13ft) (67.0%). Consequently, a large proportion indicated having no or very little space for physical activity at home (72.0%). Despite these restrictive living conditions, 92.5% of participants reported having a place for physical activity within a 10-minute walk, primarily utilizing walking paths or roads (91.5%). However, a substantial portion of the workers (39.5%) remained non-users of these available facilities.

Table 4 Environmental Characteristics of Participants (n = 200)

Characteristic	Frequency (n)	Percentage (%)
Type of living space		
Factory Housing	41	20.5
Small, rented room	159	79.5
Living Space Size		
Smaller living space (≤ 10ft x 13ft)	134	67.0
Larger living space (> 10ft x 13ft)	66	33.0
Space for activity at home		
No or very little space	144	72.0
Some or enough space	56	28.0
After-work activity at home		
Usually, no activity	83	41.5
Usually, some activity	117	58.5
Living space promotes sitting		
Disagree	111	55.5
Agree	89	44.5
Types of available places		
Park or open space	17	8.5
Walking path/road	183	91.5

Characteristic	Frequency (n)	Percentage (%)
Nearest Place for Physical Activity		
Less than a 10-minute walk	185	92.5
More than a 10-minute walk	15	7.5
Physical activity place utilization		
Non-user	79	39.5
User	121	60.5
Lack of exercise facilities promotes sitting		
Disagree	106	53.0
Agree	94	47.0

Factors Associated with Sedentary Behaviour

Table 5 presents the bivariate analysis examining the factors associated with sedentary behaviour levels. Following the reviewers' recommendations, Pearson's Chi-square test (χ^2) was utilized to identify significant associations. For variables that violated the Chi-square assumption (expected cell counts < 5), the Likelihood Ratio test was utilized. Among socio-demographic factors, age group (χ^2 = 7.819, p = 0.020), gender (Likelihood Ratio = 9.922, p = 0.007), and household size (χ^2 = 9.324, p = 0.009) were significantly associated with sedentary behaviour. Work pressure emerged as a significant work-related factor (χ^2 = 9.650, p = 0.008). Significant environmental factors included the type of living space (χ^2 = 8.624, p = 0.013), living spaces that promote sitting (χ^2 = 6.433, p = 0.040), the availability of parks/open spaces or walking paths (Likelihood Ratio = 6.854, p = 0.032), and the utilization of physical activity places (χ^2 = 16.604, p < 0.001). Finally, regarding health-related outcomes, participants reporting musculoskeletal disorders in the neck (χ^2 = 8.786, p = 0.012) and wrist/hands (χ^2 = 13.031, p = 0.001) showed significant associations with their sedentary levels.

Table 5 Factors Associated with Sedentary Behaviour among Myanmar Migrant Sewing Workers (n = 200)

Variable	Low Sedentary Level(n)	Moderate Sedentary Level (n)	High Sedentary Level(n)	χ^2	p-value
Socio-demographic Factors					
Age Group				7.819	0.020*
Younger Age (≤ 31 yrs)	17	58	27		
Older Age (> 32 yrs)	33	46	19		
Gender				9.922[a]	0.007*[a]
Male	2	0	4		
Female	48	104	42		
Marital Status				3.567	0.168
Not currently partnered	20	57	26		
Married or partnered	30	47	20		
Household Size				9.324	0.009*
Smaller Household Size	22	61	15		
Larger Household Size	28	43	31		
Education				5.441	0.245
Low education	15	28	8		
Middle education	14	40	14		
High education	21	36	24		

Variable	Low Sedentary Level(n)	Moderate Sedentary Level (n)	High Sedentary Level(n)	χ^2	p-value
Income Group				3.474	0.176
Lower Income	40	94	41		
Higher Income	10	10	5		
Individual & Health Factors					
Knowledge Level				0.132	0.936
Lower knowledge (≤ 13)	33	67	31		
Higher knowledge (> 13)	17	37	15		
BMI Index Category				7.026	0.318
Underweight	3	16	6		
Normal	23	34	20		
Overweight	9	21	4		
Obese	15	33	16		
Neck Pain				8.786	0.012*
No	41	66	25		
Yes	9	38	21		
Shoulder Pain				5.092	0.078
No	31	51	18		
Yes	19	53	28		
Upper Back Pain				0.889	0.641
No	24	43	18		
Yes	26	61	28		
Lower Back Pain				0.536	0.765
No	20	36	18		
Yes	30	68	28		
Elbows Pain				5.503	0.064
No	45	79	40		
Yes	5	25	6		
Wrist/Hands Pain				13.031	0.001*
No	37	51	34		
Yes	13	53	12		
Hips/Thighs Pain				5.959	0.051
No	36	54	29		
Yes	14	50	17		
Knee Pain				0.582	0.748
No	30	61	30		
Yes	20	43	16		
Ankles/Feet Pain				1.798	0.407
No	34	59	28		
Yes	16	45	18		
Work-Related Factors					
Work Pressure				9.650	0.008*
Lower work pressure	25	49	34		
Higher work pressure	25	55	12		
Break Skip				3.208	0.201
Never Skips	17	25	17		
Skips	33	79	29		
Work Experience Cat				0.241	0.887
Lower experience (≤ 6 years)	24	54	24		
Higher experience (> 6 years)	26	50	22		

Variable	Low Sedentary Level(n)	Moderate Sedentary Level (n)	High Sedentary Level(n)	χ^2	p-value
Environmental Factors					
Type of living space				8.624	0.013*
Factory Housing	3	26	12		
Small, rented room	47	78	34		
Living Space Size				1.986	0.370
Smaller living space	30	74	30		
Larger living space	20	30	16		
Space for activity at home				0.569	0.752
No or very little space	38	74	32		
Some or enough space	12	30	14		
After-work activity at home				2.035	0.361
Usually, no activity	19	48	16		
Usually, some activity	31	56	30		
Living space promotes sitting				6.433	0.040*
Disagree	26	52	33		
Agree	24	52	13		
Types of available places				6.854[a]	0.032*[a]
Park or open space	9	6	2		
Walking path/road	41	98	44		
Nearest Place for PA				3.727[a]	0.155[a]
< 10-minute walk	49	94	42		
> 10-minute walk	1	10	4		
Physical activity place utilisation				16.604	<0.001*
Non-user	29	42	8		
User	21	62	38		
Lack of exercise facilities makes sitting				1.694	0.429
Disagree	24	54	28		
Agree	26	50	18		

*Note: Statistically significant associations are set at $p < 0.05$. [a]Likelihood Ratio value and p-value utilized due to expected cell counts < 5, violating Pearson Chi-Square assumptions.

DISCUSSION

This study assessed sedentary behaviour and its associated factors among Myanmar migrant sewing workers in Mae Sot, Thailand. The findings showed that the mean daily sitting time was 12.9 ± 2.05 hours per day, indicating a high level of sedentary behaviour among the participants. This finding is consistent with previous studies reporting that occupations requiring prolonged sitting, including sewing work, are associated with higher levels of sedentary behaviour due to prolonged static sitting postures and repetitive production tasks (7, 9, 10). Prolonged sedentary behaviour may increase the risk of adverse health outcomes, including obesity, musculoskeletal disorders, cardiovascular disease, type 2 diabetes, and premature mortality (3).

This study found significant associations between sedentary behaviour and socio-demographic factors, specifically age group, gender, and household size among Myanmar migrant sewing workers. This is consistent with previous studies indicating that demographic and household characteristics are correlated with sedentary behaviour patterns among adults (21, 22). Older workers, females, and those with larger household sizes may face different domestic responsibilities and time constraints, which heavily influence their daily movement and leisure-time physical activity (22, 23). These findings suggest that demographic and

household circumstances should be considered when designing interventions to reduce sedentary behaviour among migrant workers.

Regarding work-related factors, higher work pressure was significantly associated with sedentary behaviour levels. Sewing machine operators who experience high production targets and intense work speed pressure often have fewer opportunities to take movement breaks, forcing them into prolonged static sitting (9, 10). This highlights the critical need to address work organization and pacing to reduce occupational sedentary time.

Furthermore, several environmental factors, including the type of living space, living conditions that encouraged prolonged sitting, the availability of parks/open spaces or walking paths, and the utilization of physical activity places, were significantly associated with sedentary behaviour. This finding is consistent with previous studies indicating that the built environment and neighborhood characteristics play an important role in shaping sedentary behaviour and physical activity (24). Limited access to supportive environments, or living in small, restrictive factory housing or rented rooms, may reduce opportunities for movement and encourage prolonged sitting during leisure time (25). Therefore, improving access to safe walking paths, open spaces, and encouraging the utilization of recreational facilities may help reduce sedentary behaviour among Myanmar migrant sewing workers.

This study found significant associations between sedentary behaviour and musculoskeletal disorders affecting the neck and wrists/hands among Myanmar migrant sewing workers. This finding is consistent with previous studies reporting that prolonged sitting and sustained static working postures, combined with repetitive manual tasks, are important risk factors for musculoskeletal disorders among sewing machine operators and other sedentary workers (9, 10). Prolonged sitting may increase mechanical loading on the cervical spine and upper extremities while reducing opportunities for postural changes and muscle recovery, thereby increasing the risk of musculoskeletal discomfort and pain (26). These findings highlight the importance of implementing ergonomic interventions, promoting regular movement breaks, and improving workstation design to reduce sedentary behaviour and musculoskeletal disorders.

No significant associations were found between sedentary behaviour and monthly household income, knowledge level, or BMI category. Similar findings have been reported in previous studies, suggesting that income and BMI are not consistently associated with sedentary behaviour, particularly among workers whose daily activities are largely determined by occupational demands rather than personal choice (22, 23). Although most participants had a high level of knowledge regarding sedentary behaviour, knowledge alone may not be sufficient to change behaviour when workers face severe occupational and environmental barriers. Similarly, BMI is influenced by multiple factors beyond sedentary behaviour, including dietary intake, overall physical activity, and individual biological characteristics, which may partly explain the absence of a significant association in this study (27).

These findings also have broader implications for international health priorities, particularly concerning health equity and the Sustainable Development Goals (SDGs), such as SDG 3 (Good Health and Well-being) and SDG 8 (Decent Work and Economic Growth). As migrant workers frequently experience systemic barriers to accessing Universal Health Coverage (UHC) in destination countries, targeted occupational health interventions within the garment sector are essential (12-14). Addressing occupational sedentary behaviour and restrictive residential environments not only mitigates localized health risks but also contributes to the global agenda of promoting decent work and equitable health outcomes for vulnerable, cross-border populations.

CONCLUSION

This study found a high level of sedentary behaviour among Myanmar migrant sewing workers in Mae Sot, Thailand, with a mean daily sitting time of 12.9 ± 2.05 hours. Levels of sedentary behaviour were significantly associated with socio-demographic factors (age group, gender, and household size), work pressure, residential environmental factors (type of living space, living environments promoting sitting, availability of activity places, and facility utilization), and musculoskeletal disorders affecting the neck and wrists/hands. These findings emphasize that public health and occupational health interventions must integrate ergonomic improvements in factories with community-level initiatives that enhance supportive residential environments to effectively reduce sedentary time and promote the health of migrant workers.

RECOMMENDATION

Based on the significant findings of this study, targeted interventions are proposed at the individual, workplace, and community levels to reduce sedentary behaviour and alleviate musculoskeletal discomfort among Myanmar migrant sewing workers. Workers should be educated and encouraged to implement active micro-breaks, specifically performing stretching exercises targeting the neck, wrists, and hands for 2–3 minutes every hour during work shifts. Additionally, workers should be encouraged to utilize nearby walking paths and open spaces during their leisure time to substitute prolonged residential sitting with light physical activity. Factory management should evaluate production quota pressures and organize work schedules that allow for brief, structured movement breaks. Improving workstation ergonomics—such as providing adjustable seating and supportive armrests—can reduce mechanical loading on the upper extremities. Workplaces should also promote a work culture that discourages break skipping. Local public health authorities, non-governmental organizations, and employers should collaborate to improve the living environment in migrant communities. Interventions should prioritize enhancing the safety, accessibility, and quality of nearby walking paths, parks, and recreational spaces to encourage higher utilization among migrant workers living in restricted residential spaces. Future research should incorporate a mixed-methods approach, utilizing focus group discussions or in-depth interviews. Qualitative investigations are necessary to explore the underlying contextual reasons why workers remain sedentary despite possessing high occupational health knowledge, and to better understand the lived experiences of production pressures and restrictive living conditions.

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB No. 2026/243.2104; approved on 20 May 2026). Verbal informed consent was obtained from all participants prior to data collection. A verbal consent process was utilized to accommodate participants with limited literacy and to ensure participant anonymity. The participant information sheet was read aloud in the Myanmar language by the trained interviewers, and participants' verbal agreement was documented by the research team. Participants were fully informed about the study objectives, the confidentiality of their information, and their right to withdraw from the study at any time without any consequences.

LIMITATIONS

This study has several limitations. First, the cross-sectional design prevents the establishment of causal relationships between sedentary behaviour and its associated factors. Second, daily sitting time and musculoskeletal disorders were assessed using self-reported questionnaires, which may be subject to recall bias or overestimation. Finally, the findings may have limited generalizability to the entire population of Myanmar migrant workers across Thailand due to the preliminary sample size of

200 participants from only three factories in Mae Sot. Furthermore, the inclusion criterion requiring participants to communicate in the Myanmar (Burmese) language may have introduced selection bias by excluding migrant workers from ethnic minority groups who possess limited Burmese proficiency.

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FACTORS INFLUENCING ADHERENCE TO DASH DIET IN ADULT PATIENTS WITH HYPERTENSION IN WATTHANA NAKHON DISTRICT, SA KAEO CROSS-SECTIONAL STUDY: A PILOT STUDY

Chayakan Laviplatanyaboon[1] and Anchalee Prasansuklab[1*]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand.

***Corresponding author**: Anchalee Prasansuklab, College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand. Email: anchalee.pr@chula.ac.th*

ABSTRACT

Introduction: Hypertension remains a leading public health concern and a primary driver of cardiovascular disease globally. In Thailand, hypertension prevalence has risen steadily, with Sa Kaeo Province among the most affected areas. The Dietary Approaches to Stop Hypertension (DASH) represents one of the well-supported dietary strategies for lowering blood pressure and preventing complications, but patient adherence to the program remains unclear. Furthermore, no validated tool currently exists to assess this form of adherence within the Thai primary-care setting, and few studies have examined its prevalence and associated factors in this population.

Objectives: This pilot study aimed to develop a standardized tool to assess DASH diet adherence and to examine associated factors among adult patients aged 18–60 years with hypertension who were receiving treatment at Watthana Nakhon Hospital, Sa Kaeo Province, Thailand.

Methodology: A self-report questionnaire was developed and tested for validity and reliability. A cross-sectional pilot study was conducted among 100 hypertensive patients during their hospital visits. The study employed convenience sampling to recruit volunteers from the NCD clinic at the hospital on Mondays and Fridays between 08:00 and 12:00. Participants completed a structured questionnaire assessing general characteristics, lifestyle factors, social support, and adherence to the DASH diet. DASH diet adherence was assessed using 12 items, with total scores ranging from 0 to 24. Adherence was categorized into three levels (low, moderate, high) using the interquartile range. Binary and multiple logistic regression analyses were performed to identify factors associated with adherence levels.

Results: All questionnaire items demonstrated acceptable content validity. Additionally, reliability testing yielded a Cronbach's alpha coefficient of 0.737, confirming high internal consistency. Most participants were female (71%), married (60%), aged 50–60 years (77%), had primary education (59%), had an income <15,000 Baht/month (91%), had a body mass index (BMI) ≥25 (67%), slept >6 hours per day (55%), did not meet physical activity recommendations (55%), had former or current alcohol consumption (65%), received moderate social support (75%), and had been diagnosed with hypertension for less than 5 years (66%). About 80% of patients had low-to-moderate adherence. In bivariate analysis, high social support (OR = 9.80; $p < 0.001$) and sleeping >6 hours per day (OR = 52.55; $p = 0.007$) were associated with higher odds of DASH diet adherence, while ever/current alcohol consumption was associated with lower odds (OR = 0.21; $p = 0.003$). In the multivariable analysis, participants who reported sleeping >6 hours per day (aOR = 38.01; $p = 0.007$) and those with high social support (aOR = 5.36; $p = 0.031$) were more likely to adhere to the DASH diet.

Conclusion: Using the developed assessment tool, approximately one-fifth of patients in this pilot study demonstrated high DASH diet adherence. Key factors associated with high DASH diet adherence included sleeping >6 hours per day and high social support. Insufficient sleep is associated with alterations in appetite-regulating hormones and increased appetite, which may be linked to poorer adherence. In contrast, high social support may enhance dietary self-efficacy, which, in turn, may lead to better adherence. These findings highlight the need for further studies with larger sample sizes to validate the present results and explore additional factors that may influence DASH diet adherence,

such as knowledge of the DASH diet. Rigorous validation of the tool, such as face and construct validity, is warranted. A better understanding of these factors may contribute to the development of more effective interventions and strategies to promote DASH adherence among hypertensive patients.

Keywords:
DASH Diet Adherence; Dietary Approach; Hypertension; Social Support; Sleep Duration

INTRODUCTION

Hypertension is a major global public health concern and a leading risk factor for cardiovascular disease, stroke, chronic kidney disease, and premature death (1). In Thailand, the burden of hypertension has increased steadily, with many patients remaining undiagnosed or inadequately controlled (2).

The Dietary Approaches to Stop Hypertension (DASH) diet is an evidence-based dietary pattern for blood pressure management. It emphasizes vegetables, fruits, whole grains, and low-fat dairy products while limiting sodium, saturated fat, and added sugar (3,4), and is recommended as part of lifestyle modification in Thai hypertension management guidelines (5). However, adherence to the DASH diet remains low to moderate in real-world settings, particularly where dietary habits are culturally established and sodium intake is high (6,7).

Sa Kaeo Province has experienced a substantial burden of hypertension, particularly in Watthana Nakhon District. However, DASH diet adherence and its associated factors in this population remain unclear, and no validated instrument is currently available to assess DASH adherence in the Thai primary-care setting. Therefore, this pilot study aimed to develop a tool for assessing DASH diet adherence and to explore associated general characteristics, lifestyle factors, and social support among adults aged 18–60 years with hypertension at Watthana Nakhon Hospital. The findings are intended to inform a larger study and support the development of targeted interventions to improve DASH diet adherence.

METHODOLOGY

Research Design

This pilot study employed a cross-sectional quantitative design to assess the level of DASH diet adherence and to explore its associated factors, including general characteristics, lifestyle factors, and social support, among adult patients with hypertension.

Target Population and Setting

The target population comprised adult hypertensive patients aged 18–60 years. The study was conducted at the non-communicable disease (NCD) clinic of Watthana Nakhon Hospital, Sa Kaeo Province, Thailand. Watthana Nakhon District was purposively selected because it reported one of the highest burdens of hypertension within the province.

Sampling Technique

Participants were recruited through convenience sampling at the NCD clinic on Mondays and Fridays between 08:00 and 12:00. Inclusion criteria were adults aged 18–60 years who had been diagnosed with hypertension for more than three months, were currently receiving treatment or follow-up at the outpatient clinic, were able to communicate in Thai, and provided voluntary informed consent. Pregnant or breastfeeding women, patients with cognitive or psychiatric impairment affecting questionnaire completion, and those with acute severe complications on the day of assessment were excluded.

Sample Size

A total of 100 participants were recruited for this pilot study, a number considered sufficient to evaluate the feasibility of the study design, test the data collection instrument, and identify potential challenges before conducting a larger-scale study.

Measurement Tools

A structured, paper-based, self-administered questionnaire was developed in the Thai language and comprised the following sections: (1) general characteristics, including sex, age, marital status, education, monthly income, body weight and height (used to compute BMI), and duration of hypertension; (2) lifestyle factors, including physical activity, alcohol consumption, and sleep duration over the preceding month; (3) social support related to the DASH diet, assessed with 12 items on a five-point Likert scale; and (4) DASH diet adherence, assessed with 12 items scored on a three-point frequency scale (total score 0–24). For DASH diet adherence, the total score was classified into low, moderate, and high levels using the interquartile range (IQR) of the score distribution: participants scoring at or below the first quartile (Q1) were classified as low, those between Q1 and the third quartile (Q3) as moderate, and those at or above Q3 as high. For the regression analysis, scores were dichotomized into low-to-moderate versus high adherence.

The interquartile range (IQR) method was selected over a predetermined scoring threshold because no validated cut-off points currently exist for DASH diet adherence scores in the Thai population, as this questionnaire was newly developed for this pilot study. In the absence of an externally validated threshold, a data-driven approach such as the IQR allows adherence levels to be classified relative to the actual distribution of scores observed in this sample, reducing the risk of misclassification that could arise from applying an arbitrary or externally derived cut-off not calibrated to this population. This approach is also consistent with common practice in pilot and exploratory studies using newly developed instruments, where sample-based distributional methods are preferred until further validation work establishes standardized thresholds

The developed questionnaire was tested for validity and reliability. Content validity was reviewed by three experts using the Item-Objective Congruence (IOC) index, with items scoring ≥ 0.5 retained. A reliability test conducted with 30 participants yielded a Cronbach's alpha of 0.737, indicating acceptable internal consistency.

Data Collection

Data were collected through in-person administration of paper-based questionnaires at the NCD clinic. Participants were informed of the study objectives, procedures, and their rights before providing written informed consent. Participation was voluntary, and all responses were kept confidential and anonymous. Questionnaires were completed independently by participants in a private setting.

Data Analysis

Data were analyzed using SPSS version 28.0. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize general characteristics, lifestyle factors, social support, and DASH diet adherence. Simple logistic regression was used to examine the association between each independent variable and high DASH diet adherence, with results reported as crude odds ratios (ORs) and 95% confidence intervals (CIs). Because of the small pilot sample and the presence of zero cells (complete separation) in some categories, Firth's penalized-likelihood method was applied (8). Variables with a p-value < 0.20 in the bivariate analysis were entered into a multiple logistic regression model, with predictors collapsed into two categories to improve model stability and reduce zero cells. Adjusted odds ratios (aORs) with 95% CIs were calculated, and statistical significance was set at a p-value < 0.05.

RESULTS

General characteristics, lifestyle factors, and social support

The general characteristics, lifestyle factors, and social support of the 100 participants are presented in Table 1. The mean age was 52.1 years (SD = 6.0), with most participants aged 50–60 years (77%). The majority were female (71%) and married (60%), and 59% had completed primary education. Most participants (91%) reported a monthly income below 15,000 Baht, and 67% were obese (BMI ≥ 25 kg/m², mean = 27.5). Two-thirds (66%) had been diagnosed with hypertension for five years or less. Regarding lifestyle, 55% did not meet the physical activity recommendation, 65% were former or current alcohol consumers, and 55% slept more than six hours per day. Most participants received a moderate level of social support (75%, mean = 41.9).

Table 1 Descriptive statistics for general characteristics, lifestyle factors, and social support (Total N = 100)

Characteristics	Frequency (N)	Percentage (%)
Sex		
Male	29	29.0
Female	71	71.0
Age group (years)		
20–39	4	4.0
40–49	19	19.0
50–60	77	77.0
Mean (SD) = 52.1 (6.0), Min–Max = 35–60		
Marital status		
Single	12	12.0
Married	60	60.0
Widowed / Divorced / Separated	28	28.0
Education		
Primary education	59	59.0
Secondary education	28	28.0
Bachelor's degree or higher	13	13.0
Monthly income (Baht)		
< 15,000	91	91.0
≥ 15,000	9	9.0
Body mass index (kg/m²)		
< 23 (normal/underweight)	21	21.0
23.0–24.9 (overweight)	12	12.0
≥ 25 (obese)	67	67.0
Mean (SD) = 27.5 (5.1)		

Characteristics	Frequency (N)	Percentage (%)
Duration of hypertension		
0–5 years	66	66.0
6–10 years	11	11.0
> 10 years	23	23.0
Physical activity level		
None / insufficient	55	55.0
Mild	41	41.0
Moderate	2	2.0
Vigorous	2	2.0
Alcohol consumption		
Never	35	35.0
Former (quit)	26	26.0
Current	39	39.0
Sleep duration per day		
≤ 6 hours	45	45.0
7–9 hours	48	48.0
≥ 10 hours	7	7.0
Social support level		
Low	8	8.0
Moderate	75	75.0
High	17	17.0
Mean (SD) = 41.9 (10.3)		

DASH diet adherence

The level of DASH diet adherence is shown in Table 2. The mean adherence score was 12.38 (SD = 2.22), with a median of 12 (IQR 11–14) and scores ranging from 8 to 16. Using the IQR method for classification, 21% of participants had low adherence, 59% had moderate adherence, and 20% had high adherence. For the regression analysis, participants were dichotomized into low-to-moderate adherence (80%) and high adherence (20%).

Table 2 Descriptive statistics for DASH diet adherence (Total N = 100)

Variable	Frequency (N)	Percentage (%)
DASH diet adherence		
Low	21	21.0
Moderate	59	59.0
High	20	20.0
Mean (SD) = 12.38 (2.22); Median = 12; IQR (Q1–Q3) = 11–14; Min–Max = 8–16		

Factors associated with high DASH diet adherence

The results of the simple logistic regression are presented in Table 3. High social support was the most consistent factor: participants receiving a high level of social support were 9.80 times more likely to have high DASH diet adherence than those receiving a low-to-moderate level (OR = 9.80; 95% CI = 3.06–31.36; p < 0.001). Former or current alcohol consumption was associated with lower odds of high adherence compared with never drinking (OR = 0.21; 95% CI = 0.08–0.60; p = 0.003). Sleeping more than six hours per day was also associated with higher odds of high adherence (OR = 52.55; 95% CI = 2.98–927.51; p = 0.007); however, because no participant in the ≤ 6-hour reference group reached high adherence (complete separation), this estimate is unstable and should be interpreted only in terms of direction. The remaining variables were not significantly associated with high DASH diet adherence.

Table 3 Simple logistic regression analysis of factors associated with high DASH diet adherence (Total N = 100)

Variable	Low to moderate N (%)	High N (%)	Crude OR	95% CI	p-value
Sex					
Female	55 (77.5)	16 (22.5)	1.00	Reference	
Male	25 (86.2)	4 (13.8)	0.59	0.19–1.89	0.378
Age group					
< 50 years	19 (82.6)	4 (17.4)	1.00	Reference	
≥ 50 years	61 (79.2)	16 (20.8)	1.16	0.36–3.79	0.803
Marital status					
No partner (single/widowed/divorced)	31 (77.5)	9 (22.5)	1.00	Reference	
Married	49 (81.7)	11 (18.3)	0.77	0.29–2.05	0.601
Education					
Primary education	47 (79.7)	12 (20.3)	1.00	Reference	
Above primary education	33 (80.5)	8 (19.5)	0.96	0.36–2.59	0.942
Monthly income (Baht)					
< 15,000	71 (78.0)	20 (22.0)	1.00	Reference	
≥ 15,000 †	9 (100.0)	0 (0.0)	0.18	0.01–3.83	0.274
Body mass index (kg/m²)					
< 23	18 (85.7)	3 (14.3)	1.00	Reference	
23.0–24.9	9 (75.0)	3 (25.0)	1.95	0.35–10.99	0.450
≥ 25	53 (79.1)	14 (20.9)	1.43	0.39–5.30	0.590
Duration of hypertension					
0–5 years	55 (83.3)	11 (16.7)	1.00	Reference	
6–10 years	8 (72.7)	3 (27.3)	1.99	0.47–8.46	0.353

Variable	Low to moderate N (%)	High N (%)	Crude OR	95% CI	p-value
> 10 years	17 (73.9)	6 (26.1)	1.79	0.58–5.50	0.307
Physical activity					
No regular exercise	43 (78.2)	12 (21.8)	1.00	Reference	
Regular exercise	37 (82.2)	8 (17.8)	0.79	0.29–2.11	0.637
Alcohol consumption					
Never	22 (62.9)	13 (37.1)	1.00	Reference	
Former / Current	58 (89.2)	7 (10.8)	0.21	0.08–0.60	0.003*
Sleep duration					
≤ 6 hours †	45 (100.0)	0 (0.0)	1.00	Reference	
> 6 hours	35 (63.6)	20 (36.4)	52.55	2.98–927.51	0.007*
Social support					
Low / Moderate	73 (88.0)	10 (12.0)	1.00	Reference	
High	7 (41.2)	10 (58.8)	9.80	3.06–31.36	<0.001*

*Values are N (row %). OR = crude odds ratio from simple (univariate) logistic regression using the Firth penalized-likelihood method; outcome = high DASH diet adherence. † Group with zero high-adherence cases (complete separation); estimates are finite under the Firth method but should be interpreted by direction only. * p < 0.05.*

Table 4 presents the results of the multiple logistic regression, in which variables with a p-value < 0.20 in the bivariate analysis were entered and collapsed into two categories. After mutual adjustment, high social support remained independently and significantly associated with high DASH diet adherence (aOR = 5.36; 95% CI = 1.17–24.59; p = 0.031); this estimate was stable, with no separation and a moderate confidence interval. Sleeping more than six hours per day was also statistically significant (aOR = 38.01; 95% CI = 2.76–523.42; p = 0.007), but the wide confidence interval, again resulting from complete separation in the reference group, means this finding should be interpreted by direction only. The other variables were not significantly associated with high adherence after adjustment.

Table 4 Multiple logistic regression analysis of factors associated with high DASH diet adherence (Total N = 100)

Variable	B	SE	p-value	Adjusted OR	95% CI
Alcohol consumption					
Never				Reference	
Former / Current	-0.69	0.67	0.291	0.50	0.13–1.82
Social support					
Low / Moderate				Reference	
High	1.68	0.78	0.031*	5.36	1.17–24.59

Variable	B	SE	p-value	Adjusted OR	95% CI
Sleep duration					
≤ 6 hours †				Reference	
> 6 hours	3.64	1.34	0.007**	38.01	2.76–523.42

*aOR = adjusted odds ratio from multiple logistic regression (Firth penalized-likelihood method), mutually adjusted for the three predictors in the model; outcome = high DASH diet adherence. B = regression coefficient; SE = standard error; CI = confidence interval. The model included alcohol consumption, social support, and sleep duration—the variables significant at p < 0.05 in the bivariate analysis. † Reference group with zero high-adherence cases (complete separation); the estimate for > 6 hours is interpretable by direction only. * p < 0.05, ** p < 0.01.*

DISCUSSION

This pilot study assessed the level of DASH diet adherence and explored its associated factors among adult patients with hypertension at Watthana Nakhon Hospital, Sa Kaeo Province. Only about one-fifth of participants demonstrated high DASH diet adherence, with the majority (80%) at a low-to-moderate level. This finding is consistent with previous reports showing that real-world adherence to the DASH dietary pattern is generally low to moderate, even among patients who are aware of its benefits (6,7).

High social support emerged as the strongest and most stable factor associated with high DASH diet adherence in both the simple and multiple logistic regression models. This aligns with substantial evidence indicating that support from family members and close contacts through encouragement, meal preparation, and shared dietary changes enhances dietary self-efficacy and improves adherence to recommended diets and medical treatment (9). In the Thai context, where meals are commonly prepared and shared within the household, family-level support may be particularly important for sustaining sodium reduction and increasing fruit and vegetable intake. This suggests that interventions to promote DASH adherence should actively engage family members and the wider community.

Longer sleep duration (> 6 hours per day) was also associated with higher adherence. Although the magnitude of this association was unstable owing to complete separation in the data, its direction is biologically plausible. Insufficient sleep is linked to alterations in appetite-regulating hormones, including reduced leptin and increased ghrelin, which heighten hunger and the preference for energy-dense, high-sodium foods, and short sleep duration has been associated with poorer overall diet quality (10,11). Adequate sleep may therefore support healthier dietary choices consistent with the DASH pattern. Given the instability of the estimate in this small sample, this relationship warrants confirmation in a larger study.

Former or current alcohol consumption was associated with lower adherence in the simple regression but lost statistical significance after adjustment, suggesting that it may cluster with other unhealthy lifestyle behaviors rather than acting as an independent determinant. The remaining characteristics sex, age, marital status, education, income, BMI, duration of hypertension, and physical activity were not significantly associated with adherence in this pilot, most likely because of the limited statistical power of the small sample.

CONCLUSION

This pilot study developed and tested an instrument for assessing DASH diet adherence among adult patients with hypertension and applied it in a primary-care setting in Sa Kaeo Province. Approximately one-fifth of participants demonstrated high adherence, indicating that overall adherence in this population is low. High social support was the strongest and most stable factor associated with high adherence, while longer sleep duration showed a promising but less stable association. These findings

underscore the importance of engaging family and community support in efforts to promote DASH adherence. Future studies with larger and more diverse samples are recommended to validate the assessment tool and to explore additional factors, such as knowledge of the DASH diet and digital health literacy, that may influence dietary adherence among hypertensive patients.

RECOMMENDATIONS

These findings should therefore be confirmed in the full study, which will provide adequate power to estimate adjusted associations more reliably and to examine additional factors that may influence DASH diet adherence, such as knowledge of the DASH diet and dietary self-efficacy. Rigorous validation of the tool, including face and construct validity and test–retest reliability, is also warranted. Beyond addressing sample size and sampling method limitations, the full-scale study should also incorporate validated measurement scales for variables that were not assessed in this pilot, particularly dietary self-efficacy and DASH diet-specific knowledge.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group 1, Chulalongkorn University. The COA number is 192/69.

LIMITATIONS

Several limitations should be acknowledged. The small pilot sample and the use of convenience sampling limit the statistical power and generalizability of the findings, and several categories exhibited complete separation, producing unstable estimates that could be interpreted by direction only even after applying the Firth method. Reliance on self-reported data may introduce recall and social-desirability bias.

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HOUSEHOLD FOOD INSECURITY AND COPING STRATEGY SEVERITY IN RURAL MYAUNGMYA TOWNSHIP, AYEYARWADY REGION, MYANMAR

Soe Thura[1]*, Orapin Laosee[1], Cheerawit Rattanapan[1], Seema Vijay Medhe[1]
[1]ASEAN Institute for Health Development, Mahidol University, Thailand
****Corresponding Author**: Orapin Laosee, ASEAN Institute for Health Development, Mahidol University, Salaya, Nakhon Pathom, Thailand, Email: orapin.lao@mahidol.ac.th*

ABSTRACT

Introduction: Household food insecurity remains a major public health concern among rural populations in low- and middle-income countries; however, township-level evidence on factors associated with coping strategy severity in rural Myanmar remains limited.

Objectives: This study aimed to assess household food insecurity and examine its association with household coping strategy severity among rural households in Myaungmya Township, Ayeyarwady Region, Myanmar.

Methodology: A cross-sectional study with two-stage cluster sampling: five flood-affected villages selected by probability proportional to size, followed by systematic random sampling of households. Of 427 households approached, 410 completed interviews. Food insecurity was measured with the Food Insecurity Experience Scale (FIES; raw score 0–8) and coping strategy severity with 13 severity-weighted items (Cronbach's alpha = 0.931). Hierarchical and final multiple linear regression models were fitted, and model assumptions were formally assessed.

Results: Overall, 24.1% of households were moderately and 7.3% severely food insecure. The FIES score showed the strongest adjusted association (B = 3.61, 95% CI 3.24–3.97, $\beta = 0.66$, $p < 0.001$; model $R^2 = 0.681$). Household size, credit access, and major house damage were associated with greater coping strategy severity, whereas the number of members aged 60 years and above and land ownership were associated with lower severity.

Conclusion: Household food insecurity was the factor most strongly associated with coping strategy severity. Strengthening household food security and livelihood resilience may reduce reliance on severe coping strategies.

Keywords:
Household Food Insecurity; Coping Strategies; Rural Households; Myanmar

INTRODUCTION

Food insecurity remains a major global public health challenge, with over two billion people facing moderate or severe food insecurity driven by economic instability, climate change and conflict (1-3). In Myanmar, food insecurity has worsened in recent years: millions face acute hunger, and a large proportion of the population experiences moderate or severe food insecurity (4).

The Ayeyarwady Region is highly vulnerable to chronic food insecurity due to agricultural market instability, a complex flood risk profile, and nationwide conflict. About 15% of households in the region fall into the low food consumption score category, indicating food access constraints (4-7).

Coping strategies encompass the actions households undertake to prevent, manage, or mitigate food shortages (8-10). Brunet et al. classify them into reducing food expenditure, increasing the money available for food, increasing food availability, and rationing available food (9, 11).

Conceptually, experienced food insecurity and coping strategies are distinct but related constructs: FIES captures a household's experienced constraints on access to adequate food, whereas coping strategies are the behavioral responses to those constraints (9, 12).

Consistent with the Transactional Theory of Stress and Coping, coping is expected to intensify with the appraised severity of food-related stress (13); sociodemographic and environmental factors were conceptualized as potential confounders.

Township-level and household-scale evidence remains scarce in Myanmar (4-7). To the best of the authors' knowledge, no previous study in the delta has quantified the association between food insecurity and coping strategy severity. The objectives of this study were therefore to assess household food insecurity, describe household coping strategies, and examine the association of food insecurity and sociodemographic and environmental factors with coping strategy severity among rural households in Myaungmya Township.

METHODOLOGY

Study design and setting

A community-based cross-sectional study was conducted in rural areas of Myaungmya Township, from 5 to 20 June 2026.

Sample size determination

The required sample size was calculated using Cochran's formula, $n_0 = Z^2p(1-p)/e^2$, with p = 0.5 (a conservative assumption in the absence of a township-level prevalence estimate), Z = 1.96 (95% confidence), and e = 0.05, yielding a minimum of 385 households; with a 10% non-response allowance, the target was set at 427.

Sampling procedure and participants

A two-stage cluster sampling technique was used, with villages as clusters. First, a frame of rural villages was obtained from township administrative records, and five villages that had experienced flooding during the previous 12 months were selected by probability proportional to size (PPS) sampling, with the number of households as the measure of size. Second, a household listing in each village established an updated frame of eligible households; the sample was allocated proportionally to village size (Moke Soe Kwin 101, Khway Lay Gyi 98, Bu Din Kwin 93, Kone Thar 71, Lu Taw 64), and households were selected by systematic random sampling (interval = eligible households ÷ allocated sample; random start). If a selected household was unavailable or declined, the next household was approached.

Household heads or adult representatives (≥ 18 years) knowledgeable about household food consumption and livelihoods were interviewed. Households residing in the selected villages for at least 12 months were eligible, whereas those unable to provide informed consent or communicate effectively were excluded. 410 households completed the interview (17 excluded owing to incomplete responses).

Data collection procedures

Data were collected through face-to-face interviews using a questionnaire covering socio-demographic characteristics, environmental factors, household food insecurity, and household coping strategies. Content validity was evaluated by three experts using the Item-Objective Congruence index (items ≥ 0.50 retained), and a pilot test among 30 households outside the study clusters was conducted. Enumerators completed a two-day training workshop, and data collection was under daily supervision.

Measures

Household food insecurity was measured using FIES (12-month recall) (12). Each item was scored as one point, yielding a raw score of 0–8. For descriptive purposes, raw scores were categorized as food secure or mildly (0–3), moderately (4–6), and severely (7–8) food insecure, based on previous literature and FAO guidance (14, 15); formal Rasch-model equating to the FIES global reference scale was not performed.

Coping strategy severity was assessed using 13 coping strategy items adapted from Brunet et al. (9). Respondents reported the frequency of each strategy during the previous 12 months on a five-point scale anchored to monthly

frequency, from never (0) to very often (more than weekly; 4). Following the principles of the Coping Strategies Index (CSI) and the previous literature review (9, 16), each item was assigned a severity weight of 1 to 5; weighted item scores (frequency × weight) were summed for the total score (theoretical range 0–116). Pilot Cronbach's alpha for the 13 items was 0.931.

Access to credit was defined as obtaining any loan or borrowed money from formal or informal sources during the previous 12 months for any purpose (yes/no). This is conceptually distinct from the coping strategy item "bought food on credit" (CS8), which captures borrowing specifically to buy food because of a lack of money or other resources during the previous 12 months. House damage during the previous 12 months was categorized as none, minor, or major, and the number of members aged 60 years and above was analyzed as a count variable.

Statistical analysis

Data were analyzed using SPSS 31. Categorical variables were summarized using frequencies and percentages, and continuous variables as medians and interquartile ranges (IQR) (skewed distributions). Following purposeful variable selection with $p < 0.25$ in simple linear regression — to avoid prematurely excluding potential confounders (17) — hierarchical multiple linear regression in three blocks (sociodemographic factors; environmental factors; food insecurity) followed the prespecified conceptual framework, evaluated by the change in R^2, followed by a final model. Collinearity and model assumptions were assessed.

Village identifiers were not retained in the dataset, so design-based variance estimation for the cluster design was not possible.

RESULTS

Characteristics of study households

Of the 410 households analyzed, slightly more than half of household heads were female (52.4%; median age 48 years, IQR 21). Most households were nuclear families (77.1%). The median FIES score was 2 (IQR 4), and the median coping strategy severity score was 16 (IQR 15).

Table 1 Characteristics of study households (n = 410)

Variable	Category	n (%) / Median (IQR)
Highest education level of household	No formal education and primary education	86 (21.0)
	Secondary education	257 (62.7)
	University/College	67 (16.3)
Employment status of household head	Unemployed	38 (9.3)
	Employed	372 (90.7)
Occupation of household head	Agricultural worker	44 (10.7)
	Fisherman	18 (4.4)
	Daily wage laborer	153 (37.3)
	Business/self-employed	120 (29.3)
	Government/private employee	37 (9.0)
	Not applicable (unemployed)	38 (9.3)
Credit within the last 12 months	No	198 (48.3)
	Yes	212 (51.7)

Variable	Category	n (%) / Median (IQR)
Land ownership	No	108 (26.3)
	Yes	302 (73.7)
House damage during the last 12 months	No damage	224 (54.6)
	Minor damage	143 (34.9)
	Major damage	43 (10.5)
Income-earning environment deterioration during the last 12 months	No	328 (80.0)
	Yes	82 (20.0)
Migration during the last 12 months	No	388 (94.6)
	Yes	22 (5.4)
Age of household head (years)	–	48 (21)
Household size	–	4 (2)
Number of members aged ≥60 years	–	0 (1)
Monthly household income (kyats)	–	350,000 (200,000)
FIES total score	–	2 (4)
Coping strategy severity score	–	16 (15)

Note. Categorical variables are presented as n (%); continuous variables as median (interquartile range, IQR).

Household food insecurity

Worrying about not having enough food to eat was the most frequently reported experience (59.8%). Based on the raw FIES score, 68.5% of households were classified as food secure or mildly food insecure (0–3), 24.1% as moderately (4–6), and 7.3% as severely (7–8) food insecure.

Table 2 Responses to the Food Insecurity Experience Scale (FIES) items (n = 410)

Item	Experience during the last 12 months	No, n (%)	Yes, n (%)
FI1	Worried about not having enough food	165 (40.2)	245 (59.8)
FI2	Unable to eat healthy and nutritious food	218 (53.2)	192 (46.8)
FI3	Ate only a few kinds of foods	230 (56.1)	180 (43.9)
FI4	Skipped a meal	358 (87.3)	52 (12.7)
FI5	Ate less than they thought they should	256 (62.4)	154 (37.6)
FI6	Ran out of food	348 (84.9)	62 (15.1)
FI7	Hungry but did not eat	348 (84.9)	62 (15.1)
FI8	Went without eating for a whole day	396 (96.6)	14 (3.4)

Note. All items refer to experiences during the last 12 months owing to lack of money or other resources.

Coping strategies

Households relied predominantly on less severe, consumption-related adjustments.

Table 3 Coping strategy item responses and severity weights (n = 410)

Item	Coping strategy	Weight	Never	Rarely	Sometimes	Often	Very often
CS1	Stopped buying foods considered important	1	204 (49.8)	179 (43.7)	18 (4.4)	6 (1.5)	3 (0.7)
CS2	Bought cheaper foods	1	107 (26.1)	192 (46.8)	76 (18.5)	21 (5.1)	14 (3.4)
CS3	Prioritized more satiating foods	1	139 (33.9)	166 (40.5)	65 (15.9)	28 (6.8)	12 (2.9)
CS4	Stored foods for anticipated shortages	1	189 (46.1)	193 (47.1)	24 (5.9)	2 (0.5)	2 (0.5)
CS5	Reduced portion sizes or stretched meals	3	170 (41.5)	170 (41.5)	39 (9.5)	20 (4.9)	11 (2.7)
CS6	Prioritized children or adolescents during distribution	3	126 (30.7)	164 (40.0)	43 (10.5)	32 (7.8)	45 (11.0)
CS7	Reorganized household expenses to buy food	2	130 (31.7)	209 (51.0)	42 (10.2)	13 (3.2)	16 (3.9)
CS8	Bought food on credit	2	179 (43.7)	163 (39.8)	36 (8.8)	24 (5.9)	8 (2.0)
CS9	Searched for a job or started self-employment to buy food	2	188 (45.9)	161 (39.3)	40 (9.8)	10 (2.4)	11 (2.7)
CS10	Sold belongings to buy food	4	323 (78.8)	82 (20.0)	4 (1.0)	1 (0.2)	0 (0.0)
CS11	Requested financial assistance from an institution	2	356 (86.8)	54 (13.2)	0 (0.0)	0 (0.0)	0 (0.0)
CS12	Asked family members or friends for food	2	284 (69.3)	101 (24.6)	14 (3.4)	8 (2.0)	3 (0.7)
CS13	Begged for food	5	400 (97.6)	6 (1.5)	0 (0.0)	4 (1.0)	0 (0.0)

Note. Values are n (%). All items refer to behaviors adopted during the last 12 months owing to lack of money or other resources.

Simple linear regression analysis

In simple linear regression, the FIES score showed the strongest crude association with coping strategy severity.

Table 4 Simple linear regression between independent variables and the coping strategy severity (n = 410)

Variable	B	95% CI	β	R^2	p
Household size	2.01	1.26, 2.76	.25	.063	<0.001
Number of members aged ≥60 years	−4.07	−5.70, −2.45	−.24	.056	<0.001
Credit access	10.74	8.54, 12.94	.43	.184	<0.001

Variable	B	95% CI	β	R^2	p
Land ownership	−12.21	−14.71, −9.72	−.43	.185	<0.001
Minor house damage[d]	6.14	3.63, 8.66	.23	.090	<0.001
Major house damage[d]	10.43	6.51, 14.34	.26	.090	<0.001
FIES total score	4.32	3.99, 4.65	.79	.621	<0.001

Note. Each row (or set of dummy variables representing the same categorical variable) is a separate simple linear regression model; R^2 is the model-level coefficient of determination, and is therefore identical for dummy variables entered together in one model. B = unstandardized coefficient; β = standardized coefficient; CI = confidence interval. [d]Reference: no house damage.

Multiple linear regression analysis

In hierarchical regression, sociodemographic factors explained 40.8% of the variance ($F(17, 392) = 15.91$, $p < 0.001$); environmental factors added 5.2% ($\Delta R^2 = 0.052$, $p < 0.001$); and household food insecurity added a further 23.0% ($\Delta R^2 = 0.230$, F change(1, 386) = 286.69, $p < 0.001$), for a full-model R^2 of 0.690 ($F(23, 386) = 37.42$, $p < 0.001$).

Table 5 Complete adjusted hierarchical model (final block) of factors associated with the coping strategy severity (n = 410)

Variable	Adjusted B	95% CI	β	p
Age of household head	−0.02	−0.08, 0.04	−.02	0.541
Household size	0.75	0.13, 1.37	.09	0.018
Number of members aged ≤15 years	0.61	−0.29, 1.51	.05	0.185
Number of members aged ≥60 years	−2.04	−3.14, −0.95	−.12	<0.001
Secondary education[a]	0.31	−1.62, 2.24	.01	0.751
University/college[a]	−0.93	−3.82, 1.97	−.03	0.530
Employment status (employed)	−1.62	−4.90, 1.66	−.04	0.331
Fisherman[b]	0.74	−3.44, 4.92	.01	0.726
Daily wage laborer[b]	1.48	−1.20, 4.15	.06	0.278
Business/self-employed[b]	1.05	−1.52, 3.62	.04	0.423
Government/private employee[b]	1.30	−2.11, 4.70	.03	0.454
Household income (per 100,000 kyats)	−0.08	−0.22, 0.05	−.04	0.222
Credit access	2.21	0.61, 3.81	.09	0.007
Main material of the house (brick/concrete/wood)	0.20	−1.57, 1.96	.01	0.828
Land ownership	−1.96	−3.85, −0.07	−.07	0.043
Two income sources[c]	−0.05	−1.66, 1.55	−.00	0.950
Three or more income sources[c]	1.03	−1.90, 3.97	.02	0.489
Minor house damage[d]	1.14	−0.49, 2.77	.04	0.169
Major house damage[d]	2.61	0.06, 5.16	.06	0.045
Livestock damage	0.91	−1.77, 3.59	.02	0.505

Variable	Adjusted B	95% CI	β	p
Income-earning environment deterioration	1.58	−0.36, 3.52	.05	0.110
Migration	0.40	−2.93, 3.72	.01	0.815
FIES total score	3.44	3.04, 3.84	.63	<0.001

Note. R^2 = 0.690; adjusted R^2 = 0.672; F(23, 386) = 37.42, p < 0.001. The unemployed occupation dummy was excluded owing to perfect collinearity with employment status. [a]Reference: no formal education and primary education. [b]Reference: agricultural worker. [c]Reference: one income source. [d]Reference: no house damage.

Variables remaining significant were entered into a final model (Table 6; R^2 = 0.681, adjusted R^2 = 0.675, F(7, 402) = 122.47, p < 0.001). The FIES score showed the strongest association with coping strategy severity (B = 3.61, 95% CI 3.24–3.97, β = 0.66, p < 0.001), indicating a 3.61-point higher severity score per one-point increase in the FIES score, holding other variables constant. Household size (B = 0.90), credit access (B = 2.23), and major house damage (B = 2.67) were associated with higher coping strategy severity, and the number of members aged 60 years and above (B = −2.35) and land ownership (B = −2.77) were associated with lower severity.

Table 6 Final multiple linear regression model of factors associated with the coping strategy severity (n = 410)

Variable	B	SE	95% CI	β	p	Tolerance	VIF
Constant	6.56	1.36	3.88, 9.25	–	<0.001	–	–
Household size	0.90	0.24	0.44, 1.36	.11	<0.001	.912	1.10
Number of members aged ≥60 years	−2.35	0.50	−3.33, −1.37	−.14	<0.001	.943	1.06
Credit access	2.23	0.80	0.66, 3.80	.09	0.006	.779	1.28
Land ownership	−2.77	0.89	−4.51, −1.02	−.10	0.002	.813	1.23
Minor house damage[a]	1.34	0.80	−0.23, 2.91	.05	0.094	.854	1.17
Major house damage[a]	2.67	1.23	0.26, 5.09	.07	0.030	.876	1.14
FIES total score	3.61	0.19	3.24, 3.97	.66	<0.001	.688	1.45

Note. R^2 = 0.681; adjusted R^2 = 0.675; F(7, 402) = 122.47, p < 0.001. B = unstandardized coefficient; SE = standard error; β = standardized coefficient; CI = confidence interval; VIF = variance inflation factor. [a]Reference group: no house damage.

Model diagnostics

The observed outcome ranged from 0 to 64, and the standardized residuals of the final model were approximately normal (skewness = 0.24; Kolmogorov–Smirnov p = 0.200; Shapiro–Wilk W = 0.995, p = 0.260), the normal P–P plot and scatterplot indicated normality, linearity, and homoscedasticity, and multicollinearity were absent.

DISCUSSION

The study examined household food insecurity and its association with coping strategy severity. 24.1% experienced moderate and 7.3% severe food insecurity, which was the factor most strongly associated with coping strategy severity. This is the first township-level study in the Ayeyarwady to quantify this association. The findings complement national and regional assessments (4, 7).

Item endorsement followed the expected FIES severity gradient (12), suggesting that food insecurity here reflects constrained economic access to adequate diets rather than absolute shortage (4-6).

The food insecurity–coping association is consistent with the Transactional Theory of Stress and Coping, in which coping intensifies with the severity of the stressor (13), and with evidence from rural Myanmar (18, 19), Bangladesh, India, and Uruguay (9, 20, 21). However, because both constructs were self-reported for the same 12-month period, the association may be inflated, and no inference can be drawn about its direction.

Household size was positively associated with coping strategy severity: larger households require greater absolute resources, and their food budgets may be exhausted more quickly. Similar associations have been reported in Myanmar and other low- and middle-income countries (22, 23).

The inverse association with elderly members may appear counterintuitive but is consistent with evidence from eastern India, where households headed by elderly were more likely to be food secure, due to experience and assets (21). In rural Myanmar, older members often anchor assistance networks. These are plausible explanations, and the opposite direction reported in southern Ethiopia (24) indicates dependence on context.

Credit access was associated with more severe coping. Credit has a documented dual role: a productive resource and a distress response (9, 19, 25). In rural Myanmar, credit use (mostly informal) plausibly marks underlying financial stress, but the direction cannot be determined (19, 22).

Land ownership was associated with lower coping: land enables own production and serves as a store of value (22).

Only major house damage remained associated after adjustment, suggesting that households can absorb small repair costs. The cause of damage was not ascertained; however, the selected villages had experienced flooding, and regional studies report that flooding threatens housing and rural livelihoods (5, 6, 26, 27).

Finally, income, minor house damage, and income-earning environment deterioration were associated with the outcome only before food insecurity entered the model, suggesting that their influence operates largely through food insecurity — supporting experience-based targeting.

CONCLUSION

Among rural households in Myaungmya, household food insecurity was the factor most strongly associated with coping strategy severity; household size, credit access, and major house damage were associated with greater severity, and elderly members and land ownership with lower severity. Strengthening food security and sustainable livelihoods may help reduce reliance on severe coping strategies.

RECOMMENDATIONS

These are considerations suggested by the observed associations. Food security and social protection programs could integrate FIES screening into social assistance and routine primary health care. Benefit levels could account for household size and dependency burden. Monitoring food-related borrowing as an early-warning indicator may help identify households under stress. Supporting landless laborers would address a source of vulnerability, and post-disaster support could combine shelter repair with food or cash assistance. Future research should employ longitudinal and qualitative designs, and extend the analysis to multiple townships.

ETHICAL DECLARATION

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (Certificate of Approval No. MU-CIRB 2026/255.0406, approved 4 June 2026), and permission was obtained from township authorities and village leaders. Written informed consent was obtained from all participants before

data collection; participation was voluntary with the right to withdraw at any time, and confidentiality and anonymity were maintained throughout the study.

LIMITATIONS

First, the cross-sectional design precludes causal inference, and temporality cannot be established. Second, all data were self-reported by the same respondent with 12-month recall, so recall error may have inflated the observed associations. Third, the analysis could not account for the two-stage cluster design because village identifiers were not retained in the analytic dataset; sampling weights were not applied, and the sample size calculation omitted a design effect. Fourth, despite expert review and pilot testing, coping instrument's severity weights were not locally elicited, and the aggregate score cannot reveal which coping domains drive the associations. Fifth, FIES results are raw scores without Rasch-model equating. Sixth, residual confounding by unmeasured factors such as wealth and social capital cannot be excluded. Finally, the study was conducted in five villages of one township, limiting generalizability.

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HIGH-SALT FOOD CONSUMPTION BEHAVIOR AMONG MYANMAR MIGRANTS IN SAMUT PRAKAN PROVINCE, THAILAND

Aye Myat Mon[1], Jukkrit Wungrath[1*], Orapin Laosee[1], Syarifah Aqilah[1]
[1]ASEAN Institute for Health Development, Mahidol University, Nakhon Pathom, Thailand
****Corresponding Author:** Jukkrit Wungrath, ASEAN Institute for Health Development, Mahidol University, Thailand,*
E-mail: jukkrit.wun@mahidol.ac.th

ABSTRACT

Introduction: High salt intake is a major modifiable risk factor for hypertension and cardiovascular disease, causing about 1.86 million deaths annually. Average intake in Thailand and Myanmar (9-12 g/day) far exceeds the WHO limit of 5 g/day. Myanmar migrants in Thailand navigate two salt-rich food cultures amid a growing digital food environment, yet determinants of their high-salt food consumption remain unexamined.

Objective: To identify determinants of high-salt food consumption among Myanmar migrants in Samut Prakan Province, Thailand.

Methodology: A cross-sectional survey of 203 Myanmar migrants aged 18-60 years used a structured Burmese-language questionnaire measuring consumption behavior (23 items) and eight determinants: attitude, subjective norms, perceived behavioral control, intention, social media exposure, cultural dietary practice, food accessibility, and salt-related knowledge, plus demographics. Reliability was assessed via Cronbach's α and KR-20. A standard multiple regression examined all determinants and demographics, with multicollinearity and residual diagnostics checked.

Results: Consumption was moderate ($M = 2.78$, $SD = 0.62$). Attitude, subjective norms, perceived behavioral control, cultural dietary practice, and intention correlated weakly to moderately with consumption ($r = 0.15$-0.21, $p < 0.05$). The full model was significant but modest, $F(11,191) = 2.84$, $p = 0.002$, adjusted $R^2 = 0.09$. Only sex ($\beta = -0.18$, $p = 0.011$) and knowledge ($\beta = 0.29$, $p = 0.002$) independently predicted consumption: men reported higher consumption than women, and greater knowledge was unexpectedly linked to higher consumption. Attitude ($\beta = 0.23$, $p = 0.097$) and social media exposure ($\beta = 0.15$, $p = 0.088$) showed marginal associations.

Conclusion: Psychosocial and cultural factors correlated with consumption at the bivariate level but weakened after adjustment; only sex and knowledge remained significant. The positive knowledge-consumption link indicates a knowledge-behavior gap, suggesting information alone is insufficient to change dietary practices. Interventions should address attitudes and the cultural food environment, not just knowledge.

Keywords:
High-Salt Food Consumption; Behavior; Cultural Dietary Practice; Myanmar Migrants; Thailand

INTRODUCTION

Excess dietary sodium is the major modifiable risk factor for raised blood pressure and cardiovascular disease (CVD), and the World Health Organization (WHO) recommends limiting intake to less than 5g of salt per day (1). Global consumption remains roughly double this threshold, and high sodium intake is among the leading dietary risk factors for the global burden of these diseases (2). A nationwide 24-hour urinary sodium study estimated that Thai adults consume about 9.1 g of salt per day, largely from condiments such as fish sauce, soy sauce, shrimp paste, and monosodium glutamate, and from processed and ready-to-eat foods (3). Myanmar reports comparably high intake (4). Spatial analyses have identified Samut Prakan and other Bangkok-metropolitan provinces as high-prevalence hypertension clusters linked to rapid urbanization and industrial concentration (5, 6).

Samut Prakan hosts a large Myanmar migrants workforce employed in manufacturing, logistics, and seafood processing (7). Myanmar dietary traditions feature fermented and dried fish, pickled vegetables, and liberal salty seasoning (8), while the Thai food environment relies heavily on salty condiments, instant noodles, and street food (3). Because both origin and host settings are salt-sensitive, migration is unlikely to reduce sodium exposure, and many instead compound it (3, 8). This is layered with an expanding digital food environment in which social media promotes energy-dense, ultra-processed foods that are typically high in salt (9). Despite widespread awareness of salt-related risks, a persistent gap remains between knowledge and behavior (10, 11).

The Theory of Planned Behavior (TPB) identifies attitude, subjective norm, and perceived behavioral control (PBC), together with intention, as key psychological determinants of health and dietary behavior (12), and these constructs are among the most consistently supported predictors of food-related behavior (13, 14). The classic TPB is specified as a sequence in which intention mediates the effect of attitude, subjective norms, and perceived behavioral control on behavior. The present study did not test this mediational sequence; rather, it drew on the TPB psychological constructs, attitude, subjective norms, PBC, and intention, as direct determinants of high-salt food consumption, to estimate the independent association of each construct with the behavior itself. Because high-salt consumption among migrants is also shaped by contextual factors beyond core cognition, the framework was extended with four context-specific determinants: social media exposure, cultural dietary practice, food accessibility, and knowledge about salt-related health risks. Accordingly, this study examined attitude, subjective norm, PBC, intention, and these extended determinants as parallel correlates of high-salt food consumption behavior among Myanmar migrants in Samut Prakan Province. To date, no study has examined these determinants jointly in this population. This study aimed to identify the determinants of high-salt food consumption behavior among Myanmar migrants in Samut Prakan Province, Thailand.

METHODOLOGY

Study design and participants

This analysis used a cross-sectional design among Myanmar migrants aged 18-60 years residing for at least six months in Mueang Samut Prakan, Bang Bo, and Bang Phli districts of Samut Prakan Province and able to communicate in Burmese. Individuals under dietary restrictions that substantially alter salt intake were excluded. A total of 203 participants were included in the present analysis; with eleven predictors, this sample exceeds the commonly cited minimum of 10-15 cases per predictor for multiple regression.

Instrument and measures

Data were collected through face-to-face, interviewer-assisted administration of a structured questionnaire developed from prior TPB and salt-behavior instruments and translated into Burmese. The seven Likert-Based determinants: attitude, subjective norms, PBC, intention, social media exposure, cultural practice, and food accessibility, were each measured with five 5-point items (1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree), with negatively worded items reverse-scored and averaged to composite scores. Knowledge of salt-related health risks was assessed with five dichotomous (Yes/No) items summed to a 0-5 score. High-Salt food consumption behavior, the outcome, was measured with 23 food-frequency items (1= never to 5= every day) covering seasoning and condiments use, composite dishes, traditional accompaniments, and processed foods, and averaged so that higher scores indicate more frequent high-salt food consumption. Content validity was established through expert review (Item-Objective Congruence).

Data analysis

Internal consistency was assessed using Cronbach's α for Likert Scales and KR-20 for the

dichotomous knowledge items. Descriptive statistics summarized participant characteristics and construct scores, and Pearson correlations examined bivariate associations with the behavior score. A standard (simultaneous) multiple linear regression then modeled the mean high-salt food consumption score on the eight determinants entered together with three sociodemographic covariates (age, length of stay in Thailand, and sex), yielding unstandardized (B) and standardized (β) coefficients. Regression assumptions were checked, including multicollinearity (variance inflation factor, VIF), independence of residuals (Durbin-Watson), and normality of residuals (Shapiro-Wilk). Analyses were performed using IBM SPSS 27; significance was set at $p < 0.05$.

RESULTS

Participant Characteristics

Participants (N = 203) had a mean age of 32.5 years (SD = 9.2, range 18-60) and a mean length of stay in Thailand of 5.9 years (SD = 3.7). Over half of the participants were male (52.2%).

Descriptive statistics, reliability, and correlations

Construct means, standard deviations, reliability, and zero-order correlations with behavior are shown in Table 1. Cultural dietary practice scored highest (M=3.89), and PBC lowest (M=2.62). Reliability was good for attitude (α = 0.89), the 23-item behavior scale (α = 0.90), intention (α = 0.86), cultural dietary practice (α = 0.84), and PBC (α = 0.83); acceptable for social media exposure (α = 0.73) and subjective norm (α = 0.71); and lower for food accessibility (α = 0.62) and knowledge (KR-20 = 0.67). Attitude, subjective norm, PBC, cultural dietary practice, and intention showed small but significant positive correlations with behavior (r = 0.15-0.21), whereas knowledge was uncorrelated (r = -0.00). The demographic covariates were not significantly correlated with behavior bivariately (age r = -0.09, length of stay r = -0.11, sex r = -0.11).

Table 1 Descriptive Statistics, reliability, and correlations with behavior (N= 203)

Construct	Mean	SD	α/ KR-20	R with behavior
Attitude	3.01	1.09	0.89	.21**
Subjective Norm	3.18	0.77	0.71	.15*
Perceived Behavioral Control	2.62	0.87	0.83	.18*
Construct	**Mean**	**SD**	**α/ KR-20**	**R with behavior**
Intention	2.85	0.94	0.86	.17*
Social Media Exposure	3.35	0.66	0.73	.14
Cultural Dietary Practice	3.89	0.88	0.84	.17*
Food Accessibility	2.80	0.54	0.62	.09
Knowledge of salt-related health risks	3.21	1.45	0.67	-.00
High-Salt Food Consumption Behavior	2.78	0.62	.90	_

Determinants of High-Salt Food Consumption Behavior (multiple linear regression)

The overall regression model was statistically significant, $F(11, 191) = 2.84$, $p = 0.002$, ($R^2 = .141$; adjusted $R^2 = .091$), where R^2 indicates the proportion of variation in the dependent variable, high-salt food consumption behavior, that is explained by the independent variables included in the model. Here, the eight determinants and three demographic covariates together explained 14.1% of the variation in high-salt food consumption behavior ($R^2 = .141$). After adjusting for the number of predictors relative to the sample size, the adjusted R^2 was .091, indicating that the model accounted for approximately 9.1% of the variation in the outcome. As shown in Table 2, two predictors were independently significant. Sex was

negatively associated with consumption (B = -0.223, β = -.18, p =.011); because sex was coded 1 = male and 2 = female, this indicates that men reported more frequent high-salt food consumption than women after adjustment. Knowledge of salt-related health risks was the strongest predictor (B = 0.125, β = .29, p = 0.002): higher knowledge scores were associated with more frequent consumption. Attitude (β = .23, p = 0.097) and social media exposure (β = .15, p = 0.088) approached but did not reach significance; subjective norm, PBC, intention, cultural dietary practice, food accessibility, age, and length of stay were non-significant. Several determinants that correlated with behavior individually (Table 1) were not significant once entered together, while knowledge, which is uncorrelated at the bivariate level, became a strong predictor only after adjustment. This pattern is consistent with a possible statistical suppression effect; however, because this interpretation is based on the observed coefficient pattern rather than a formal suppression test, it should be regarded as tentative and requires confirmation in an independent, larger sample. Multicollinearity was within acceptable limits (all VIF ≤ 4.25). The Durbin-Watson statistic was 1.24, and residuals showed a modest departure from normality (Shapiro-Wilk W = .98, p = 0.009), which is unlikely to materially affect estimates at this sample size.

Table 2 Multiple Linear Regression Predicting High-Salt Food Consumption Behavior

Predictor	B	SE	β	t	p	VIF
(Constant)	1.551	0.459	_	3.38	.001	_
Age	-0.006	0.005	-.09	-1.27	.206	1.22
Length of Stay in Thailand	-0.015	0.012	-.09	-1.25	.212	1.14
Sex (1= male, 2 = female)	-0.223	0.086	-.18	-2.58	.011	1.08
Attitude	0.131	0.079	.23	1.67	.097	4.25
Subjective Norm	-0.053	0.084	-.07	-0.63	0.532	2.41
Perceived behavioral control	0.052	0.081	.07	0.64	.520	2.83
Social Media Exposure	0.138	0.081	.15	1.71	.088	1.64
Cultural Dietary Practice	0.090	0.061	.13	1.46	.145	1.68
Food Accessibility	0.083	0.089	.07	0.93	.351	1.35
Knowledge of salt-related health risks	0.125	0.040	.29	3.09	.002	1.95
Intention	0.016	0.077	.02	0.21	.834	3.01

Note. R^2 = .141, adjusted R^2 = .091, F (11, 191) = 2.84, p = .002. Outcome = mean high-salt food consumption behavior (higher = more frequent). Significant predictors (p < .05): sex and knowledge of salt-related health risks.

DISCUSSION

This study examined attitude, subjective norm, perceived behavioral control, intention, and four contextual determinants as direct correlates of high-salt food consumption behavior among Myanmar migrants in Samut Prakan Province. Together, the R^2 value indicates that these independent variables accounted for only a modest share of the variation in the dependent variable, high-salt food consumption behavior (adjusted R^2 =.09). This is consistent with evidence that psychological constructs predict dietary intention more strongly than actual consumption, and that real-world eating is also governed by habits and taste that operate largely outside deliberate control (14, 15). The magnitude of the variation explained here is consistent with the wider Theory of Planned Behavior literature, where TPB constructs typically explain less variation in directly observed behavior than in intention; Armitage and Conner(13) reported that TPB variables account for 27% of variance in behavior versus 39% in intention across 185 studies. Because this

study modeled behavior directly rather than through the classic intention-mediated TPB pathway, and unmeasured influences such as price, taste preference, and habitual cooking practices were not captured, some reduction in explanatory power relative to intention-focused models is expected; the effect that did emerge remains practically relevant for designing targeted interventions. In a working migrant population with established food routines, it is therefore unsurprising that self-reported cognitions account for only part of what people actually eat.

Two determinants stood out. First, men reported more frequent high-salt consumption than women after adjustment, in line with broader evidence that men more often consume processed and high-sodium foods (16). This is practically important because salt-reduction messaging in migrant communities is frequently delivered through maternal and family health services, which reach women more readily than men. Male workers, concentrated in factories, construction, and logistics jobs, may be better reached through workplace-based and occupational-health channels. The fact that sex was unrelated to behavior on its own and emerged only after adjustment indicates that its effect is partly obscured by overlap with the other determinants, and that it deserves explicit attention rather than treatment as a simple background variable.

Second, and notably, knowledge of salt-related health risks was uncorrelated with behavior at the bivariate level but emerged as an unexpected positive predictor in the adjusted model: rather than protecting against high intake, greater knowledge was independently associated with more frequent high-salt food consumption. This pattern mirrors the well-documented knowledge-behavior gap in salt research: national surveys in Malaysia and India show that, despite high awareness of the harms of excess salt, only a minority of adults actively limit their intake (10, 17), and studies in Thailand and China likewise find that salt-related knowledge often coexists with high-risk consumption (11, 18). Several non-mutually exclusive explanations may account for this reversal. Because the cross-sectional design cannot establish temporal order, migrants with heavier salt exposure may simply be more likely to receive health messaging afterward, rather than knowledge preceding and shaping consumption. This reversal may also reflect a broader distinction between general awareness that a behavior is harmful and the actionable, skills-based knowledge needed to change in practice; the present knowledge measure captures only the former. Part of the association may additionally reflect the statistical suppression noted in section 4.3, which should be treated as tentative rather than as evidence that knowledge causally increases consumption. The practical message is clear and consistent with this literature; awareness alone is an insufficient lever for change. Evidence that the effect of knowledge on intake is mediated by intention and shaped by social and economic circumstances (19, 20) reinforces the point: information must be paired with motivation, skills, and supportive conditions if it is to influence what people eat,

Attitude toward high-salt food showed the strongest association among the psychological constructs but reached only borderline significance after adjustment, consistent with evidence that taste-related attitudes are an important driver of salt intake (21). Social media exposure was similarly positive but non-significant, in keeping with research linking food-related digital content to higher consumption of energy-dense, often salty foods (9, 22). Both findings are plausible and worth pursuing in a larger sample, where determinants that here only approached significance may prove reliable. Subjective norm, perceived behavioral control, cultural dietary practice, and intention each correlated with behavior individually but were not independent predictors once entered together, reflecting their shared variance as overlapping facets of a salt-favorable orientation rather than an absence of relevance,

Food accessibility was not an independent predictor of behavior. This null result should be interpreted with care. The food accessibility scale had relatively modest internal consistency, which may have attenuated its association. Equally important, perceived accessibility of cheap, salty food is likely to be near-universally high among migrants living higher than lower consumers. In other words, the absence of an individual-level effect does not imply that access is unimportant; rather, it may reflect a setting in which salty options are uniformly available to almost everyone. Self-reported perceived accessibility also differs from objectively measured availability, and the two need not align. This finding therefore cautions against over-attributing behavior to the food environment based on the measure alone, while leaving open the role of structural availability that a single perceptual scale cannot fully capture.

Taken together, the results fit the migrant context without resting on any single explanation: Myanmar migrants move between two salt-rich food cultures and maintain culturally embedded seasoning and shared-meal practices after relocation (8, 23), patterns associated with elevated dietary risk among Myanmar workers in comparable industrial provinces (7). Within this context, behavior appears to be sustained by a combination of taste, habit, cultural continuity, and demographic patterning rather than by awareness or stated intention.

CONCLUSION

These findings argue for moving beyond information-only campaigns toward multi-component, culturally grounded salt-reduction strategies. Because knowledge did not translate into lower consumption, awareness efforts should be combined with practical, skills-based components: how to season with less salt, how to choose lower-sodium condiments, and delivered in Burmese through the community and digital channels migrants already use. The independent sex difference suggests that male workers warrant targeted engagement through workplace and occupational-health services rather than family-oriented channels alone. Besides, promoting reduced-sodium versions of familiar condiments and dishes offers a complementary approach supported by the wider migrant-diet literature, though this was not tested directly here. Such demand-side and culturally tailored measures, alongside broader efforts to make lower-salt options affordable and available where migrants eat, are more likely than awareness alone to reduce sodium intake and the associated hypertension burden in this high-risk population.

ETHICAL DECLARATION

The study was approved by the Mahidol University Central Institutional Review Board with approval from COA No. MU-CIRB 2026/ 183.2804. Written informed consent was obtained in Burmese; participation was voluntary, and no personal identifiers were recorded.

LIMITATIONS

The cross-sectional design precludes causal inference, and the counterintuitive knowledge result requires confirmation in longitudinal work. Data were self-reported and subject to social-desirability and recall bias, and self-reports tend to underestimate sodium intake when salt is hidden in mixed dishes and condiments (18). The knowledge and food-accessibility scales had modest reliability, which may have weakened their measured associations, and the model's low explained variation indicates that important determinants were not captured.

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INHIBITORY EFFECT OF 2,7-DIHYDROXY-3,4,6-TRIMETHOXY-9,10-DIHYDROPHENANTHRENE ON MIGRATION AND EPITHELIAL-MESENCHYMAL TRANSITION IN NON-SMALL-CELL LUNG CANCER CELLS

Yuhao Xu[1], Boonchoo Sritularak[2], Narumol Bhummaphan[1*]

[1] College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330

[2] Department of Pharmacognosy and Pharmaceutical Botany, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand, 10330

***Corresponding Author**: Narumol Bhummaphan,*

College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, E-mail: Narumol.b@chula.ac.th

ABSTRACT

Introduction: Lung cancer remains the leading cause of cancer-related mortality worldwide, with non-small cell lung cancer (NSCLC) accounting for approximately 85% of all cases. In cancer, epithelial-to-mesenchymal transition (EMT) is the ability to switch from epithelial to mesenchymal behavior and drives metastasis. Despite advances in current therapeutic strategies, metastasis remains a major challenge contributing to poor prognosis and treatment failure. Drug discovery attempts have been made to find potent compounds that will suppress EMT. 2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene is a phenanthrene derivative isolated from the Thai orchid, *Pinalia densa,* which exhibits diverse pharmacological activities. Although this compound has been reported to exhibit cytotoxic activity against some cancer cell types, its effects on NSCLC progression and migration have not been investigated.

Objectives: This study aims to evaluate the cytotoxic and anti-migratory effects of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene in human NSCLC cells and to investigate its effects on migration-related EMT protein expression.

Methodology: Cytotoxicity against A549 cells was assessed using the MTT assay at various concentrations (0-200μM) of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene. Based on the cytotoxicity results, non-cytotoxic concentrations (0, 5, and 10μM) were selected for further evaluation. Cell migration was evaluated using a wound healing (scratch) assay, and wound closure was monitored at 48 and 72 h. Western blot analysis was performed to examine the expression of migration- and EMT-related proteins, including Paxillin, N-cadherin, and Vimentin, with GAPDH used as the loading control. All experiments were performed in triplicate (n = 3).

Results: 2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene exhibited dose-dependent cytotoxicity against A549 cells, with an IC_{50} value of 81.5μM. Treatment with non-cytotoxic concentrations (5 and 10μM) significantly inhibited A549 cell migration in a dose-dependent manner compared with the untreated control. Western blot analysis demonstrated dose-dependent downregulation of migration- and EMT-related proteins. At 10μM, the compound reduced the expression of Vimentin, N-cadherin, and Paxillin by approximately 50%, 20%, and 25%, respectively, relative to the untreated control (n = 3).

Conclusion: 2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene inhibited the migration of A549 NSCLC cells and reduced the expression of the migration-associated EMT markers. These findings provide evidence of the anti-migratory activity of this phenanthrene derivative in NSCLC cells and support its potential for further investigation as a natural product-derived therapeutic candidate for lung cancer.

Keywords:

NSCLC; Cell Migration; Epithelial-To-Mesenchymal Transition; Phenanthrene Derivative; Pinalia Densa

INTRODUCTION

Lung cancer remains one of the most frequently diagnosed malignancies and the leading cause of cancer-related mortality worldwide, accounting for approximately 2.5 million new cases and 1.8 million deaths in 2022 (1). Among all lung cancer cases, non-small cell lung cancer (NSCLC) accounts for approximately 85%, representing the major histological subtype of the disease (2). Despite advances in surgery, chemotherapy, radiotherapy, targeted therapy, and immunotherapy, the prognosis of patients with advanced NSCLC remains poor, largely due to tumor metastasis and therapeutic resistance (3).

Metastasis is a complex multistep process that enables cancer cells to disseminate from the primary tumor and establish secondary tumors at distant sites (4). One of the key biological mechanisms involved in cancer metastasis is epithelial-to-mesenchymal transition (EMT), a process in which epithelial cells lose their cell-cell adhesion properties and acquire a mesenchymal phenotype with enhanced migratory and invasive capabilities (5). During EMT, the expression of epithelial markers is reduced, while mesenchymal markers such as N-cadherin and Vimentin are upregulated (6). In addition, migration-related proteins, including Paxillin, play important roles in focal adhesion dynamics and cell motility, contributing to cancer progression and metastasis (7).

2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene is a phenanthrene derivative isolated from the Thai orchid *Pinalia densa*, which has been reported to exhibit cytotoxic activity against several cancer cell types, indicating its potential bioactivity (8). However, its effects on NSCLC, particularly on cell migration and EMT-related mechanisms, remain unclear. Therefore, this study aims to investigate its cytotoxic and anti-migratory effects in A549 cells.

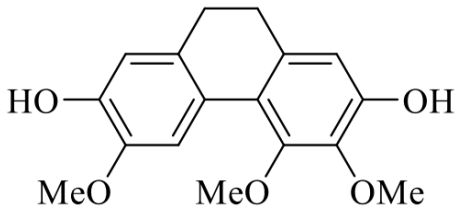

Figure 1. Structure of 2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene (8).

METHODOLOGY

Cell culture

Human non-small cell lung cancer A549 cells were cultured in DMEM supplemented with 10% fetal bovine serum and 1% penicillin-streptomycin. Cells were maintained at 37°C in a humidified atmosphere with 5% CO_2 and routinely subcultured using trypsin-EDTA.

Plant material and compound preparation

2,7-Dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene was kindly provided by the Department of Pharmacognosy and Pharmaceutical Botany, Chulalongkorn University (>98% purity). The compound was dissolved in DMSO and used at the indicated concentrations in the culture medium.

Cell viability assay

Cell viability was assessed using the MTT assay. A549 cells were treated with different concentrations of the compound for 48 h. MTT reagent was then added, and formazan crystals were dissolved in DMSO. Absorbance was measured at 570 nm, and cell viability was calculated relative to the untreated control.

Cell migration assay

Cell migration was evaluated using a wound healing assay. A confluent A549 monolayer was scratched using a sterile pipette tip and washed with PBS to remove detached cells. Cells were then incubated with a culture

medium containing the compound. Images were captured at 0 h and subsequent time points, and migration was quantified by measuring wound width reduction using ImageJ software.

Western blot analysis

Cells were lysed in RIPA buffer containing protease inhibitors, and protein concentration was determined using a BCA assay. Equal amounts of protein were separated by SDS-PAGE and transferred onto PVDF membranes. Membranes were incubated with primary antibodies against Paxillin, N-cadherin, and Vimentin, followed by HRP-conjugated secondary antibodies. Protein bands were detected using an ECL system and quantified using ImageJ, with GAPDH as the loading control.

Statistical Analysis

All data are presented as mean ± standard deviation (SD) from three independent experiments (n = 3). Statistical analysis was performed using GraphPad Prism. Data were analyzed using unpaired t-tests under the assumption of a normal (Gaussian) distribution and equal variances between groups. Each treatment concentration was compared separately with the untreated control group. A p-value < 0.05 was considered statistically significant.

RESULTS

The cytotoxic effect of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on A549 cells was evaluated using the MTT assay after 48 h of treatment. As shown in Figure 2, the compound reduced A549 cell viability in a concentration-dependent manner. A marked decrease in cell viability was observed at concentrations of 100 and 200μM, and the calculated IC_{50} value was 81.5μM, indicating moderate cytotoxic activity against NSCLC cells.

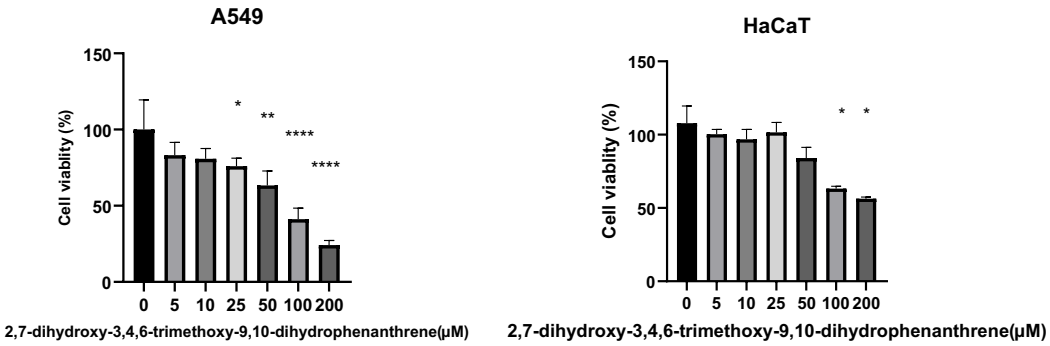

Figure 2. Effects of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on cell viability of A549 and HaCaT cells after 48 h treatment. A549 and HaCaT cells were treated with the indicated concentrations of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene for 48 h, and cell viability was determined using the MTT assay. Data are presented as the mean ± SD of three independent experiments (n = 3). Statistical significance was determined using an unpaired t-test. P < 0.05 was considered statistically significant.

To assess its toxicity toward normal cells, HaCaT cells were treated under the same conditions. The compound exhibited substantially lower cytotoxicity in HaCaT cells, with cell viability remaining above 50% even at the highest tested concentration (200μM). The estimated IC_{50} value was therefore greater than 200μM. These findings suggest that 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene exhibits selective cytotoxicity toward A549 cancer cells compared with normal cells.

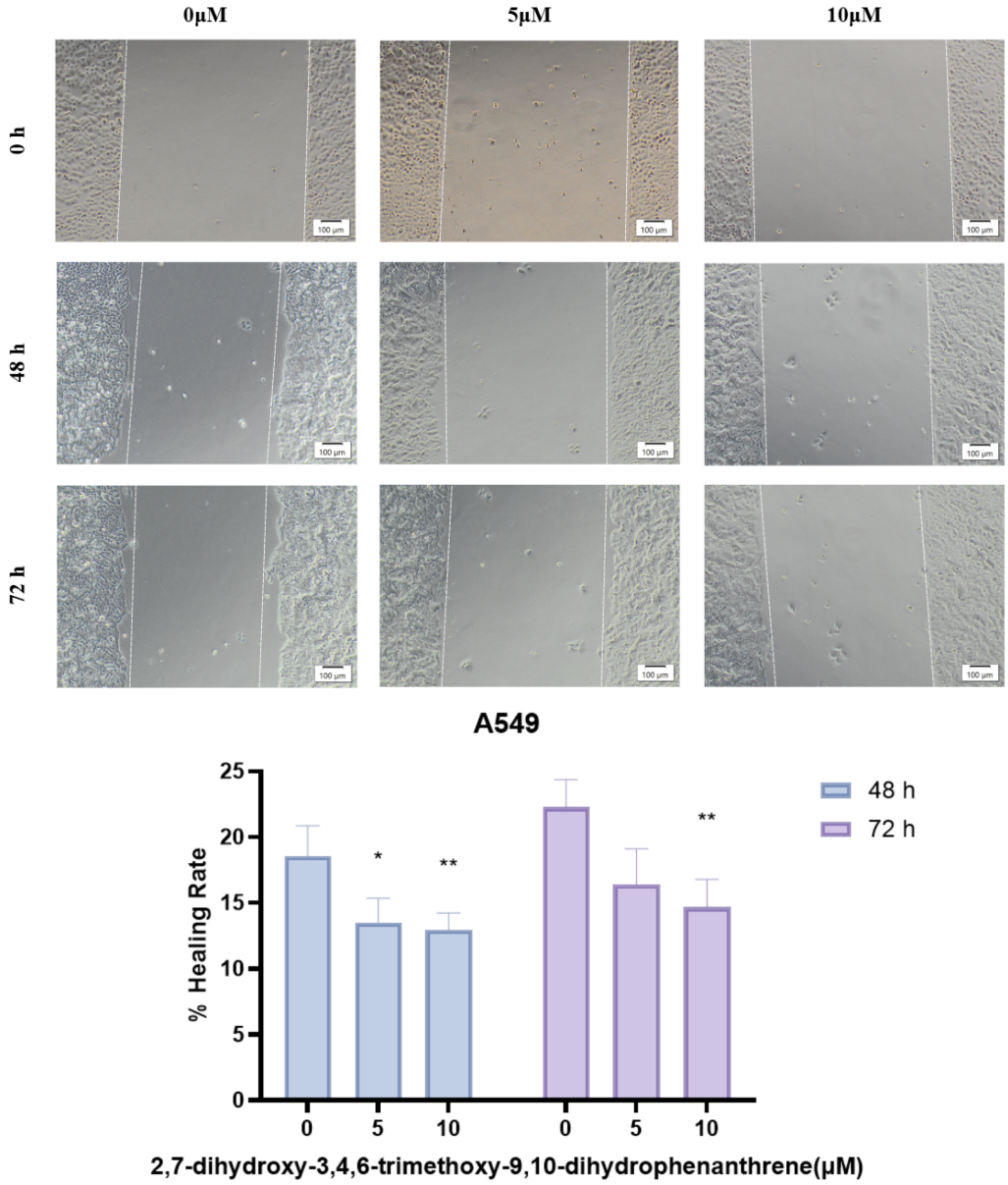

Figure 3. Inhibitory effect of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on A549 cell migration. Representative images of wound closure in A549 cells treated with 0, 5, and 10μM 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene at 0, 48, and 72 h are shown (upper panel). Quantitative analysis of the wound healing rate is presented in the lower panel. Data are expressed as the mean ± SD of three independent experiments (n = 3). Statistical significance was determined using an unpaired t-test. $P < 0.05$ was considered statistically significant.

The effect of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on A549 cell migration was evaluated using a wound healing assay. As shown in Figure 3, treatment with the compound reduced wound closure compared with the untreated control at both 48 and 72 h. Cells treated with 5 and 10μM exhibited lower wound healing rates than the control group, supporting a potential inhibitory effect on A549 cell migration, although the contribution of cell proliferation to wound closure cannot be completely excluded. The reduction in wound closure was maintained throughout the observation period and showed a concentration-dependent trend.

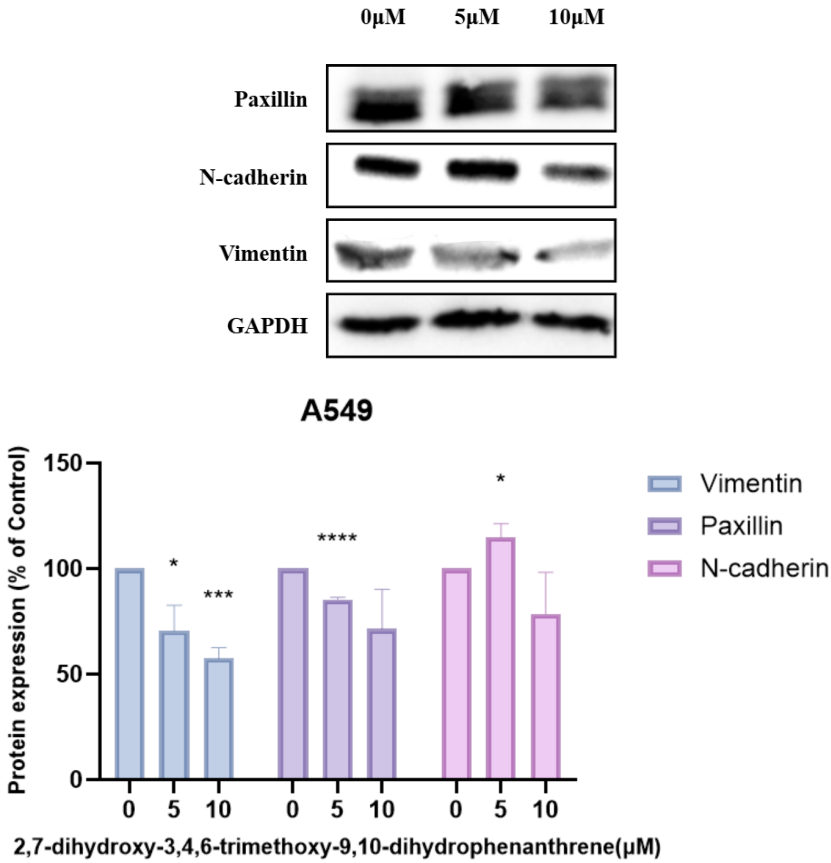

Figure 4. Effects of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on migration- and EMT-related protein expression in A549 cells. Representative western blot images of Paxillin, N-cadherin, and Vimentin are shown in the upper panel, with GAPDH used as the loading control. Quantitative densitometric analysis of protein expression is presented in the lower panel. Protein expression levels were normalized to GAPDH and expressed relative to the untreated control. Data are presented as the mean ± SD of three independent experiments (n = 3). Statistical significance was determined using an unpaired t-test. $P < 0.05$ was considered statistically significant.

The effects of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene on migration- and EMT-related protein expression were evaluated by Western blot analysis. As shown in Figure 4, treatment with the compound reduced the expression of Paxillin, N-cadherin, and Vimentin compared with the untreated control. At 10μM, Vimentin expression was reduced by approximately 50%, while Paxillin and N-cadherin expression decreased by approximately 25% and 20%, respectively. The reduction in Vimentin expression was the most pronounced among the proteins examined. These findings suggest that the compound is associated with the downregulation of migration- and EMT-related proteins.

DISCUSSION

The present study demonstrated that 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene exhibited selective cytotoxicity against A549 cells while showing lower cytotoxicity toward HaCaT cells. In addition, the compound significantly reduced wound closure in A549 cells at non-cytotoxic concentrations, supporting a potential inhibitory effect on cell migration.

Western blot analysis showed that treatment with the compound decreased the expression of Vimentin, N-cadherin, and Paxillin. Vimentin and N-cadherin are key mesenchymal markers associated with EMT, whereas Paxillin plays an important role in focal adhesion and cell motility (5-7). The observed anti-migratory effect

was associated with the downregulation of these migration- and EMT-related proteins. However, because wound closure in a scratch assay can be influenced by both cell migration and proliferation, the contribution of altered cell proliferation to the observed reduction in wound closure cannot be completely excluded. Although the findings are limited to an in vitro model, this study provides additional evidence supporting the potential of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene as a natural product-derived candidate for NSCLC therapy.

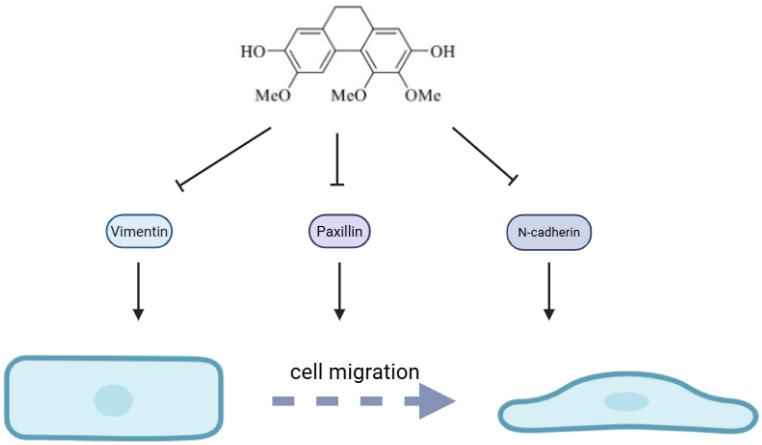

Figure 5. Proposed association between 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene and migration- and EMT-related proteins.

CONCLUSION

This study demonstrated that 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene exhibited selective cytotoxicity against A549 NSCLC cells while showing lower cytotoxicity toward HaCaT cells. The compound also reduced wound closure in A549 cells at non-cytotoxic concentrations and decreased the expression of migration- and EMT-related proteins, including Paxillin, N-cadherin, and Vimentin. These findings suggest a potential association between the compound and the regulation of migration- and EMT-related proteins. However, the underlying molecular mechanisms remain to be further investigated. Overall, this study supports the potential of 2,7-dihydroxy-3,4,6-trimethoxy-9,10-dihydrophenanthrene as a promising natural product-derived candidate for further investigation in the treatment of NSCLC.

ETHICAL DECLARATION

This study involved in vitro experiments using established human cell lines, A549 and HaCaT, and did not involve human participants, human subjects, or identifiable personal data. Therefore, ethical approval for human participant research was not applicable to this study.

LIMITATIONS

This study has some limitations that should be considered. The experiments were conducted using only one NSCLC cell line, A549, which may not fully represent the biological characteristics or responses of other NSCLC subtypes. In addition, the study was limited to an in vitro experimental model, and the observed anti-migratory effects have not yet been confirmed in vivo. Further studies using additional NSCLC cell lines and appropriate in vivo models are therefore needed to validate these findings and further clarify the underlying mechanisms of the compound.

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ORAL HEALTH CONDITIONS AMONG INCARCERATED INDIVIDUALS WITH AND WITHOUT TYPE 2 DIABETES MELLITUS: A CROSS-SECTIONAL STUDY

Su Myat Noe[1], Oranart Matangkasombut[2], Thantrira Porntaveetus[1,3]*

[1]Geriatric Dentistry and Special Patients Care (International Program), Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, 10330

[2]Department of Microbiology and Center of Excellence on Oral Microbiology and Immunology, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, 10330

[3]Department of Physiology and Center of Excellence in Precision Medicine and Digital Health, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, 10330

***Corresponding Author:** Thantrira Porntaveetus, Center of Excellence in Precision Medicine and Digital Health, Department of Physiology, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand, 10330. E-mail: Thantrira.P@chula.ac.th*

ABSTRACT

Introduction: Incarcerated populations experience profound oral health disparities driven by limited healthcare access, socioeconomic disadvantage, and inadequate preventive care. While type 2 diabetes mellitus (T2DM) is recognized as an amplifier of oral diseases, particularly periodontal inflammation, the compounded impact of T2DM on the overarching effects of the correctional environment on oral health outcomes remains poorly understood.

Objectives: To evaluate oral hygiene, caries experience, and periodontal health among male inmates with and without T2DM.

Methodology: A cross-sectional study was conducted among incarcerated men at a maximum-security correctional facility in Thailand. Thirty age-matched participants were recruited by purposive sampling, comprising a T2DM group (n=15) identified via medical records and a non-diabetic control group (n=15). Assessments included comprehensive questionnaires detailing sociodemographic data, medical history, and behavioral risk factors. Clinical examinations quantified the Oral Hygiene Index-Simplified (OHI-S), number of decayed teeth, and bleeding on probing (BOP). Data were analyzed utilizing non-parametric statistics (Mann-Whitney U, Pearson Chi-Square, and Fisher's Exact tests).

Results: The cohort is composed entirely of males with comparable age distributions (T2DM: median 60 [IQR 46–63]; non-diabetic: 57 [IQR 43–59] years, p=0.389) and predominantly with low education level (≤secondary education) (93.3% vs 80.0%, p=0.598). The T2DM group exhibited a significantly higher burden of systemic comorbidities, notably hypertension (73.3% vs 13.3%, p<0.001), whereas the non-diabetic group reported a significantly higher history of illicit drug use (66.7% vs. 20.0%, p=0.010). Crucially, clinical metrics revealed severe, uniform oral health degradation across both groups. No significant differences were observed in OHI-S scores (3.8 vs. 3.2, p=0.412) or decayed teeth (median 1 [IQR 0–2] vs. 1 [IQR 0–4], p=0.653). Strikingly, gingival inflammation was ubiquitous: the median percentage of BOP sites was 100% [IQR 100%–100%] in the T2DM group and 100% [IQR 60%–100%] in non-diabetics (p=0.126).

Conclusion: Poor oral hygiene and pervasive gingival inflammation were observed among these incarcerated men, with no statistically significant differences observed between the T2DM and non-diabetic groups within this sample. Despite the limitations of a small sample size and cross-sectional design, these findings underscore the need for targeted medical-dental interventions, including routine oral health screenings and preventive care within correctional settings, to inform broader health policies for this marginalized population.

Keywords:

Oral Health; Caries; Type 2 Diabetes Mellitus; Healthcare Access; Incarcerated Population

INTRODUCTION

Incarcerated individuals represent a marginalized population that experiences significant health disparities, particularly regarding the burden of Non-Communicable Diseases (NCDs) (1, 2). Globally, the prison population has reached 11.7 million (3), and evidence suggests that these individuals carry a disproportionate prevalence of NCD risk factors compared to the general public (1, 2). Alongside systemic health issues, research consistently demonstrates that incarcerated individuals have higher rates of dental caries, periodontal disease, and tooth loss than community-dwelling counterparts (4, 5), with these disparities compounded by behavioral risk factors prevalent within correctional environments (6, 7). Recent meta-analyses further quantify this issue, reporting that the prevalence of dental caries among inmates in developing regions can reach 78.42% (6). This burden of disease is driven by environmental and behavioral risk factors inherent to correctional facilities, including inadequate access to routine dental care, high-sugar diets, restricted oral hygiene resources, and a history of tobacco and illicit drug use (6-9). Consequently, the correctional setting itself acts as a major determinant of oral health decline (5).

Concurrently, Type 2 Diabetes Mellitus (T2DM) is a major global public health challenge. In 2024, diabetes affected an estimated 11.11% of the global adult population, corresponding to 589 million individuals (10). This prevalence is rapidly escalating in Southeast Asia, including Thailand, where Previous Thai National Health Examination Surveys (NHES) have shown that the diabetes prevalence in Thailand has significantly risen over the past decade, from 7.0% in 2004 to 9.7% in 2014 (11). According to research, there is a well-established relationship between diabetes and oral health, with each potentially affecting the other (12, 13). Hyperglycemia facilitates a favorable environment for the proliferation of pathogenic oral bacteria, resulting in oral microbiome dysbiosis, which may lead to severe dental caries and significant periodontal tissue destruction (12).

While the detrimental effects of both the prison environment and T2DM on oral health are well-documented independently, their concurrent impact remains poorly understood. Recent literature highlights the negative impact of previous incarceration on the oral health of older adults with diabetes in the community (14); however, there is a critical lack of clinical data examining currently incarcerated populations managing metabolic diseases, and studies focusing specifically on those with T2DM are still limited. Therefore, this study aimed to evaluate oral hygiene, caries experience, and periodontal health among male inmates with and without T2DM.

METHODOLOGY

Study design, participants and setting

This cross-sectional study was conducted among male inmates with and without type 2 diabetes mellitus (T2DM) at Bang Kwang Central Prison, Nonthaburi, Thailand. Thirty male inmates were enrolled in the study. Using a purposive sampling approach, the sample was divided into two groups comprising 15 participants each. The T2DM group was identified through prison medical records based on a confirmed diagnosis of type 2 diabetes mellitus and the non-diabetic control group was also verified via medical record review and matched by approximate age range. To be eligible for the T2DM cohort, participants were required to have a documented, medically confirmed diagnosis of T2DM within the prison medical records. Control participants were selected based on a confirmed absence of diabetes and were age-matched to the T2DM group to ensure a comparable age distribution. Individuals were excluded from the study if they had severe medical conditions such as cognitive impairment, active mental disorder, and those who refuse or cannot receive an oral examination or were unwilling to provide informed consent.

Data collection

Data collection comprised a review of prison medical records, self-reported

questionnaires, and clinical oral examinations. Relevant clinical information, including verification of T2DM status and medical history, was retrieved from the prison electronic database. A structured questionnaire was administered to assess participant behaviors, including smoking history, alcohol consumption, history of illicit drug use, and oral health practices.

Oral examination

The clinical oral examination consisted of three diagnostic indices: the number of decayed teeth, the Simplified Oral Hygiene Index (OHI-S), and Bleeding on Probing (BOP). Dental caries experience was assessed by recording the number of visually decayed teeth following the World Health Organization (WHO) (15). Oral hygiene status was evaluated using the OHI-S by Greene and Vermillion (1964) (16), assessing the six index tooth surfaces (16, 11, 26, 36, 31 and 46) for debris and calculus. The OHI-S scores range from 0 to 6 and are clinically classified as Good (0.0-1.2), Fair (1.3-3.0), or Poor (3.1-6.0) oral hygiene. Periodontal inflammation was determined by bleeding on probing (BOP) (17) to assess the extent of gingival bleeding and inflammation, recorded as the percentage of bleeding sites with a WHO periodontal probe using a weight of 20g. All clinical examinations were performed by two calibrated dentists from the research team who underwent pre-study calibration on three non-study volunteers outside the facility. Inter-examiner reliability demonstrated excellent agreement, with Kappa values ranging from 0.89 to 0.97 for all clinical metrics.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics Version 29.0. The normality of continuous variables was assessed using the Shapiro-Wilk test. As the data were non-normally distributed, non-parametric statistics were utilized for all group comparisons. Continuous variables are presented as medians with interquartile range (IQR), and differences between groups were analyzed with the Mann-Whitney U test. Descriptive statistics included frequencies and percentages for categorical variables, which were compared using the Pearson Chi-Square test or Fisher's Exact test where appropriate. Statistical significance was set at $p<0.05$.

RESULTS

A total of 30 male inmates successfully completed the study, distributed equally into inmates with type 2 diabetes mellitus (n=15) and a non-diabetic control group (n=15). The median age of the T2DM group was 60 years [IQR 46–63], and non-diabetic inmates showed a median age of 57 years [IQR 43–59]. Participants had a predominantly low education level (≤secondary education), with 93.3% (n=14) of T2DM patients and 80% (n=12) of non-diabetic inmates. Inmates with T2DM presented with a higher systemic comorbidity burden compared to their non-diabetic counterparts. Notably, a diagnosis of hypertension was documented in 73.3% (n=11) of the T2DM group versus merely 13.3% (n=2) of the non-diabetic group ($p<0.001$). Dyslipidemia and other systemic conditions were exclusively observed within the diabetic group (26.7% vs. 0% for both, $p=0.100$). Conversely, the non-diabetic group reported a significantly higher history of illicit drug use compared to the T2DM group (66.7% vs. 20.0%, $p=0.010$). No statistically significant differences were observed concerning smoking history ($p=0.256$) or alcohol drinking ($p=0.700$). Regarding oral health behaviors, the group displayed statistical homogeneity. Over half of the diabetic cohort (53.3%) reported never or rarely visiting a dentist within the last two years, compared to 40.0% of the non-diabetic controls ($p=0.464$). Daily toothbrushing frequencies were also statistically comparable between the two groups ($p=0.700$) (Table 1).

Table 1 Characteristics of the study population

Variable	T2DM Inmates (n=15)	Non-DM Inmates (n=15)	*p*-value
	Median [IQR]	Median [IQR]	
Socio-demographics			
Age (years)	60 [46–63]	57 [43–59]	0.389
Education level			0.598
Low Education (≤Secondary education)	14 (93.3%)	12 (80.0%)	
High Education (>Secondary education)	1(6.7%)	3 (20.0%)	
Smoking			0.256
Never	7 (46.7%)	4 (26.7%)	
Ever/Ex-smoker	8 (53.3%)	11 (73.3%)	
Drug use			**0.010**
Never	12 (80.0%)	5 (33.3%)	
Ever	3 (20.0%)	10 (66.7%)	
Alcohol drinking			0.700
Never	6 (40.0%)	4 (26.7%)	
Ever	9 (60.0%)	11 (73.3%)	
Oral health behaviors			
Last dental visit			0.464
Within 2 years	7 (46.7%)	9 (60.0%)	
Never/Rare	8 (53.3%)	6 (40.0%)	
Toothbrushing frequency			0.700
1-2 times/day	11 (73.3%)	9 (60.0%)	
> 2 times/day	4 (26.7%)	6 (40.0%)	
Systemic conditions			
Hypertension			**<0.001**
Yes	11 (73.3%)	2 (13.3%)	
No	4 (26.7%)	13 (86.7%)	
Dyslipidemia			0.100
Yes	4 (26.7%)	0 (0.0%)	
No	11 (73.3%)	15 (100.0%)	
Other Diseases			0.100
Yes	4 (26.7%)	0 (0.0%)	
No	11 (73.3%)	15 (100.0%)	

Notes: Data are presented as n (%) for categorical variables and Median [IQR 25th –75th percentiles] for continuous variables. *p*-values were calculated using the Mann–Whitney U test for continuous variables, and Pearson Chi-Square test or Fisher's exact test for categorical variables. Bold values indicate statistical significance ($p < 0.05$).

With regard to clinical oral metrics, T2DM inmates exhibited a median OHI-S score of 3.8 [IQR 2.8-4.6], whereas the non-diabetic controls presented a median score of 3.2 [IQR 2.2-4.2], demonstrating no statistically significant difference between groups (*p*=0.412) (Table 2). Similarly, active dental caries experience was comparable between groups; the median number of decayed teeth stood at 1 [IQR 0-2] in the diabetic group and 1 [IQR 0-4] among the controls (*p*=0.653). The evaluation of gingival inflammation revealed a median bleeding on probing (BOP) value of 100% [IQR 100%–100%] for the T2DM group and 100% [IQR 60%–100%] for the non-diabetics (*p*=0.126) (Table 2).

Table 2 Clinical oral health comparisons between T2DM and Non-Diabetic Inmates

Variable	T2DM Inmates (n=15)	Non-DM Inmates (n=15)	*p*-value
	Median [IQR]	Median [IQR]	
Oral hygiene			
OHI-S Score	3.8 [2.8-4.6]	3.2 [2.2-4.2]	0.412
Dental status			
Number of Decayed teeth	1 [0-2]	1 [0-4]	0.653
Bleeding on Probing (BOP) %			
BOP (%)	100% [100%-100%]	100% [60%-100%]	0.126

Notes: Data are presented as n (%) for categorical variables and Median [IQR 25th –75th percentiles] for continuous variables. *p*-values were calculated using the Mann–Whitney U test for continuous variables, and the Pearson Chi-Square test or Fisher's exact test for categorical variables. Bold values indicate statistical significance ($p < 0.05$).

DISCUSSION

The present study compared the clinical oral health status of incarcerated men with Type 2 Diabetes Mellitus (T2DM) to a non-diabetic control group. Globally, it is well-documented that incarcerated populations suffer from profound oral health disparities, exhibiting significantly worse oral hygiene, higher rates of dental caries, and more severe periodontal disease compared to the general population (4). Consistent with this global trend, our clinical metrics revealed a uniform and significant degradation of oral health across our entire sample, characterized by ubiquitous gingival inflammation (100% BOP) and high Oral Hygiene Index-Simplified (OHI-S) scores. Interestingly, these clinical outcomes were comparable between both T2DM and non-diabetic groups, with no statistically significant differences observed within the current sample. However, given the small sample size, the study is likely underpowered to detect subtle differences between the groups. The clinically striking observation of 100% median BOP across both groups is consistent with their poor OHI-S scores. This suggests that the generalized gingival inflammation observed in this population may be largely attributable to plaque, calculus, and debris accumulation. Ultimately, these findings may reflect inadequate daily oral hygiene practices, compounded by limited access to routine dental or periodontal care and other contextual challenges within the correctional environment. In the general population, the literature dictates that poorly controlled diabetes significantly exacerbates gingival inflammation and periodontal tissue destruction (12, 13). Conversely, the relationship between T2DM and dental caries is more highly debated; for instance, recent case-control studies have found no association between T2DM and increased caries prevalence (18), and in some cases, diabetics exhibit fewer decayed teeth than healthy controls (19). Furthermore, it was expected that the diabetic cohort would demonstrate significantly worse gingival metrics, as widespread Bleeding on Probing (BOP) is a well-established clinical predictor for the progression of severe periodontal destruction (17). However, under the conditions of this correctional setting, anticipated diabetes-related differences in oral disease severity may have been attenuated or undetectable within this current sample.

It is also crucial to examine the competing behavioral risk factors prevalent in incarcerated populations, particularly substance abuse. In our study, the non-diabetic control group reported a significantly higher history of illicit drug use prior to incarceration compared to the T2DM group (66.7% vs. 20.0%, p=0.010). The literature establishes that illicit drug abuse is a major risk factor for rampant dental caries and severe periodontal destruction, often leading to highly neglected oral hygiene and progressive oral tissue damage (9, 20). Therefore, the markedly higher prevalence of illicit drug use

among the non-diabetic inmates may have acted as a potential confounding factor by adversely affecting oral health independently of diabetes status. Consequently, this imbalance may have attenuated potential differences in oral health outcomes between the study groups, contributing to the comparable clinical findings observed in the present study.

Our findings also align with existing epidemiological data regarding systemic comorbidities and healthcare access in prisons. Hypertension was observed in 73.3% of the T2DM group, which is consistent with literature identifying hypertension as a highly prevalent comorbidity alongside T2DM, particularly in Southeast Asian populations (21). Moreover, the stressful nature of the prison environment itself is known to further elevate cardiovascular and metabolic risks (22). With regard to oral health behaviors, over half of the diabetic cohort (53.3%) and 40% of the controls reported rarely or never visiting a dentist in the past two years. This supports global reports highlighting significant barriers to dental care access within the justice system, where treatment is often restricted to emergency extractions due to pain, rather than preventive procedures (23).

In summary, the uniformly poor oral health observed across all participants highlights a severe and pervasive burden of disease among these inmates. Since untreated oral conditions can exacerbate systemic diseases, cause persistent pain, and hinder an individual's successful reintegration into society upon release, a shift in correctional healthcare policy is necessary. Relying solely on targeted dental care for medically high-risk groups is insufficient for this population.

CONCLUSION

This study demonstrates a high prevalence of poor oral hygiene and oral health among incarcerated men, with no significant difference detected by T2DM status in this current sample. Therefore, we encourage the implementation of universal, integrated medical-dental care through routine oral health screening upon prison entry, regular dental examinations throughout incarceration, oral health education and prevention, integration of smoking and substance-use cessation programs, and incorporation of dental services within chronic disease management plans to support the overall health and rehabilitation of all incarcerated individuals.

ETHICAL DECLARATION

Ethical approval was obtained from the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HREC-DCU 2025-118) and written informed consent was obtained before the study was performed. Participation was voluntary; participants were informed of their right to withdraw at any time without affecting their legal status or access to medical or dental care, and participant confidentiality was maintained throughout the study.

LIMITATIONS

While the findings of this study provide critical insights into the oral health of incarcerated individuals, they must be interpreted within the context of certain limitations. Primarily, the study is of a cross-sectional design, and this limits the ability to establish the relationships or draw definitive causal inferences. Furthermore, the small sample size (n=30) substantially limits the statistical power of this study and increases the risk of Type II error. Therefore, the absence of statistically significant differences should be interpreted cautiously, as true differences may not have been detected within this current sample. In addition, the absence of key diabetes-related information—including HbA1c levels, disease duration, antidiabetic medication use, and glycemic control status—limits our ability to fully interpret the potential influence of metabolic status on oral health outcomes. Therefore, future studies should incorporate these metabolic biomarkers to better assess diabetes-related oral health effects within this population. Moreover, periodontal evaluation was restricted to Bleeding

on Probing (BOP); incorporating comprehensive clinical parameters such as probing depth, clinical attachment loss, radiographic bone loss, and periodontal staging would provide a more complete characterization of periodontal health. In addition, conducting the study at a single maximum-security correctional facility and including only male inmates may restrict the generalizability of the results to other incarcerated populations, such as female inmates, juvenile detention centers, minimum-security prisons, or community correctional programs. Given these constraints, it would be interesting to further examine the relationship between T2DM and oral health in prison populations using a larger, multi-center longitudinal cohort to better understand disease progression in this environment.

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SPORTS HABITS AND SPORTS INJURIES ASSOCIATED WITH CHRONIC PAIN AMONG UNIVERSITY OF PHYSICAL EDUCATION AND SPORTS STUDENTS IN BEIJING, CHINA

Li Jiameng[1*] and Pokkate Wongsasuluk[1,2*]

1 College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

2 Excellent Center for Health and Social Sciences and Addiction Research, Thailand

****Corresponding Author**: Pokkate Wongsasuluk, College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand, E-mail: pokkate.w@chula.ac.th*

ABSTRACT

Introduction: Chronic pain is a prevalent global public health problem. Against the backdrop of China's "Healthy China" strategy, sports students face a higher risk of sports injuries and chronic pain owing to long-term, high-intensity, and frequent specialized training. There remains limited understanding of the factors associated with chronic pain related to sports habits among university sports students.

Objectives: This study aims to explore the correlation and association of sports habits, sports injuries, and chronic pain among sports university students in Beijing.

Methodology: This cross-sectional study adopted an online questionnaire and recruited participants via convenience sampling from the Capital University of Physical Education and Sports in Beijing. The questionnaire covered social demographics, study factors, sport injury, sport history, sport hobbies, and chronic pain. Chronic pain was assessed using the 45 Body Area Rating Scale (BARS-45). Descriptive statistics, Mann-Whitney U test, and Chi-square Test were used to find the associated factors.

Results: A total of 424 participants from grades 1 to 4 at the Capital University of Physical Education and Sports in Beijing, China, who had a specialized sport, were recruited. Of these, 305 (71.9%) participants were male and 119 (28.1%) were female. The result of chronic pain score showed a mean ± SD of 36.51 ± 7.60; 203 (47.9%) participants had a high chronic pain score. The Mann-Whitney U test found that age, weight, and height did not have a significant impact on chronic pain. The Chi-square Test results showed that the significant associated factors for high chronic pain levels included sex, family's monthly income, part-time work, study faculty, number of specialized sports, type of major specialized sport, injury times, surgery history, duration of chronic pain, seeking medical care, external interference treatments, number of learned sports in the past, type of major learned sport, type of major sports for hobby, and playing frequency of major sport for hobby.

Conclusion: Male, high family monthly income, high part-time work, students not from the Sports Training Faculty, a high number of sports, major specialized sport is table tennis, high injury times, have surgery, long duration of chronic pain, not seeking medical care, not receiving external interference treatments, a high number of learned sports in the past, major learned sport is table tennis, and major sports for hobby is table tennis have significantly higher chronic pain. These findings provide critical insights for the Beijing municipal government, health authorities, medical service systems, social organizations, and other relevant institutions.

Keywords:

Chronic Pain; Injuries; Sports; Student; China

INTRODUCTION

According to the World Health Organization (2022), chronic pain refers to persistent or recurrent pain lasting more than 3 months, affecting approximately one-third of the global population (1). Chronic pain is reclassified into primary and secondary types (2). Regular physical activity can effectively reduce pain severity and prevent the occurrence of chronic pain (3). Appropriate exercise can stimulate

endorphin secretion, improve neuroinflammation, enhance muscle strength and joint stability, thereby relieving pain (4). However, excessive exercise intensity, unreasonable training load, and incomplete recovery will significantly increase the risk of acute and chronic musculoskeletal injuries (5). Once an acute injury such as muscle strain or joint sprain occurs, if it lacks timely and standardized treatment, it will easily induce persistent local tissue inflammation and abnormal joint mechanical structure, eventually leading to the transformation from acute pain to chronic pain (6).

The frequency of high-intensity sports activities is the most closely associated indicator of sports injuries (7). Musculoskeletal injuries are common types of sports injuries among students majoring in sports (8). The high-incidence injury sites are concentrated on parts with high physical load such as the shoulders, elbows, and knee joints (9). Chronic sports injuries have an insidious onset and high recurrence rate, causing continuous troubles for students in terms of training and future career development (10). In addition, many sports students regard pain and injury as an inevitable part of training, forming a cognitive attitude of "living with pain," which makes them ignore early pain signals and delay intervention (11). Although chronic pain is prevalent among young adults, current research lacks an in-depth understanding of the specific mechanisms, manifestations, and coping strategies of chronic pain in the student population (12). Therefore, this study aims to investigate the current level and distribution of chronic pain and systematically explore the associations between social demographics, study factors, sports habits, sports injury history, and chronic pain.

METHODOLOGY

Study Area and Population

This quantitative cross-sectional study recruited undergraduate sport students from the Capital University of Physical Education and Sports in Beijing, China. Inclusion criteria were aged ≥18 years, enrolled at the university with a specialized sport, having sustained at least one sports-related injury and pain within the past 3 months, and able to complete the online questionnaire. Exclusion criteria included ongoing mental health treatment, leave of absence exceeding one month, surgery in the previous 6 months, and accidents, illnesses, or chronic pain unrelated to sports injury.

Sampling Technique

The population consisted of 2,748 students. Cochran's formula was used to calculate the sample size: $n=Z^2P(1-P)/e^2$. The minimum sample size was 385 students. This study added 10% to the sample size to account for missing data. Finally, the total number of subjects was 424 students.

The data were collected through an online questionnaire by convenient sampling. Social media channels used in this study included WeChat, Weibo, and Red Note; the collection period was June 2026. The questionnaire items were reviewed by three public health experts using the Item-Objective Congruence (IOC) score, with an average score of 0.76. Cronbach's α = 0.81 was calculated to assess internal consistency. These values demonstrated acceptable internal consistency, confirming questionnaire reliability.

Variables and Measurement Tools

Independent variables included social demographic, study, and sport factors. The dependent variable was the total pain score obtained from the BARS-45. BARS-45 divides the human body into 45 sections and assigns them numbers (Figure 1). Participants rate pain intensity for each region on a 4-point scale: 0 - no pain, 1 - mild pain, 2 - moderate pain, 3 - severe pain. Add up the scores of the 45 sections, with a range of 1 - 135.

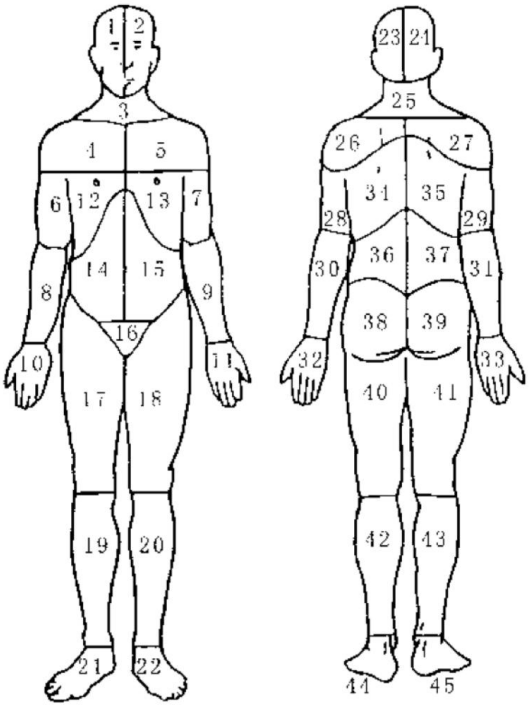

Figure 1 BARS-45 pain area

Statistical Analysis

SPSS version 29.0.2.0 was used to analyze data. Descriptive statistics, including mean, SD, range, median, and interquartile range, were calculated. The Kolmogorov–Smirnov test was used to assess normality. The Mann–Whitney U test was used to examine differences in continuous variables. The chi-square test was used to identify associated factors.

RESULTS

Socio-demographic Characteristics and Study Factors

Males accounted for 71.9%. Because the sample consisted of undergraduate students, age ranged from 18-22. The Mean ± SD of age was 19.72 ± 1.25, and the Median was 19.50. The Median of height was 167, and the Median of weight was 60. 58.5% of students had a family monthly income of 6,000–20,000 Yuan. 39.6% of students had part-time work 2–3 times per week (Table 1).

Table 1. Socio-demographic characteristics of participants (n = 424)

Variables	Frequency (%)
Sex	
Male	305 (71.9)
Female	119 (28.1)
Age (years)	
Mean ± SD	19.72 ± 1.25
Min – Max	18 – 22
Median (P25, P75)	19.50 (19.00, 21.00)
Height (CM)	
Mean ± SD	167.36 ± 5.50
Min – Max	158 – 183
Median (P25, P75)	167.00 (163.00, 172.00)

Variables	Frequency (%)
Weight (KG)	
Mean ± SD	59.92 ± 7.43
Min – Max	48 – 82
Median (P25, P75)	60.00 (53.00, 66.00)
Family's monthly income	
2,000-6,000 Yuan	44 (10.4)
6,000-20,000 Yuan	248 (58.5)
More than 20,000 Yuan	132 (31.1)
Part-time work	
No	44 (10.4)
1 time per week	58 (13.7)
2-3 times per week	168 (39.6)
More than 3 times per week	154 (36.3)

Of the participants, 56.4% were from the Sports Training Faculty, 35.8% were first-year students, and 90.1% had only 1 specialized sport. Regarding the types of major specialized sports, 20.5% were basketball. The median of training frequency of the major specialized sport was 5 times/week, and the median of training duration of major specialized sport was 1 hour/time (Table 2).

Table 2. Study factors of participants (n = 424)

Variables	Frequency (%)
Faculty	
Sports Training Faculty	239 (56.4)
Martial Arts and Performance Faculty	79 (18.6)
Relaxation and Social Sports Faculty	81 (19.1)
Ice and Snow Sports Faculty	25 (5.9)
Grade	
First year	152 (35.8)
Second year	118 (27.8)
Third year	60 (14.2)
Fourth year	94 (22.2)
Number of specialized sports	
1	382 (90.1)
2	42 (9.9)
Type of major specialized sports	
Basketball	87 (20.5)
Volleyball	35 (8.3)
Sprint	50 (11.8)
Long distance run	54 (12.7)
Swimming	46 (10.8)
Table tennis	36 (8.5)
Football	13 (3.1)
Dance	29 (6.8)
Martial art	28 (6.6)
Tennis	31(7.3)
Taekwondo	15 (3.5)

Variables	Frequency (%)
Training frequency of major specialized sport (times/week)	
Mean ± SD	
Min – Max	5.10 ± 0.30
Median (P25, P75)	5 – 6
Training duration of major specialized sport (hours/time)	5.00 (5.00, 5.00)
Mean ± SD	
Min – Max	
Median (P25, P75)	1.16 ± 0.37
	1 – 2
	1.00 (1.00, 1.00)

Among the participants, 44.1% were injured 2 times, 70.0% had experienced muscle and tendon injuries, and 38.0% had experienced chronic pain for 19-24 months. 73.9% of participants did not seek medical consultation, and 88.0% chose external intervention treatments. 77.8% of the students had learned a sport, and 21.2% had ever learned basketball. The median training frequency of the major learned sport was 1 time/week, and the median training duration of the major learned sport was 2 hours/time. 17.0% of students chose swimming as their major sport for hobby. The median playing frequency of the major sport for hobby was 1 time/week, the median playing duration of the major sport for hobby was 2 hours/time, and the median competition participation frequency for the hobby sport was 2 times/year (Table 3).

Table 3. Sport factors of participants (n = 424)

Variables	Frequency (%)
Injured times	
1	36 (8.5)
2	187 (44.1)
3	129 (30.4)
4	32 (7.6)
More than 4	40 (9.4)
Type of injury	
Muscle and tendon injuries	297 (70.0)
Joint ligament injuries	105 (24.8)
Bone Injuries	22 (5.2)
Duration of chronic pain	
3-12 months	52 (12.3)
12-18 months	136 (32.1)
19-24 months	161 (38.0)
More than 24 months	75 (17.7)
Seek medical doctor	
Yes	111 (26.1)
-For muscle and tendon injuries	40 (9.4)
-For joint ligament injuries	49 (11.6)
-For bone Injuries	22 (5.2)
No	313 (73.9)
-For muscle and tendon injuries	257 (60.6)
-For joint ligament injuries	56 (13.2)
External interference treatments	

Variables	Frequency (%)
Yes	373 (88.0)
No	51 (12.0)
Number of learned sports	
1	330 (77.8)
More than or equal to 2	94 (22.2)
Type of the major learned sports	
Basketball	90 (21.2)
Volleyball	43 (10.1)
Sprint	44 (10.4)
Long distance run	65 (15.3)
Swimming	50 (11.8)
Table tennis	35 (8.3)
Football	10 (2.4)
Dance	36 (8.5)
Martial art	22 (5.2)
Tennis	9 (2.1)
Taekwondo	20 (4.7)
Training frequency of major learned sport (times/week)	
Mean ± SD	
Min – Max	1.08 ± 0.44
Median (P25, P75)	1 – 6
Training duration of major learned sport (hours/time)	1.00 (1.00, 1.00)
Mean ± SD	
Min – Max	
Median (P25, P75)	2.00 ± 0.82
Type of major sports for hobby	1 – 3
Basketball	2.00 (1.00, 3.00)
Volleyball	
Sprint	45 (10.6)
Long distance run	37 (8.7)
Swimming	51 (12.0)
Table tennis	56 (13.2)
Football	72 (17.0)
Dance	44 (10.4)
Martial art	32 (7.6)
Tennis	10 (2.3)
Taekwondo	22 (5.2)
Playing frequency of major sports for hobby (times/week)	34 (8.0)
Mean ± SD	21 (5.0)
Min – Max	
Median (P25, P75)	
Playing duration of major sport for hobby (hours/time)	1.00 ± 0.07
Mean ± SD	1 – 2
Min – Max	1 (1, 1)
Median (P25, P75)	
Training frequency of participation in the competition for hobby (times per year)	2.00 ± 0.82
Mean ± SD	1 – 3

Variables	Frequency (%)
Min – Max	2 (1, 3)
Median (P25, P75)	
	2.00 ± 0.82
	1 – 3
	2 (1, 3)

The correlation between the continuous independent variables and the chronic pain score

From the results, the total score of chronic pain showed a mean ± SD of 36.51 ± 16.76, the range being 5 – 86, and the median (P25, P75) is 36 (24, 47)

According to the results of the normality test, age, height, and weight did not follow a normal distribution. The chronic pain score followed a normal distribution, so the scores were grouped using the mean as the criterion. Scores ≤ 36 were classified as the low chronic pain group, while scores > 36 were classified as the high chronic pain group.

From Table 4, the Mann-Whitney U test was used for variables that did not follow a normal distribution to compare group differences. Age, weight, and height had no significant impact on chronic pain.

Table 4. Age, Height and Weight Mann-Whitney U test Results (n = 424)

	Chronic pain group Median (P_{25}, P_{75})		Mann-Whitney U test		p
	Low (n=221)	High (n=203)	U	z	
Age	20.00 (19.00,21.00)	19.00 (19.00,21.00)	22180.000	-0.205	0.837
Height	167.00 (163.00,172.00)	167.00 (163.00,172.00)	22196.500	-0.177	0.852
Weight	60.00 (53.00,66.00)	60.00 (54.00,66.00)	21323.500	-0.880	0.379

*p<0.05

Chi-square test results showed that the associated factors of chronic pain were sociodemographic, study, and sport-related factors. Sex, family's monthly income, part-time work, faculty, number of specialized sports, type of major specialized sport, injury times, surgery, duration of chronic pain, seeking a medical doctor, external interference treatments, number of learned sports in the past, type of major learned sport, type of major sports for hobby, and playing frequency of major sport for hobby are significantly correlated with chronic pain (Table 5).

Table 5. The associated factors from Chi-square results (n = 424)

Variables	Categories	Chronic pain group		X^2	p
		Low (n=221)	High (n=203)		
Sex	Male	198	107	71.297	< 0.001*
	Female	23	96		
Age	≤19	106	106	0.766	0.382
	≥20	115	97		
Height	≤167	112	103	0.000	0.990
	>167	109	100		
Weight	≤60	118	103	0.299	0.585
	>60	103	100		
Underlying diseases	Yes	9	13	1.169	0.280
	No	212	190		
Family's monthly income	2,000 – 6,000 Yuan	39	5	90.673	< 0.001*
	6,000 – 20,000 Yuan	156	92		
	More than 20,000 Yuan	26	106		
Part-time work	No	35	9	87.875	< 0.001*
	1 time per week	46	12		
	2-3 times per week	104	64		
	More than 3 times per week	36	118		
Faculty	Sports Training Faculty	177	62	105.620	< 0.001*
	Other Faculty	44	141		
Grade	First year	80	72	0.412	0.938
	Second year	62	56		
	Third year	29	31		
	Fourth year	50	44		
Number of specialized sports	1	218	164	37.795	< 0.001F*
	2	2	39		
Type of major specialized sport	Basketball	73	14	92.452	< 0.001F*
	Volleyball	22	13		
	Sprint	36	14		
	Long-distance run	31	23		
	Swimming	19	27		
	Table tennis	4	32		
	Other	36	80		
Training frequency of major specialized sport	5 times per week	204	179	12.067	0.151
	6 times per week	17	24		
Training duration of major specialized sport	1 hour per time	190	166	1.386	0.239
	2 hours per time	31	37		
Injury times	1	33	3	121.190	< 0.001F*
	2	135	52		
	3	47	82		
	4	4	28		
	More than 4	2	38		

Variables	Categories	Chronic pain group		X^2	p
		Low (n=221)	High (n=203)		
Injury type	Muscle and tendon injuries	147	150	2.744	0.098
	Other injuries	74	53		
Surgery	Yes	130	188	64.421	< 0.001*
	No	91	15		
Duration of chronic pain	3-12 months	48	1	124.575	< 0.001[F]*
	12-18 months	99	37		
	19-24 months	69	92		
	More than 24 months	5	70		
Seek medical doctor	Yes	90	21	50.529	< 0.001[F]*
	No	131	182		
External interference treatments	Yes	218	155	49.672	< 0.001[F]*
	No	3	48		
Number of learned sports in the past	1	209	121	74.965	< 0.001*
	More than or equal to 2	12	82		
Type of major learned sport	Basketball	79	11	130.685	< 0.001[F]*
	Volleyball	33	10		
	Sprint	30	14		
	Long distance run	38	27		
	Swimming	13	37		
	Table tennis	2	33		
	Other	26	71		
Training frequency of major learned sport	1 time per week	214	192	1.319	0.251
	More than 1 time per week	7	11		
Training duration of the major learned sport	1 hour per time	80	63	1.295	0.523
	2 hours per time	71	69		
	3 hours per time	70	71		
Type of major sports for hobby	Basketball	40	5	102.211	< 0.001*
	Volleyball	31	6		
	Sprint	39	12		
	Long distance run	35	21		
	Swimming	18	54		
	Table tennis	7	37		
	Other	51	68		
Playing frequency of major sport for hobby	1 time per week	221	201	2.188	< 0.001[F]*
	2 times per week	0	2		
Playing duration of major sport for hobby	1 hour per time	74	67	4.847	0.089
	2 hours per time	64	77		
	3 hours per time	183	59		
Training frequency of participation in the competition for hobby	1 time per year	70	71	0.932	0.627
	2 times per year	72	68		
	3 times per year	79	64		

[F]Fisher exact, *p<0.05

DISCUSSION

Sex is significantly associated with chronic pain; a higher percentage of girls than boys reported frequent pain at follow-up ($p = 0.005$) (13). Approximately 21.8% of female respondents reported chronic pain compared with 19.1% of male respondents ($p < 0.001$) (14). In the case of acute injuries, the proportion of students in the physical education major developing into persistent chronic pain due to the curriculum covering rehabilitation courses was only 11.2%, while that for students specializing in a single sport was 36.8% (15). Although multi-sport activities are beneficial for overall physical development (16), according to research conducted in the Netherlands, they may also lead to inconsistent movement patterns, uneven load distribution, and cumulative microtraumas in different parts of the body (17).

A study on sports trauma surgery and chronic persistent pain conducted in Japan revealed that athletes who underwent sports injury surgery had a significantly reduced risk of chronic pain (OR = 0.153, 95% CI: 0.034~0.722) (18). The reason for the varying results might be that some of the samples in this study were in the post-operative pain period, and the cause of this pain was not chronic pain resulting from an injury.

After the pain persists for more than 3 months, for every additional month of pain duration, the OR for chronic pain that does not resolve increases by 1.51 (19). Patients who did not seek medical treatment promptly after injury experienced chronic pain; the OR was 4.94 (95% CI: 3.11~7.83, $p < 0.001$) (20). The OR for the deep massage intervention group once a week was 0.28 (95% CI: 0.16~0.49, $p < 0.001$), and the incidence of chronic pain in athletes without massage intervention increased by 3.6 times. Massage improves fascial adhesions, reduces muscle tension and local inflammatory mediator accumulation, and reduces long-term mechanical pain sensitization (21).

CONCLUSION

Among students majoring in specialized sports at the Capital University of Physical Education and Sports in Beijing, China, 47.9% reported high chronic pain.

Male, high family monthly income, high part-time work, students not from the Sports Training Faculty, high number of sports, major specialized sport is table tennis, high injury times, have surgery, long duration of chronic pain, no seek medical doctor, not with external interference treatments, high number of learned sports in the past, whose major learned sport is table tennis and whose major sports for hobby is table tennis have significantly higher chronic pain.

These findings provide critical insights for the Beijing municipal government, health authorities, medical service systems, social organizations, and other relevant institutions.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University, with COA No. 152/69.

LIMITATIONS

This study used an online self-reported questionnaire, and the results may be biased if participants misunderstood some items. The research was carried out at one university in Beijing and is not representative of sport students from other regions.

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Track VII

Sexual, Reproductive and Women's Health, Gender and Sexuality

ADVERSE EXPERIENCES AND UNMET MATERNITY CARE NEEDS AMONG MYANMAR MIGRANT WOMEN WHO EXPERIENCED MISCARRIAGE IN THAILAND

Hnin Wai Wai Lin[1], Truc Ngoc Hoang Dang[1*] and Kanokwan Tharawan[1]

[1]Institute for Population and Social Research, Mahidol University, Salaya, Phuttamonthon, Nakhon Pathom 73170, Thailand

****Corresponding Author**: Truc Ngoc Hoang Dang, Institute for Population and Social Research, Mahidol University, Nakhon Pathom 73170, Thailand, E-mail: drhninwaiwailin@gmail.com, truc.ngo@mahidol.ac.th*

ABSTRACT

Introduction: Predominantly labor-driven migration from Myanmar to Thailand has shifted the composition of mixed migration flows, including reproductive-age women. They face multidimensional barriers in accessing maternity care and treatment for miscarriage in Thailand. While experiences of maternity healthcare access among Myanmar women were examined, there are limited studies about the disadvantaged experiences and unmet needs of comprehensive maternity care regardless of geosocial-demographic backgrounds.

Objectives: This study aimed to explore the adverse experiences and unmet maternity care needs of Myanmar migrant women who have ever experienced miscarriage in Thailand.

Methodology: A qualitative study involved 15 Myanmar women aged 23-39 who experienced spontaneous miscarriage in the past 5 years. Participants were recruited through purposive and snowball sampling on social media. Semi-structured interviews were conducted virtually, and transcripts were thematically analyzed using Penchansky and Thomas's Six Access Framework.

Results: For acceptability, women expressed concerns about respectful treatment, discrimination, and a lack of autonomy. There is a critical need for more flexible legal documentation and insurance to enhance accessibility. High healthcare costs, income loss, and job insecurity were significant issues post-pregnancy loss. Regarding adequacy, many reported insufficient communication, pain management, psychological support, or timely contraceptive access. Additionally, gaps existed in the availability of high-quality interpretation services, and a major unmet need is the lack of understanding regarding pregnancy-related health education and when to seek help for a miscarriage.

Conclusion: Heterogeneous Myanmar migrant women with miscarriages are encountering compounding intersections of vulnerability. To strengthen inclusion and advance rights-based maternity healthcare, there is a critical need for migrant-friendly services encompassing respectful and non-discriminatory treatment with full autonomy, flexible legal and insurance integration, and workplace policies, adequate high-quality interpretation services, effective communication between migrant's patient and healthcare providers, and awareness information provision in migrant-friendly ways to align mainly with the SDG goals 3, 5, 10, and 17 of leaving no one behind.

Keywords:

Migration; Miscarriage; Maternity Care; Myanmar; Minority Rights

INTRODUCTION

Migration is a complex, multidimensional social process shaped by political, economic, social, and environmental forces (1). The inclusive definition of the International Organization for Migration (2) recognizes the diversity of migration experiences and underscores the vulnerability migrants face across multiple dimensions of life. Among these, female migrants accounted for approximately 39% of total migrant workers worldwide (3). In 2024, Thailand had the largest migrant population in Southeast Asia, with nearly 2.5 million, and Myanmar had the largest among neighboring countries (4).

Both "push" and "pull" factors shape the migration pattern of Myanmar nationals. The

COVID-19 pandemic from 2020 to 2022, the military coup in February 2021, and the implementation of the conscription law on 10 February 2024 are major events that profoundly reshaped traditional migration trends in Myanmar. In July 2024, at least 1.7 million Myanmar migrants were living in irregular situations, particularly in border provinces. As of January 2025, 2.27 million Myanmar migrants were formally registered as workers, representing 68% of all registered migrants in Thailand (5). This large and irregular Myanmar population includes many women of reproductive age whose precarious legal status restricts access to public healthcare, social protection, and employment benefits. Among them, reproductive health services are particularly affected, including access to maternity care, skilled birth attendance, contraception, and post-pregnancy-loss care (6,7).

Although maternity care is widely recognized as a core sexual and reproductive health right (SRHR) and a key indicator for monitoring health equity under the Sustainable Development Goals (SDGs), Myanmar migrant women usually experience complex challenges in managing their reproductive health while balancing precarious employment, caregiving responsibilities, and insecurity (8). Equally important, miscarriage is a common pregnancy complication that can cause significant physical, psychological, and financial distress (9). Among migrant women, these negative consequences are more pronounced, and miscarriage remains a largely hidden and underreported issue (10). Despite standards and healthcare professionals emphasizing equal standards of care, real-world experiences reveal persistent gaps between policy and practice. Therefore, migrant women's lived experiences need to be understood, particularly paying attention to the gaps attached to pregnancy loss.

By situating these experiences, the study demonstrated that unmet maternity healthcare needs are a multidimensional development challenge rather than just a health-sector issue. Therefore, this study aimed to examine adverse experiences and unmet maternity care needs among Myanmar migrant women in Thailand. It utilized the modified Theory of Access, developed by Penchansky and Thomas (1981) and expanded by Saurman (2016), which emphasizes the gaps between individuals and health care systems (11). This is particularly relevant for mobile populations, who may actively seek care but remain unable to access services due to limited information about available options in new communities. By applying it, the study sought to explain how migration status, legal insecurity, and broader structural barriers shape women's experiences of accessing maternity and post-miscarriage care, as shown in Figure 1

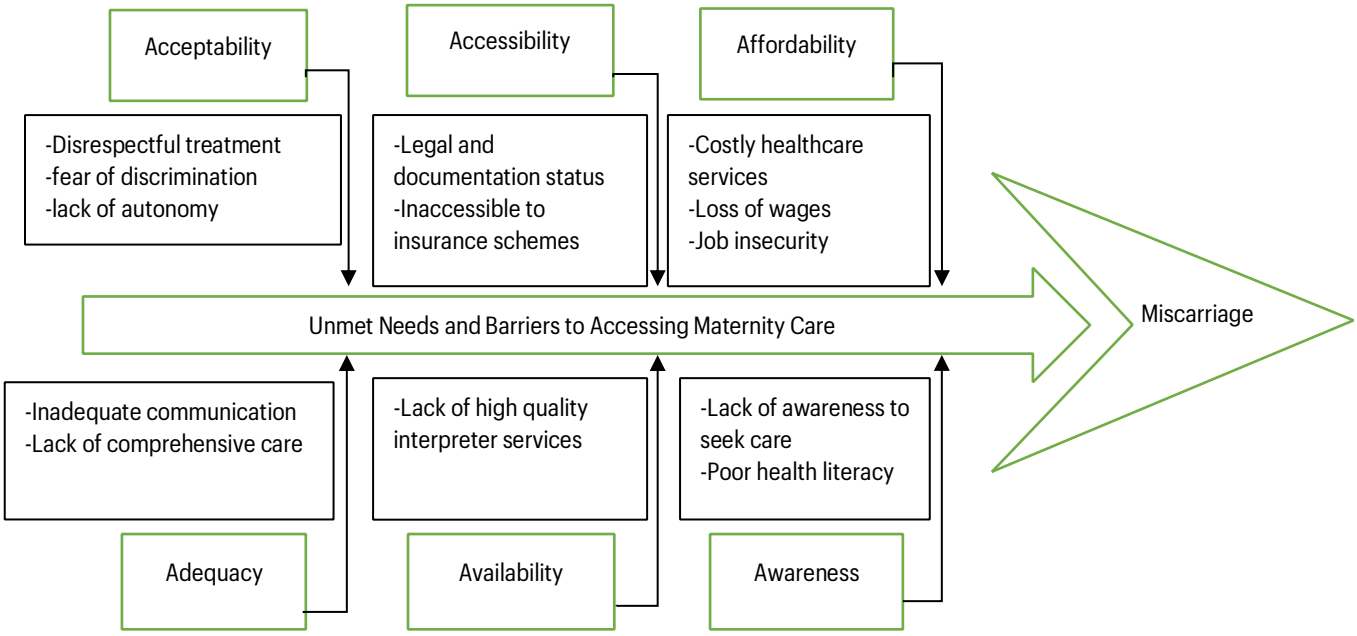

Figure 1 Conceptual Framework of the Study

METHODOLOGY

Study Design

A qualitative phenomenological study was conducted to gain a deeper understanding of lived experiences and structural barriers that statistical data cannot fully capture.

Target Population and Recruitment Process

The study focuses on Myanmar migrant women aged 15-50 in Thailand who experienced spontaneous miscarriage in the past five years. The WHO definition of reproductive age was extended by one year to cover women who got pregnant at the age of 49. Women who experienced voluntary or medical termination were not included. Participants were recruited through purposive and snowball sampling via Facebook and TikTok, ensuring a diverse range of sociodemographic backgrounds.

Data Collection

Virtual in-depth interviews were conducted with 15 women by the main author using semi-structured questionnaires designed to explore multidimensional barriers, informed by previous literature across the six access frameworks. Pilot testing was done with one woman who had a miscarriage to ensure clarity. Interviews lasted about 45 to 90 minutes and were conducted by phone or via Zoom, based on participant preference. Informed consent was thoroughly obtained regarding the research, interview process, audio recording, and confidentiality, as well as the researcher's status and profile to address concerns about trust and credibility, both in the social media invitation post and once again before the interview. In addition, an experienced medical research assistant took notes and reminded the researcher about the key process. Trauma-informed practices were utilized, allowing participants control over their narratives. Participants were clearly informed that they could stop the interview at any time. Recruitment was conducted until data saturation was reached, with no new information emerging from subsequent interviews. Data collection lasted nearly 2 months, from April to May 2026. In total, four women dropped out after giving consent without giving any reason.

Data Analysis

All verbatim transcripts were translated from Burmese to English, with careful attention to important details during the interview. After

ensuring completeness and familiarity with the transcripts, each participant was assigned a unique ID, and transcripts were coded using a conceptual framework. Data analysis was conducted in Excel, thematically identifying initial codes and subthemes under six main themes. Quotations were validated with the research assistant and participants, with guidance from the major advisor throughout to ensure accuracy.

RESULTS

Under the conceptual framework developed from the modified Theory of Access, diverse miscarriage experiences of non-homogeneous women from various provinces were identified as six major themes, including acceptability, accessibility, affordability, adequacy, availability, and awareness. Table 1 presents the sociodemographic factors and total number of miscarriages.

Table 1 Sociodemographic characteristics of women with miscarriage

ID	Age	Education	Occupation	Marital Status	Documentation status	Provinces	Number of Pregnancy Losses	Thai Language Proficiency
1	23	High school	Construction worker	Married	Undocumented	Samut Prakan	1 time	Basic
2	25	Lower secondary	Construction worker	Married	Documented	BKK	1 time	Basic
3	31	Lower secondary	Factory worker	Married	Documented	Samut Prakan	1 time	Basic
4	24	High school	Factory worker	Married	Documented	Samut Sakhon	1 time	Basic
5	25	Lower secondary	Factory worker	Married	Documented	BKK	1 time	Basic
6	28	High school	Factory worker	Married	Documented	Samut Sakhon	3 times	Intermediate
7	30	University student	Factory worker	Married	Documented	Samut Sakhon	2 times	Basic
8	31	University student	Supervisor	Married	Documented	Chonburi	1 time	Proficient
9	39	High school	Cleanser	Married	Documented	Ratchaburi	1 time	Intermediate
10	28	Lower secondary	Shop assistant	Cohabitation	Documented	Surat Thani	1 time	Basic
11	30	Lower secondary	Restaurant worker	Married	Documented	BKK	2 times	Proficient
12	24	High school	Restaurant worker	Married	Undocumented	Phuket	1 time	Basic
13	32	Lower secondary	Dependent	Married	Documented	Phuket	1 time	Intermediate
14	31	High school	Businesswomen	Married	Documented	Prachuap Khiri Khan	1 time	Proficient
15	34	Bachelor's degree	Office worker	Married	Documented	Tak	2 times	Basic

Note. Documentation status and Thai language proficiency were recorded at the time of miscarriage and were not representative of the data collection period.

Six Dimensions of Maternity Healthcare Access Barriers

Acceptability

Disrespectful treatment by healthcare providers was revealed, as women were being treated as educational tools rather than as patients during miscarriage. Some women stressed the dismissive pronouns used for them rather than their real names.

"In the operating room, I was treated by trainee doctors while a senior OG doctor watched and taught them how to evacuate my uterus. It was like the scene of a tuition teacher instructing his students how to calculate a math problem. I was lying on the bed with my legs and thighs separated, and everyone had come to examine my body." ID-12

"The staff sometimes used the term "Tang Dao" (migrant labourers) when calling our names, such as "Phama Tang Dao...," instead of calling our own names directly. They want to say that we are people who come to Thailand for work, like those from Myanmar, Laos, and Cambodia. This made me feel looked down upon." ID-8,12

Beyond this, frequent discriminatory treatments like being shouted at, scolded, or treated harshly and impatiently were reported for the reasons of their nationalities and inability to speak Thai.

"I was scolded once by the staff before evacuation because I didn't understand their order to put a pad when the bleeding continued." ID-12

"Since I don't understand their language, they seem to lose patience with me. Rather than because I was in Myanmar, I was shouted at and scolded at the hospital." ID-1

"We are seen later if the patients are from Myanmar." ID-6 (3 miscarriages)

"The first OG doctor I met was very bad-mouthed. She treated me as if I were different or somehow inferior." ID-8

Lack of autonomy was also elicited, as medication decisions and contraceptive choices were frequently made on behalf of partners or interpreters without the women's full understanding and informed consent.

"Although the doctor permitted sterilization, I could not do so as my husband hadn't agreed and wanted more children, but I don't want any more." ID-14

"The hired translator only told me,' You should use a Depo injection to ensure you are not pregnant immediately," and translated to the doctor to give a Depo injection." ID-12

Accessibility

Documentation-related barriers highlighted the significant intersection in which a migrant's legal status serves as a gatekeeper for timely care. Women who have experienced miscarriages admitted that the lack of complete legal documentation or the inaccessibility of insurance schemes transformed a medical emergency into a period of legal risk and systemic exclusion.

"At the time of bleeding, I didn't have complete documentation, and they are still in process. So, I didn't go to the hospital. Until now, I have only had a Work Permit, and I need to complete CI further." ID-2

"They asked me a lot about the required documents for legal status, and I cannot go to any hospital for ANC due to a lack of documentation. I am afraid of being detained." ID-1

"Because I didn't have any documentation or a Social Security card at first, I avoided the government hospital and went to a private clinic instead." ID-12

Affordability

Costly healthcare services included both direct and indirect costs of medical procedures and out-of-pocket expenses. Moreover, participants experienced financial burdens due to self-transportation costs, the need for extra medications, and follow-up appointments.

"As I didn't have legal documentation and insurance, I incurred a lot of costs at the hospital. It was around 24,000 THB, and transportation fees were 5,000 THB." ID-1

"The expenditure was very high at the hospital for us. We only had 10,000 baht on hand,

and we had to borrow the rest to cover the 20,000-baht hospital bill." ID-12

"The medical costs were covered by social security, but I spent a lot on transportation due to many follow-ups to check and confirm the fetal viability, maybe 1,000 baht for each visit." ID-11 (2 miscarriages)

"They ordered us to buy some drugs for two months outside the hospital by ourselves. I didn't know what these were. I only had to pay about 1,000 Baht for some extra medication." ID-14

Not only these expenditures, but a recurring theme across interviews was also the loss of wages after seeking care for miscarriage, which led to the exacerbation of financial burden for these women in their time of vulnerability.

"I had no income during the 15 days I rested. They deducted over 500 baht a day, including overtime, which is more than my daily base wage (375 baht per day)." ID-2

"My boss allowed me to take unpaid leave for a month. Since I was unable to work, we had to live on my husband's income. Whether things were comfortable or not is another matter, but at least we didn't go starving." ID-10

A further point is that the economic impact extends beyond financial hardship to job loss, which represents the most catastrophic financial situation.

"Because I couldn't return to work the very next day after discharge from the hospital, they fired me." ID-12

"I lost my day job because I had to take a one-month leave to recover from the miscarriage and the resulting uterine infection."ID-14

Adequacy

Inadequate communication was frequently described as a challenge in receiving information from healthcare providers. Women with miscarriages were limited in their understanding of disease conditions, treatment options, and the recovery process.

"The biggest issue was communication, and it was always "one question, one answer." They never explained the "why" behind what happened." ID-7 (2 miscarriages)

"After discharge, they gave me many drugs. I didn't understand well what I needed to take for pain and which drug was for what purpose." ID-1

"I was advised to avoid sexual activity with my husband for 45 days, but they didn't explain any warning signs about complications at home. I also didn't have a chance to ask how to prevent miscarriage from happening again for my future pregnancy." ID-4

Most importantly, participants collectively recalled that there is a lack of comprehensive care, such as inadequate pain management, a lack of psychological counselling, and delayed contraceptive information provision.

"I underwent the uterine evacuation procedure without any anesthesia, and it was incredibly painful. I thought I had died at that time." ID-12,14

"I didn't have any psychological counselling services from the hospital." ID-1,3,4,5,7,8,9,10,11,12,13,15

Another point is that patients were being discharged without being given contraceptive information immediately to manage their future family planning after their loss, and it was only discussed at the follow-up appointment.

However, some could not return for appointments due to legal and financial hardships.

"They didn't order any contraception before discharge, and just gave an appointment. I cannot go back for the follow-up as I fear asking about documentation." ID-1

"The hospital didn't explain the contraceptive plan and counselling at discharge." ID-4,9,12

Availability

A lack of sufficient high-quality interpreter support in the government hospital further compounds the well-known language barrier for Myanmar migrants. Lacking dedicated and well-qualified interpreters forced participants to encounter disadvantageous pregnancy-loss experiences.

"Even with an interpreter provided by the hospital, they often didn't explain things correctly

or would tell me. They always say, 'It's nothing' before the doctor has even finished." ID-5

"The interpreter translated me quickly and rushed to call the next woman." ID-7 (2 miscarriages)

"There are only a few interpreters. I had to rely on translation apps on the nurses' phones in the operating room." ID-12

Awareness

For Myanmar migrant women, limited pregnancy-related health literacy exacerbated unmet maternity care needs not only due to uncertainty about miscarriage-related signs and symptoms, but also due to not knowing about important supplements to take during pregnancy.

"During my first miscarriage in 2021, I did not realize the bleeding was a serious warning sign. I lacked prior experience and did not know I was miscarrying." ID-15 (2 miscarriages)

"For the second miscarriage, I had back pain, frequent urination, and swelling in my hands and feet. I thought it was just normal pregnancy symptoms from standing at work all day." ID-7 (2 miscarriages)

"I thought it would be ok if I went to the hospital for ANC only at 5 months of pregnancy." ID10,14

"I wasn't aware of the need to take folic acid consistently to protect against fetal defects, so I didn't take folic acid." ID-11 (2 miscarriages), 13

DISCUSSION

A long history of migration flows and ongoing unstable situations forced the Myanmar people to migrate to Thailand for many reasons. Among them, reproductive-age women face multifaceted disadvantages in miscarriage experiences while adapting to fit in the destination country. Women who have miscarried feel placed at a disadvantage by disrespectful treatment and discrimination. This made them feel dismissed and inferior, leading to fear and shame in navigating their loss. Beyond this, treatment decisions were often mediated by interpreters or partners, overriding the reproductive rights of these women. These largely reflect the challenges of women's autonomy when receiving care in a foreign country (12).

Another point is that the total duration of stay in Thailand also influences the completeness of documentation and the integration of social protection schemes. Although women with insurance had covered the costs, others still faced high costs, even at government hospitals. These financial impacts were further extended by hidden indirect costs and loss of wages or jobs after seeking care for a miscarriage. Consequently, adverse pregnancy experiences resulted from the avoidance of facilities, self-medication, and informal sources (13).

Equally important, inadequate information in the physical and psychological healthcare setting inevitably led to a huge gap for these marginalised women. The findings cumulatively stated the gaps of insufficient pain management, lack of immediate contraceptive provision, and, importantly, psychological counselling. Although the WHO recommends early initiation of contraception in an uncomplicated miscarriage (14), these unmet needs could create an unintended pregnancy and immediate and long-term physical and mental trauma (15,16). Not only that, but the lack of dedicated, qualified translators also created the most pervasive barrier to a full understanding of miscarriage conditions. This resulted in severely limited access to competent reproductive health services (17).

This study provided the very first and foremost evidence about diverse challenges encountered by Myanmar migrant women while navigating pregnancy loss in Thailand. To avoid delayed medical interventions and long-term mistrust, there is an urgent need to consider policy recommendations to address structural barriers and to develop inclusive maternity health policies.

CONCLUSION

This study contributed unique qualitative evidence of miscarriage experiences and unmet

maternity care needs among Myanmar migrant women. Employing the six-dimensional theories of access could explain the barriers and misalignment between their maternity care needs and the healthcare system. Compounding intersections and marginalization exacerbated their vulnerabilities. To strengthen inclusion and advance a rights-based approach, there is a critical need for migrant-friendly services encompassing respectful and non-discriminatory treatment with full autonomy, flexible legal and insurance integration, and workplace policies, adequate high-quality interpretation services, effective communication, and awareness information provision to align mainly with the SDG goals 3, 5, 10, and 17 of leaving no one behind. Ultimately, healthy migrants will ensure the economic stability of the Kingdom of Thailand.

RECOMMENDATION

Further large-scale quantitative evidence is needed to identify and quantify other socio-determinants of maternity healthcare access barriers among migrant women.

ETHICAL DECLARATION

This study was approved by the IPSR-IRB, under Project Reference Number IPSR-IRB-2026-017.

LIMITATION

The sample size may not include all women with miscarriages in Thailand. However, participants were purposively recruited to ensure diverse sociodemographic backgrounds across various regions, providing rich, in-depth insights into the lived experiences of migrant women.

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AN ANALYSIS OF ONLINE SEXUAL VIOLENCE AS A RISK FACTOR FOR SEXUAL HEALTH FOR OUT-OF-SCHOOL ADOLESCENT GIRLS IN ZIMBABWE

Lynn Ndlovu*, Kanokwan Tharawan[1]*

[1]Institute for Population and Social Research (IPSR), Mahidol University, Salaya, Nakhon Pathom, 73170, Thailand

****Corresponding Author:*** *Kanokwan Tharawan,*
Institute for Population and Social Research (IPSR), Mahidol University, Nakhon Pathom, 73170, Thailand

ABSTRACT

Introduction: The increasing use of digital platforms among adolescents has created new opportunities for communication but, on the other hand, has increased exposure to Online Sexual Violence (OSV), including harassment, sexual coercion, exploitation, and non-consensual sharing of intimate images. Despite growing concerns, limited research has explored the lived experiences of out-of-school adolescent girls in Zimbabwe, a population facing vulnerability due to limited education access, reduced institutional protection, and social and economic challenges. Limited protection frameworks further restrict reporting and support after exposure.

Objectives: To explore the experiences related to online sexual violence among out-of-school adolescent girls in Zimbabwe, and to examine adolescents' perceptions and experiences of how online sexual violence and offline experiences influence their sexual health

Methodology: A qualitative descriptive study design was employed. Data were collected through face-to-face in-depth interviews with 15 out-of-school adolescent girls aged 16–19 years who had experienced online sexual violence. Participants were purposively recruited through a community-based social service agency. The sample size was determined by data saturation, achieved when additional interviews did not generate new information or themes. Data were analyzed using thematic analysis guided by the Social Ecological Model. Credibility was enhanced through in-depth interviews, the use of probing questions, and comparing themes across participants.

Results: Findings demonstrated that online sexual violence occurred across multiple interconnected levels. At the individual level, participants experienced online harassment, sexual coercion, and pressure to share intimate images. At the interpersonal level, intimate relationships increased vulnerability through manipulation, threats, and unequal power dynamics, with online experiences progressing to offline sexual violence. At the community level, being out of school increased vulnerability through social expectations and societal beliefs. At the institutional level, challenges in preserving digital evidence reduced adolescents' confidence in formal reporting systems, as they perceived evidence was required to pursue a case.

Conclusion: Rather than viewing online sexual violence as an isolated digital behavior, this study demonstrates that among out-of-school adolescent girls in Zimbabwe, online sexual violence is embedded within existing power relations, social beliefs, and weak institutional protection. Digital platforms therefore function as extensions of existing social inequalities rather than creating entirely new forms of violence.

Keywords:
Online Sexual Violence; Adolescents; Zimbabwe

INTRODUCTION

Sexual and gender-based violence (SGBV) remains a global public health and social challenge rooted in unequal power relations. With the increasing use of digital technologies, sexual violence has extended beyond physical spaces into online environments, creating new challenges for prevention, regulation, and accountability. Although digital platforms enhance communication, access to information, and social connection (1),

they have also facilitated harmful behaviors, including online sexual violence (OSV). Online sexual Violence refers to harmful sexual behaviours conducted through digital technologies, including mobile phones and online platforms. These behaviours are often unwanted, intrusive, and experienced as violating, and include sexual harassment, sexually explicit messages, threats, non-consensual sharing of sexual content, and sexual extortion (2).

Adolescents are particularly vulnerable to OSV due to increased exposure to digital spaces and evolving online interactions (3). Studies in Zimbabwe show an increase in access to mobile phones, internet use, and mobile ownership among youth (16). Globally, existing evidence indicates that women and girls are disproportionately affected by online sexual harassment, cyberstalking, and other forms of digital abuse (2). However, much of the available research has focused on adolescents within school settings, with limited attention given to out-of-school adolescents who may experience different vulnerabilities due to reduced access to structured support systems and sexual health information (4). Out-of-school refers to children and youth who fall within the official age range for a given level of education but are not attending either formal or informal school. (5)

Across sub-Saharan Africa, sexual violence remains a major concern as countries such as South Africa continue to report high levels of sexual violence, with increased concerns during the COVID-19 period (6). Emerging evidence further shows that online violence affects adolescent girls and represents a growing social and public health concern (7). Zimbabwe faces similar challenges, yet national evidence on the prevalence, forms, and consequences of online sexual violence among adolescents remains limited and fragmented (8). In this regard, this justifies the need for this research, as limited research has explored the lived experiences of out-of-school adolescent girls in Zimbabwe, a population facing vulnerability due to limited education access, reduced institutional protection, and social and economic challenges. Limited protection frameworks further restrict reporting and support after exposure. In addition, although the Cyber and Data Protection Act of 2021 provides a framework for digital protection, concerns remain regarding its ability to specifically address sexual violence occurring online (9). The lack of specific protection mechanisms may contribute to underreporting and limited accountability for perpetrators (10).

The effects of online sexual violence extend beyond digital spaces and may mirror the psychological and social consequences of offline sexual violence. Digital sexual violence can result in shame, stigma, fear, and emotional distress, which may prevent survivors from seeking support (2). Research has shown that adolescents often disclose experiences only to close peers due to fear of retaliation, lack of evidence, and concerns about being blamed or not taken seriously (11). These barriers contribute to the invisibility of online sexual violence and limit responses aimed at protecting adolescent sexual health.

Therefore, understanding online sexual violence among out-of-school adolescent girls is essential for developing prevention strategies and strengthening adolescent sexual health interventions. This study explored the experiences of online sexual violence and its implications for the sexual health of out-of-school adolescent girls in Zimbabwe.

METHODOLOGY

Study design

A qualitative descriptive study design was employed to explore adolescents' experiences of online sexual violence and its influence on their offline safety and sexual health. Data were generated through face-to-face in-depth interviews with 15 adolescent girls aged 16 –19 years. This approach was appropriate as it allowed the study to capture participants lived experiences and perceptions related to online sexual violence. Given the sensitive nature of the topic, in-depth interviews provided a safe and private environment for adolescents to share personal experiences and perspectives.

Study setting and participant recruitment

The study was conducted at a social service organization located in Bulawayo, Zimbabwe. The organization provides psychosocial support services to girls who have experienced gender-based violence and facilitates referrals to relevant support programmes. Participants were recruited from an existing community-based social service organization for survivors of violence. The organization provided access to private counselling rooms to promote confidentiality, emotional safety, and participant comfort.

Purposive sampling was used to recruit participants who met the study criteria. The study included out-of-school adolescent girls aged 16–19 years who were members of the support programme and had experiences relevant to the research topic. Adolescents currently enrolled in school were excluded as the study focused specifically on out-of-school adolescents. The sample size was guided by data saturation, which was reached when additional interviews no longer generated new information.

Data collection

Data were collected using a semi-structured interview guide developed in alignment with the study objectives and the Social Ecological Model (SEM). Interviews were conducted face-to-face by the researcher in private rooms at the site due to the sensitive nature of the study. The interviews lasted between 45 mins to 1hr.

Interviews were conducted in Ndebele, the local language, to allow participants to express themselves comfortably and were then translated into English, preserving participants' original meanings. With participants' and parental/guardian consent, interviews were audio-recorded and transcribed manually. The transcripts were translated from Ndebele into English by the researcher for analysis while preserving participants' original meanings. During data collection, the researcher-maintained reflexivity through journaling reactions and observations that could result in any bias.

Data analysis

The data were manually translated from Ndebele to English by listening to the audio recordings word for word, as no verbatim transcription software was available for Ndebele. Coding was achieved through recurring patterns within participants' voices, and themes were grounded in their voices to allow for lived experiences. Data quality was enhanced through prolonged engagement with transcripts repeatedly to maintain the original voice of the participants. Data analysis was primarily inductive, allowing themes to emerge from adolescents' own experiences rather than imposing researchers' thoughts. The Social Ecological Model guided interpretation of findings by organizing themes across multiple levels, including individual, interpersonal, community, and institutional factors influencing adolescents' vulnerability to online sexual violence. Participant identifiers were replaced with unique codes using Participant IDs to protect confidentiality and maintain anonymity

RESULTS

Table 1 Characteristics of participants and context of online sexual violence

Characteristic	Outcomes
Age	16-19
Education status	Out-of-school girls (all participants) due to orphanhood, unemployed parents, financial assistance
Living arrangement	Parents, grandparents, relatives, alone
Type(s) of online sexual violence experienced	Unwanted Image sharing among partners and strangers, unwanted sexual messages, sexual harassment, threats, blackmail, coercion, body shaming

Main digital platforms	Social media application
Relationship to perpetrator	Stranger between 35-55, partner ranging from 18-45, relative (45yrs)
Help-seeking	Did not report; told a trusted friend

Individual Level: 'I dealt with the shame alone.'

Participants expressed how violence damaged them emotionally as they lacked support structures. Experiences such as fear, shame, and fear of being judged resulted in many internalizing the blame associated with the abuse, resulting in silence and isolation. Participants explained:

'I rarely talk to anyone when I face problems because I fear being judged…' (ID 11, 17, living with an unemployed single mother)

Another participant was of the same view and stated:

'I dealt with the shame alone.' (ID 9, 16yrs,stays with grandmother)

The above participants shared the same feeling as they had similar experiences of feeling shame, reflecting the emotional burden experienced by survivors, where feelings of embarrassment and fear prevented them from disclosing their experiences. Instead of receiving support, participants described managing the consequences of online sexual violence privately, increasing feelings of isolation.

Online-Offline Continuum – 'After some time chatting, he asked to meet me in person.'

A unique contribution of this study is the addition of the online–offline continuum to explain how online interactions transition into offline spaces, addressing a gap that may not be fully captured by the Social Ecological Model (SEM). Participants explained that interactions often started as casual or harmless but gradually progressed as perpetrators built trust and later requested to meet in person. Participants' experiences highlighted that online risks cannot be separated from offline realities, as digital interactions may increase adolescents' vulnerability to harm. One adolescent stated:

"I met my partner aged 24 on a social media app…he told me he was given my contacts by a friend, but I knew he was lying. After some time chatting online, I started to like him… After some time chatting, he asked to meet me in person. We met at his house, and he initiated sex, but I felt this was our first date; it wasn't proper. When I refused, he told me he would look for another woman, and besides, everyone was doing it."

ID 15, aged 19, single mother, works as a housemaid

This finding reveals that online platforms are used as a foundation for sexual violence. Participants perceived online interactions as a process through which perpetrators developed trust before requesting offline meetings.

Interpersonal Level - "… none of them wanted to use protection."

For interactions that transitioned offline, participants in two accounts report failure to negotiate for safer sexual behaviour with their partners. One participant narrates her previous encounters with partners she met on social media, then met them after some time offline. :

"I once got very sick for some time until a friend told me to go to the clinic. I was told I had an STI. I never knew who infected me because I had met with 2 men online at that time, and none of them wanted to use protection."

ID 13, orphan lives with grandmother

Another participant described how an online chat developed into a relationship offline. However, the relationship only ended when she reported she was pregnant and the partner relocated without a trace. The participant exclaimed:

"After some time of chatting online, he asked me to come to his house. I insisted on using protection instead; he refused. He told me he would look for another woman and, besides, everyone was doing it."I did not have the power to say no! Yes, that's how I got pregnant. I never

knew things would turn out this way. I last saw him when I told him I was 3months pregnant. I never heard from him again. Now have to take care of the baby myself by working in people's houses doing chores"

The girls reported non-use of safer sexual methods, which increased vulnerability of their sexual health. According to the girls' narratives, sexual networks through having multiple concurrent relationships among adolescents increased the risk for STIs. Participant 13 also revealed how she delayed seeking health services; only after encouragement from a friend did she become courageous enough to seek medical attention. The above findings reveal participants had limited power to reject non-use of protective measures.

Community Level- "You reach the age of 16 without a boyfriend, there is definitely something wrong with you"

Adolescents' narratives revealed how cultural pressure influenced their decision-making regarding relationships. They described that social pressures emanated from cultural norms that view women as being ready for marriage if they are out of school. In addition, these beliefs are strengthened by the fact that they are idle most of the time, staying at home, thus creating room for engaging in relationships out of pressure and seeking acceptance. The participant strongly emphasized, with strong conviction, as she expressed:

"Girls are affected by cultural beliefs that when you reach the age of 16 without a boyfriend there is definitely something wrong with you ...so you do anything to keep your boyfriend even if it's sending intimate pictures against my will..."

ID6,19yrs, living with unemployed mother

Another participant reported :

"He kept on pressuring me to send intimate pictures, but I could not stand losing my partner over intimate pictures... At this age, not having a boyfriend is not normal...There is something so wrong about you!"

ID11, 17yrs, living with unemployed single mother

The girls reported how gendered expectations around pleasing men and preserving relationships limited their ability to assert boundaries, prioritise their own safety, and be aware of being pressured into sending intimate pictures.

Institutional Level- " It is not the best place"

Participants echoed their challenges with institutions such as the police to report cases of online digital violence, especially for participant 1, an orphan living with her sister who once attempted to report a perpetrator (sister's husband) who was threatening her online, forcing her into a relationship.

Participant 1 shared her thoughts on reporting, saying:

"The police station is not the best place; sometimes they require evidence for it to be a case, and in most cases social applications have settings to erase evidence such as view once or disappearing messages options, so I had no evidence"

Participant 1, 17yrs, orphaned, lives with married sister

The participants reported that reporting to the police for online violence needed proof for police to take action. In addition, adolescents raised concerns about how social media applications easily delete data, making it difficult for police to assist.

DISCUSSION

Adolescents' Understanding and Experiences of Online Sexual Violence (Individual Level)

At the individual level, findings captured adolescents' experiences and understanding of online sexual violence. Participants described the sharing of intimate images as a common behaviour within relationships, reflected in the theme "it's part of dating". This suggests that some adolescents may have limited awareness of online risks and may interpret behaviours that increase vulnerability as normal expressions of trust and commitment. This concurs with previous studies in Sub-Saharan Africa which reported that adolescents view behaviours of intimate image

sharing as harmless (11). Their perception of image sharing resulted in adolescents' failure to recognize manipulation and pressure as violence, and later they failed to negotiate with perpetrators' increasing demands offline, resulting in negative SRH outcomes.

At the interpersonal level, participants reported experiences of threats, emotional manipulation, and blackmail in their relationships that had started online. The theme *"None of them wanted to use protection"* demonstrates how relationships that start in digital spaces can reproduce power imbalances, where perpetrators use fear and coercion to control victims, as they were threatened with being replaced by another woman, resulting in failure to negotiate for safer sexual methods and even consent to use protection. In sub-Saharan Africa, girls often have limited power to negotiate safer sex because men are commonly viewed as the primary decision-makers in sexual relationships. (12).

The movement from online experiences to offline consequences highlighted important implications for adolescent sexual and reproductive health. A unique contribution of this study extends the Social Ecological Model by demonstrating how online sexual violence progresses to offline harm and identifying the mechanisms used by perpetrators. Pressure, manipulation, and fear of losing relationships reduced adolescents' ability to make independent sexual decisions. Consequently, these experiences limited their capacity to negotiate consent, condom use, and timely access to sexual and reproductive health services. These pressures to maintain relationships at all costs reveal a gap in SRH information among adolescents. Furthermore, these findings show how online platforms may increase adolescents' vulnerability to negative SRH outcomes, including unintended pregnancy, non-use of contraception, and delayed access to SRH services. Strengthening comprehensive sexuality education and promoting healthy relationships may support adolescents to make informed sexual health decisions. Previous research similarly shows that limited sexual health knowledge contributes to unsafe sexual practices and poorer sexual and reproductive health outcomes (13).

Societal pressures and beliefs shaped adolescents' views of online relationships. Out-of-school girls felt pressure, mainly from their peer networks, to be in romantic relationships, believing it was abnormal to be single at their age. While friends provided a sense of trust and belonging (14), these social expectations reinforced risky behaviours and increased vulnerability. Societal beliefs further encouraged girls to send intimate images to maintain relationships, reflected in the statement,

"I can't lose my partner over a picture."

This illustrates how existing feminine expectations to please men influenced adolescents' decisions, increasing their risk of continued victimization and poor sexual and reproductive health outcomes. In relation to the framework, these gender norms shaped how adolescents perceived violence on digital platforms, demonstrating that online spaces extended the same inequalities that exist offline.

Institutions shaped adolescents' views and perceptions in that they perceived reporting as difficult to approach, given that digital evidence, particularly on platforms, could not be preserved due to application settings that delete evidence. This, however, reduced confidence in seeking assistance, resulting in perpetrators avoiding accountability for their actions. This finding is consistent with previous studies that help-seeking through formal reporting mechanisms is limited (15), underscoring the need for stronger legislation and institutional responses to encourage reporting of online sexual violence cases.

LIMITATIONS

The sample size of 15 participants may be too small to represent the larger population of adolescents in Zimbabwe. This may also include experiences of those adolescents who are out of school but located in different geographical contexts, such as the rural part of Zimbabwe.

CONCLUSIONS

This study explored how online sexual violence contributes to sexual health risks among out-of-school adolescents. The findings addressed the study objectives by demonstrating that online and offline forms of violence are interconnected and influenced by existing social norms and gendered power relations. Using the Socio-Ecological Framework, the study highlighted that adolescents' vulnerability to online sexual violence is shaped by multiple interacting factors, including individual vulnerabilities, interpersonal relationships, digital environments that move to offline, and broader institutional influences. This demonstrates that online sexual violence does not occur in isolation but is embedded within existing social contexts.

RECOMMENDATIONS

The findings highlight the need for comprehensive interventions to protect adolescents in digital spaces. Prevention strategies should address the factors that increase vulnerability, including limited sexual and reproductive health (SRH) knowledge, economic vulnerability, and challenges in accessing support. Strengthening SRH education among adolescent girls may improve their ability to make informed decisions, exercise sexual autonomy, and negotiate safer sexual practices.

There is also a need for programmes targeting boys and men to address harmful gender norms and promote respectful online behaviours. Participants' experiences of body shaming and other forms of online abuse demonstrate that digital violence is gendered and often reflects broader inequalities. Engaging males in prevention efforts may contribute to reducing harmful behaviours and promoting safer online environments.

Finally, strengthening reporting mechanisms and support systems is essential to encourage disclosure and reduce the impact of online sexual violence. Addressing online sexual violence is critical as its consequences extend beyond digital spaces, affecting adolescents' emotional wellbeing, self-esteem, relationships, and overall sexual health.

ETHICAL DECLARATION

Ethical approval was granted by the Institutional Review Board of the Institute of Population and Social Research (COA No. No2026/04-019) and the Medical Research Council of Zimbabwe (MMRCZ/B/3138). Informed consent and assent were obtained before participation, and participants were informed of their right to withdraw at any stage. Given the sensitive nature of the study, confidentiality, privacy, and emotional support procedures were prioritized throughout the research process.

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ASSOCIATION BETWEEN FERTILITY LIMITING INTENTIONS AND COUPLE CONTRACEPTIVE UTILIZATION AMONG MARRIED MEN IN URBAN YANGON, MYANMAR

Thaw Zin Thein[1], May Chan Oo[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand

****Corresponding author:** May Chan Oo,*

College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand, Email: maychan.o@chula.ac.th

ABSTRACT

Introduction: Fertility limiting intention, defined as the desire to stop childbearing after achieving the desired family size, is an important factor associated with contraceptive behavior. While men's reproductive intentions may be relevant to family planning, evidence regarding their association with self-reported couple contraceptive use remains limited in Myanmar. This study examined the association between fertility limiting intentions and couple contraceptive utilization among married men in urban Yangon, Myanmar.

Methodology: This cross-sectional study included 408 married men from four urban townships in Yangon, Myanmar. Townships were selected via simple random sampling, with participants recruited through online convenience sampling on social media platforms. Data were collected via Google Forms using a self-administered structured questionnaire. Current self-reported couple contraceptive use was defined from the male respondent's report that he or his partner was currently using any modern or traditional contraceptive method; partner reports were not collected or independently verified. Fertility limiting intention reflected the respondent's stated desire not to have any, or any further, children. Descriptive statistics summarized participant characteristics, and multiple logistic regression identified associated factors, reporting adjusted odds ratios (AORs) with 95% confidence intervals (CIs), with statistical significance set at $p < 0.05$.

Results: Overall, 56.4% of participants reported current couple contraceptive utilization, with condoms being the most common method among users (43.5%), followed by long-acting reversible methods (17.0%). Men with fertility limiting intentions were significantly more likely to report contraceptive use than those who desired additional children (AOR = 13.901, 95% CI: 7.119–27.147, $p < 0.001$). Participants without children were less likely to utilize contraception compared with those who had children (AOR = 0.236, 95% CI: 0.118–0.471, $p < 0.001$). Receipt of family planning information was positively associated with contraceptive utilization (AOR = 3.405, 95% CI: 1.551–7.478, $p = 0.002$). Older age (≥45 years) and longer marriage duration (≥17 years) were associated with lower odds of contraceptive use.

Conclusions: Fertility limiting intentions were strongly associated with couple contraceptive utilization among married men in urban Yangon. While online convenience sampling and self-reported measures limit broader generalizability and causal inference, these findings highlight the importance of incorporating fertility intentions into family planning counseling and male engagement strategies.

Keywords:

Fertility Limiting Intention; Contraceptive Utilization; Family Planning; Married Men; Myanmar

INTRODUCTION

Family planning (FP) remains one of the most cost-effective public health interventions for improving maternal and child health outcomes and supporting couples in achieving their desired family size (1). Despite global progress, an estimated 218 million women in low- and middle-income countries still have an unmet need for modern contraception (2). While women's contraceptive behavior has been widely studied, men's reproductive intentions and influence on couple-level contraceptive decisions have received little attention, despite their frequent authority in household decision-making (3,4).

Fertility limiting intention, defined as the desire to stop childbearing after achieving the desired family size, may be associated with contraceptive behavior. However, fertility intentions do not always translate into contraceptive use (5).

Myanmar has experienced a substantial decline in fertility, yet contraceptive prevalence remains approximately 52% and unmet need for FP persists. In Yangon, contraceptive prevalence is higher than the national average, highlighting the importance of understanding factors associated with contraceptive utilization (6-9). Discontinuation of short-acting modern methods, particularly pills and injectables, is also common, limiting sustained protection from unintended pregnancy (10).

Evidence on Myanmar men supports the need to examine their reproductive intentions directly. A secondary analysis of the 2015–16 Myanmar Demographic and Health Survey found that only 39% of sexually active men reported current modern contraceptive use, with disparities by geography, occupation, and household wealth (11). Similarly, research among married men in Kyaukpadaung Township found that 40% were actively involved in FP, with involvement predicted by attitudes, subjective norms, and intention to participate, a pattern consistent with the Theory of Planned Behavior (12). Programmatic assessments have also documented limited contraception knowledge and misconceptions among Myanmar men, including beliefs that birth-spacing methods cause ill health (13).

Despite evidence on male involvement, knowledge, and attitudes toward FP in Myanmar, few studies have tested whether men's fertility limiting intention is associated with couple contraceptive utilization. Evidence from other low- and middle-income settings suggests that parity, desire for additional children, spousal communication, male support, and exposure to FP information are associated with contraceptive uptake and continuation (3,4,14-17). Therefore, this study examined whether fertility limiting intention was associated with self-reported couple contraceptive use among married men in four urban townships of Yangon, Myanmar, while accounting for socio-demographic characteristics, reproductive history, FP information, and access-related factors. The study contributes urban Myanmar evidence on how men's reproductive intentions relate to reported contraceptive practice and may inform FP counseling approaches that engage men's reproductive intentions alongside those of their partners.

METHODOLOGY

The four townships were selected by simple random sampling from the urban townships of Yangon to provide geographic coverage within the study area. Eligibility criteria were currently married men of reproductive age, with a wife or partner also of reproductive age, residing in the selected townships and able to complete the online questionnaire. Men who were not currently married, whose wife or partner was not of reproductive age, or who did not reside in the selected townships were excluded. The required sample size was determined before data collection based on the planned logistic regression analysis; 408 eligible respondents were included in the final analysis.

The questionnaire was structured to cover socio-demographic characteristics, reproductive history, fertility intentions, FP information, access to services, and contraceptive utilization. The available study documentation does not report a formal Cronbach's alpha or other internal-consistency coefficient; therefore, no reliability coefficient is presented here.

A community-based cross-sectional study was conducted among married men residing in four urban townships (Kamayut, Ahlon, Kyauktada, and Thingangyun) of Yangon, Myanmar. Participants were recruited using a convenient sampling approach through social media such as Facebook, Telegram, and Viber. Eligible participants were currently married men of reproductive age whose wives or partners were also of reproductive age, recruited from households within the selected townships. Data were collected using a structured self-administered questionnaire assessing socio-

demographic characteristics, reproductive history, fertility intentions, FP information, access to services, and contraceptive utilization.

The primary outcome was current self-reported couple contraceptive use, defined as the male respondent's report that he or his partner was currently using any modern or traditional contraceptive method. The partner was not surveyed, and the reported use was not independently verified. The key explanatory variable was fertility limiting intention, operationalized as the respondent's stated desire not to have any, or any further, children. Descriptive statistics (frequencies and percentages) were used to summarize participant characteristics and contraceptive method mix among current users. Variables associated with contraceptive utilization in bivariable analysis were entered into multiple logistic regression. Multicollinearity among variables included in the adjusted model was assessed using variance inflation factors (VIFs) and tolerance values. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported, with $p < 0.05$ considered statistically significant.

RESULTS

Table 1 shows the socio-demographic, reproductive, family planning information, and service access characteristics of the study participants. Of the 408 married men surveyed, nearly half were aged 33–44 years, with a median age of 38 years. Most participants had undergraduate or postgraduate education, and more than half were non-manual workers. Regarding reproductive characteristics, about two-thirds had living children and did not desire additional children, suggesting that fertility limiting intention was common in this sample.

Access to family planning services appeared generally favorable, as most participants had received FP information, reported the presence of a place to obtain FP services, and lived within 3 km of the nearest FP source, although more than one-fourth still required 30 minutes or longer to reach services. Overall, 230 participants (56.4%) reported current couple contraceptive utilization, while 178 (43.6%) reported no current use. Among contraceptive users, condoms were the predominant method, indicating the important role of male-controlled methods in contraceptive practice.

Table 1 Socio-demographic, reproductive, family planning information, and service access characteristics of the study participants (n = 408)

Characteristics	Study Participants (n = 408)	
	n	%
Age (years)		
≤ 32	112	27.4
33 – 44	201	49.3
≥ 45	95	23.3
Min – Max = 21 – 65, Median (Q1 – Q3) = 38 (32 – 44)		
Education Background		
Basic	30	7.3
Undergraduate	207	50.7
Postgraduate	171	41.9
Occupation		
Dependent	32	7.8
Manual worker	29	7.1
Non-manual worker	217	53.2
High-level professional	130	31.9

Characteristics	Study Participants (n = 408)	
	n	%
Marriage duration (years)		
< 7	113	27.7
7-16	196	48
≥ 17	99	24.3
Min – Max = 1 – 39, Median (Q1 – Q3) = 11 (6 – 15)		
Having children		
Yes	281	68.9
No	127	31.1
Desire for having children/more children		
Yes	127	31.1
No	281	68.9
Received FP information		
Yes	356	87.3
No	52	12.7
Presence of a place to obtain FP		
Yes	389	95.3
No	6	1.5
Not sure	13	3.2
Distance to nearest FP source (km)		
≤ 3km	252	61.8
> 3km	156	38.2
Travel duration (minutes)		
≤ 10 mins	135	33.1
11 - 29 mins	156	38.2
≥ 30 mins	117	28.7
Min – Max = 3 - 70, Median (Q1 – Q3) = 15 (10 – 30)		
Current contraceptive use		
Yes	230	56.4
No	178	43.6

Figure 1 shows the distribution of social norms, cultural norms, knowledge, and perception related to family planning among the study participants. More than half of the participants reported no social norms related to family planning (59.1%), whereas cultural norms were present among slightly more than half of the respondents (54.9%). Regarding knowledge, most participants had a moderate level of family planning knowledge (68.6%), while only 25.3% had good knowledge. Similarly, perception toward family planning was mostly moderate (48.3%), with 25.0% having low perception and 26.7% having high perception. Overall, these findings suggest that although family planning knowledge and perception were generally moderate, cultural norms remained relatively common among the study participants.

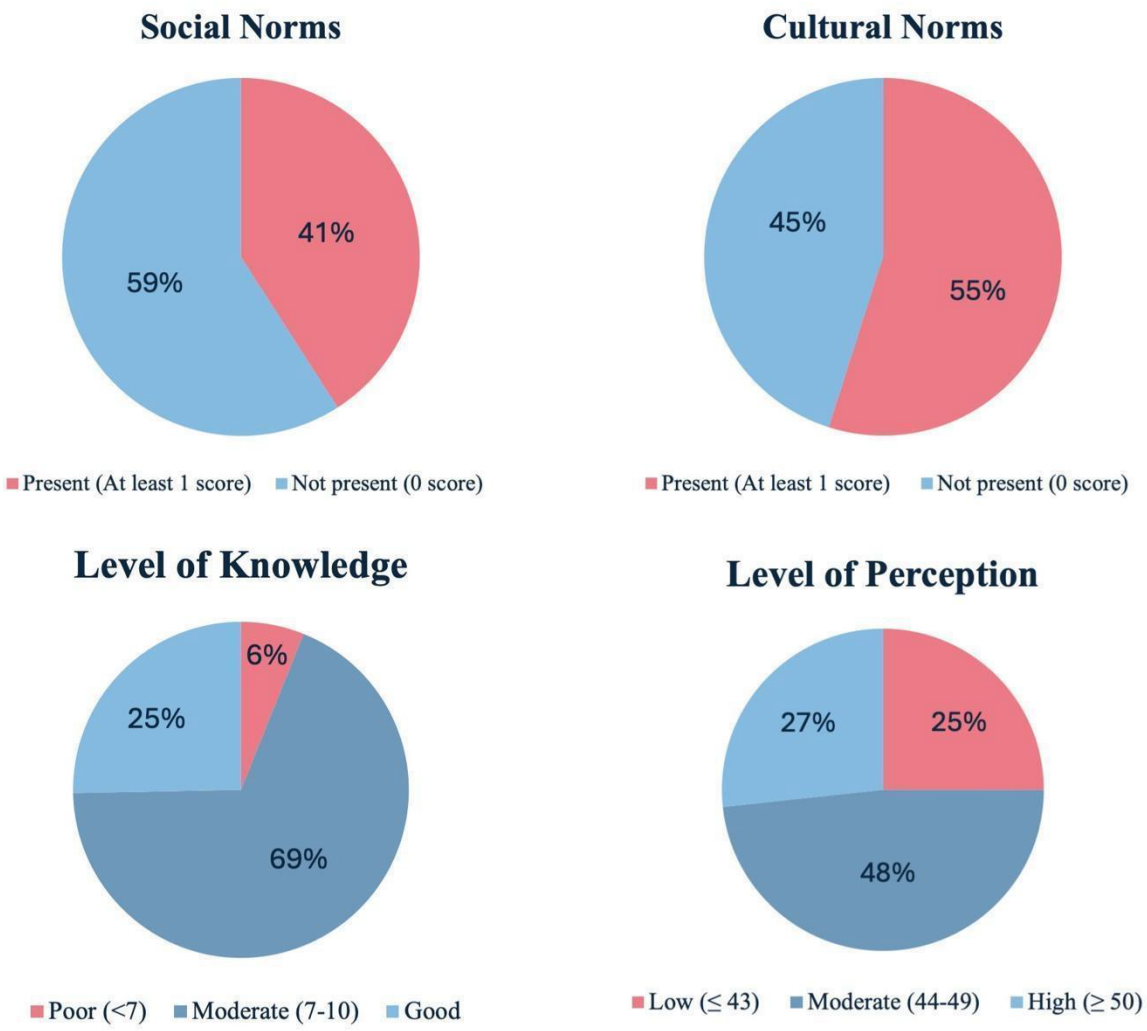

Figure 1 The distribution of social norms, cultural norms, knowledge, and perception related to family planning among the study participants

Bivariable logistic regression (Table 2) identified several factors significantly associated with couple contraceptive utilization. Age was strongly associated with use: men aged 33–44 years had higher odds of contraceptive use than those aged 32 years or younger (COR = 1.749, 95% CI: 1.088–2.813, p = 0.021), while men aged 45 years and older had markedly lower odds (COR = 0.445, 95% CI: 0.253–0.781, p = 0.005). Marriage duration followed a similar pattern, with men married 7–16 years showing higher odds of use relative to those married fewer than 7 years (COR = 1.611, 95% CI: 1.007–2.579, p = 0.047), though the association weakened for men married 17 years or more. Having living children was strongly associated with contraceptive use (COR = 2.615, 95% CI: 1.701–4.021, p < 0.001), whereas men who desired additional children were markedly less likely to report contraceptive use than those who did not (COR = 0.198, 95% CI: 0.126–0.312, p < 0.001). Moderate perception scores were also positively associated with use (COR = 1.680, 95% CI: 1.038–2.721, p = 0.035). Education, occupation, receipt of family planning information, distance to the nearest family planning source, social and cultural norms, and knowledge were not significantly associated with contraceptive use in bivariable analysis.

Table 2 Bivariable logistic regression analysis of factors associated with couple contraceptive utilization among married men in urban Yangon, Myanmar (n = 408)

Variable	No n (%)	Yes n (%)	COR	95% CI LL	95% CI UL	p-value
Age group (years)						
≤ 32	51 (45.5)	61 (54.5)	Ref	—	—	< 0.001
33 – 44	65 (32.3)	136 (67.7)	1.749	1.088	2.813	0.021
≥ 45	62 (65.3)	33 (34.7)	0.445	0.253	0.781	0.005
Education						
Basic	14 (46.7)	16 (53.3)	Ref	—	—	0.793
Undergraduate	87 (42.0)	120 (58.0)	1.207	0.560	2.603	0.632
Postgraduate	77 (45.0)	94 (55.0)	1.068	0.491	2.325	0.868
Occupation						
Other	130 (46.8)	148 (53.2)	Ref	—	—	—
High professional	48 (36.9)	82 (63.1)	1.501	0.979	2.300	0.063
Marriage duration (years)						
< 7	54 (47.8)	59 (52.2)	Ref	—	—	0.011
7 – 16	71 (36.2)	125 (63.8)	1.611	1.007	2.579	0.047
≥ 17	53 (53.5)	46 (46.5)	0.794	0.463	1.364	0.404
Have children						
No	76 (59.8)	51 (40.2)	Ref	—	—	—
Yes	102 (36.3)	179 (63.7)	2.615	1.701	4.021	< 0.001
Desire for additional children						
No	89 (31.7)	192 (68.3)	Ref	—	—	—
Yes	89 (70.1)	38 (29.9)	0.198	0.126	0.312	< 0.001
Received FP information						
No	28 (53.8)	24 (46.2)	Ref	—	—	—
Yes	150 (42.1)	206 (57.9)	1.602	0.893	2.874	0.114
Presence of a place to obtain FP						
No	5 (83.3)	1 (16.7)	Ref	—	—	0.216
Yes	168 (43.2)	221 (56.8)	6.577	0.761	56.828	0.087
Not sure	5 (38.5)	8 (61.5)	8.000	0.711	90.001	0.092
Distance to nearest FP source (km)						
≤ 3	114 (45.2)	138 (54.8)	Ref	—	—	—
> 3	64 (41.0)	92 (59.0)	1.187	0.793	1.779	0.405
Travel duration (minutes)						
≤ 10	69 (51.1)	66 (48.9)	Ref	—	—	0.059
11 – 29	58 (37.2)	98 (62.8)	1.766	1.106	2.822	0.017
≥ 30	51 (43.6)	66 (56.4)	1.353	0.823	2.225	0.234
Social norms						
Not Present	96 (39.8)	145 (60.2)	Ref	—	—	—
At least one traditional norm	82 (49.1)	85 (50.9)	0.686	0.461	1.022	0.064
Cultural norms						
Not Present	77 (41.8)	107 (58.2)	Ref	—	—	—
At least one traditional norm	101 (45.1)	123 (54.9)	0.876	0.591	1.299	0.511
Knowledge						
Poor/moderate	132 (43.3)	173 (56.7)	Ref	—	—	—
Good	46 (44.7)	57 (55.3)	0.945	0.603	1.482	0.807

Variable	No n (%)	Yes n (%)	COR	95% CI LL	95% CI UL	p-value
Perception						
Low	54 (52.9)	48 (47.1)	Ref	—	—	0.091
Moderate	79 (40.1)	118 (59.9)	1.680	1.038	2.721	0.035
High	45 (41.3)	64 (58.7)	1.600	0.928	2.758	0.091

COR, crude odds ratio; CI, confidence interval; LL, lower limit; UL, upper limit; Ref, reference category.

The final logistic regression model demonstrated an acceptable fit. The Hosmer–Lemeshow goodness-of-fit test was non-significant (p = 0.868), whereas the omnibus test was significant (p < 0.001). No problematic multicollinearity was detected (maximum VIF = 1.87; minimum tolerance = 0.63).

In the multiple logistic regression model (Table 3), fertility limiting intention showed the strongest adjusted association with self-reported couple contraceptive use. Men who did not desire additional chil-dren had substantially higher odds of reporting current contraceptive use than men who desired more children, after adjustment for other covariates (AOR = 13.901, 95% CI: 7.119–27.147, p < 0.001). Having no living children was associated with substantially lower odds of contraceptive use compared with having children (AOR = 0.236, 95% CI: 0.118–0.471, p < 0.001). Receipt of family planning information was independently associated with greater odds of contraceptive use after adjustment (AOR = 3.405, 95% CI: 1.551–7.478, p = 0.002). Older age (≥ 45 years: AOR = 0.073, 95% CI: 0.028–0.189, p < 0.001) and longer marriage duration (≥ 17 years: AOR = 0.253, 95% CI: 0.094–0.680, p = 0.006) remained independently associated with significantly lower odds of contraceptive use after adjustment. Occupation, travel duration to family planning sources, social norms, and perception were not statistically significant in the adjusted model.

Table 3 Multiple logistic regression analysis of factors independently associated with couple contraceptive utilization among married men in urban Yangon, Myanmar (n = 408)

Variable	AOR	95% CI LL	95% CI UL	p-value
Age group (years)				
≤ 32	Ref	—	—	< 0.001
33 – 44	0.529	0.260	1.076	0.079
≥ 45	0.073	0.028	0.189	< 0.001
Occupation				
Other	Ref	—	—	—
High professional	1.152	0.663	2.001	0.615
Marriage duration (years)				
< 7	Ref	—	—	0.021
7 – 16	0.506	0.229	1.114	0.091
≥ 17	0.253	0.094	0.680	0.006
Have children				
Yes	Ref	—	—	—
No	0.236	0.118	0.471	< 0.001
Desire for additional children				
Yes	Ref	—	—	—
No	13.901	7.119	27.147	< 0.001

Variable	AOR	95% CI LL	95% CI UL	p-value
Received FP information				
No	Ref	—	—	—
Yes	3.405	1.551	7.478	0.002
Travel duration (minutes)				
≤ 10	Ref	—	—	0.867
11 – 29	0.851	0.463	1.564	0.603
≥ 30	0.949	0.507	1.777	0.870
Social norms				
Not present	Ref	—	—	—
At least one traditional norm	0.661	0.395	1.105	0.114
Perception				
Low	Ref	—	—	0.186
Moderate	1.733	0.942	3.188	0.077
High	1.264	0.637	2.508	0.503

AOR, adjusted odds ratio; CI, confidence interval; LL, lower limit; UL, upper limit; Ref, reference category.

DISCUSSION

The magnitude of the adjusted association (AOR = 13.901) should also be interpreted cautiously. The large estimate may partly reflect the close conceptual relationship between fertility-limiting intention and contraceptive behavior, as well as the distribution of participants across these categories. Sparse data, overlap between the predictor and outcome, or residual confounding cannot be ruled out from the available analyses. Thus, the estimate should be interpreted as a strong association rather than evidence of a causal effect. Consistent with previous studies, fertility limiting intention was the strongest predictor of contraceptive utilization, indicating a strong association between having fertility-limiting intentions and reported contraceptive use (5,8,19).

The association between having living children and contraceptive use also mirrors findings from other settings, where couples without children, or with low parity, are less likely to adopt contraception due to fertility concerns and social pressure to demonstrate fecundity (14). In this Myanmar sample, men without children had roughly a quarter of the odds of contraceptive use compared with men who had children, even after adjusting for fertility limiting intention, suggesting that parity and intention operate as related but distinct drivers of behavior; achieving a desired family size appears to be necessary, but not sufficient on its own, for contraceptive uptake.

Receipt of FP information was independently associated with contraceptive utilization, although it was not statistically significant in bivariable analysis. The change after adjustment may reflect confounding or suppression by other reproductive characteristics, particularly fertility intention and parity (3,14,17,18). The negative association between older age, longer marriage duration, and contraceptive use differs from some findings, including an Ethiopian study where couples married longer were slightly more likely to be current contraceptive users (15). However, use of barrier and short-acting hormonal methods may decline with age and relationship duration because of reduced coital frequency, perceived lower fecundity, or reliance on permanent methods not fully captured by this study's outcome (19). Since condoms were the predominant method, older and longer-married men may be less consistent users of episodic methods. Future studies should capture the full method mix, including permanent methods.

Some variables significant in bivariable analysis lost significance after adjustment, suggesting that their unadjusted associations may be confounded by other reproductive characteristics, including fertility limiting intention and parity. Social and cultural norms

and knowledge were not significantly associated, contrasting with Theory of Planned Behavior-based work among Myanmar men in the Mandalay Region, where attitudes and subjective norms predicted FP involvement (12). This difference may reflect variation in outcome measurement, study setting, or local context.

These findings have implications for FP programming in Myanmar. Counseling should explore both partners' fertility intentions, reproductive goals, and decision-making dynamics, rather than focusing only on method provision. Such approaches may help couples discuss how reproductive goals relate to contraceptive practice. Given the association between FP information and use, investment in couple-based counseling, health worker engagement, and mass media remains important (16), consistent with evidence that men's exposure to FP messaging shapes contraceptive attitudes and behavior in similar Asian settings (11,13).

CONCLUSION

Fertility limiting intentions were strongly associated with self-reported couple contraceptive use among married men in urban Yangon, Myanmar. Participants who did not desire additional children had substantially higher odds of reporting contraceptive use than those who desired additional children. Having children and receiving FP information were positively associated with contraceptive utilization, whereas older age and longer marriage duration were negatively associated with contraceptive use. These findings suggest that fertility intentions and reproductive goals may be useful topics in FP counseling and male engagement interventions. Strengthening access to FP information and encouraging men's participation in reproductive decision-making may support contraceptive use, although longitudinal research is needed before causal conclusions can be drawn. Future longitudinal studies are recommended to better understand the temporal relationship between fertility intentions and contraceptive behavior.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (RECCU), Thailand (COA No.264/68). Participation was voluntary, anonymous, and confidential, and participants could withdraw at any time without consequences.

STRENGTHS AND LIMITATIONS

A key strength of this study is its focus on married men's fertility-limiting intentions and their association with couple contraceptive utilization, an area that remains relatively underexamined in Myanmar. The study included 408 married men and used multiple logistic regression to account for relevant socio-demographic, reproductive, and family planning-related factors. The study also provides urban Myanmar evidence on the relationship between men's reproductive intentions and reported contraceptive practice.

Several limitations should be considered. First, the cross-sectional design prevents causal inference and does not establish the temporal direction between fertility intentions and contraceptive use. Second, contraceptive use was self-reported by men and was not independently verified by their partners, which may introduce reporting or recall bias. Third, online convenience sampling may have overrepresented more educated and digitally connected men, limiting representativeness. Finally, the study was restricted to four urban townships in Yangon, limiting generalizability to rural and other populations in Myanmar. The outcome also did not distinguish contraceptive method types or consistency of use.

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DETERMINANTS OF BREAST CANCER AND BREAST SELF-EXAMINATION KNOWLEDGE AND PERCEPTIONS AMONG WOMEN AGED 20–49 YEARS IN YANGON, MYANMAR

Nway Nway Mon [1]***, May Chan Oo*** [1]***

[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.*

***Corresponding author:** May Chan Oo,*

College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, Email: maychan.o@chula.ac.th

ABSTRACT

Introduction: Breast cancer is one of the most common cancers among women worldwide and is an increasing public health concern in Myanmar. Breast self-examination (BSE) is a simple and low-cost approach that may enhance breast health awareness and support early detection. Women aged 20–49 years represent an important reproductive-age population for breast health promotion and early detection interventions. However, evidence regarding women's knowledge and perceptions of breast cancer and BSE in Myanmar remains limited.

Objective: This study aimed to assess the levels of knowledge and perceptions of breast cancer and BSE and identify their determinants among reproductive-age women aged 20-49 years in Yangon, Myanmar.

Methodology: A cross-sectional study was conducted among 319 women aged 20–49 years who had resided in Yangon for at least six months. Data were collected through a structured online questionnaire distributed via social media platforms using convenience sampling. Descriptive statistics, Chi-square tests, and multiple logistic regression analyses were performed using IBM SPSS version 29 to identify independent determinants. Statistical significance was set at $p < 0.05$.

Results: Among the participants, 75.5% had poor knowledge, with only 5.6% demonstrating good knowledge regarding breast cancer and BSE. Additionally, 58.3% had negative perceptions, while 41.7% had positive perceptions. Bivariate analysis showed significant associations between knowledge and occupation, monthly household income, age at menarche, informational accessibility, and financial accessibility. Perceptions were significantly associated with education, occupation, religion, monthly household income, age at menarche, pregnancy history, informational accessibility, and financial accessibility ($p < 0.05$). Multivariable logistic regression identified occupation ($p = 0.013$), religion (AOR = 0.20, 95% CI: 0.06–0.70, $p = 0.011$), age at menarche ($p < 0.001$), and informational accessibility (AOR = 0.20, 95% CI: 0.10–0.39, $p < 0.001$) as significant factors associated with knowledge. Meanwhile, religion (AOR = 2.76, 95% CI: 1.14–6.66, $p = 0.024$), age at menarche ($p < 0.001$), and informational accessibility (AOR = 0.41, 95% CI: 0.23–0.75, $p = 0.004$) remained significant factors associated with perception.

Conclusion: Poor knowledge and negative perceptions of breast cancer and BSE were common among women in Yangon. These findings may inform the development of targeted breast health education and awareness programs that prioritize women with limited access to breast health information to improve breast cancer awareness and promote positive breast health behaviors in Myanmar.

Keywords:
Breast Self-Examination; Breast Cancer; Health Belief Model; Women; Myanmar.

INTRODUCTION

Breast cancer is the most diagnosed cancer among women worldwide, a leading cause of cancer-related mortality (1). In 2022, approximately 2.3 million new cases and 670,000 deaths were reported globally (2). Although screening and treatment have improved survival in many developed countries, breast cancer remains a major health problem in low-and middle-income countries, where women

are diagnosed at advanced stages and have limited access to healthcare (3).

In Asia, incidence has increased steadily, with many countries reporting peak occurrence among women aged 40–50 years (4, 5). Consequently, breast cancer affects women during their most productive and reproductive years, creating social and economic consequences for individuals, families, and communities (6).

Myanmar faces a growing breast cancer burden. According to GLOBOCAN 2022, breast cancer is the most frequently diagnosed cancer among women in Myanmar and a major cause of cancer-related deaths (7). Many women continue to be diagnosed at advanced stages of disease, while limited awareness of symptoms and risk factors and restricted access to screening and diagnostic services contribute to delayed healthcare-seeking behavior and poor outcomes (8).

Breast self-examination (BSE) is a simple, low-cost method that promotes breast awareness and may facilitate earlier recognition of abnormal breast changes, particularly where organized screening programs are limited (9, 10).

Knowledge and perceptions regarding breast cancer and BSE are important factors associated with preventive health behaviors. According to the Health Belief Model (HBM), knowledge and perceptions influence preventive health behaviors, while inadequate knowledge is associated with lower participation in breast health practices (11). Women aged 20–49 years were selected because they represent the reproductive-age population, when breast awareness, education, and BSE can be introduced to promote early recognition of breast changes and guide age-appropriate preventive interventions (12).

In Myanmar, studies on breast cancer and BSE have mainly focused on healthcare workers, students, and hospital-based populations, with limited evidence among women in the community. Therefore, this study aimed to assess knowledge and perceptions regarding breast cancer and BSE and identify their determinants among reproductive-age women aged 20–49 years in Yangon, Myanmar.

Methodology

Study Design, Setting and Population

A quantitative cross-sectional study was conducted among women aged 20–49 years residing in Yangon, Myanmar. Data were collected from 6 May 2026 and continued for approximately three weeks,

Sample size

The sample size was calculated using a single population proportion formula based on a previous study in Nepal (13), which reported 27.1%, and adjusted for 5% non-response, yielding a final sample of 319 women.

Sampling Method and Data Collection

Data were collected using a self-administered Google Forms questionnaire distributed via social media platforms, mainly Facebook and Messenger. Recruitment messages included study information and the questionnaire link. Participants were screened for eligibility questions, confirming that they were women aged 20–49 years and had resided in Yangon for at least six months. Participants who did not meet these criteria were not eligible to continue. Eligible women provided electronic informed consent before participation. All items were required, preventing the submission of incomplete questionnaires. Potential duplicate submissions were checked using participants' phone numbers provided for incentives, and no duplicates were identified. A total of 319 complete responses were included in the final analysis.

Measurement tools

The questionnaire consisted of four sections: socio-demographic characteristics, reproductive health factors, healthcare accessibility factors, and knowledge and perceptions regarding breast cancer and BSE. Knowledge was assessed using 17 items adapted from studies in India, Jordan, and Oman (14-16).

Correct responses scored one point, with negatively worded items reverse-scored. Using Bloom's cut-offs, scores ≤10 (<60%) indicated poor, 11-13 (60-79%) moderate, and 14-17 (≥80%) good knowledge (17). Moderate and good knowledge categories were combined as adequate knowledge for regression analysis because the proportion with good knowledge was small. Perceptions were assessed using HBM constructs on a four-point Likert scale, adapted from a Saudi Arabian study (18). Negatively worded items were reverse-scored, and scores were categorized as positive and negative using the median.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29. Descriptive statistics summarized participant characteristics, knowledge, and perceptions. Chi-square tests examined bivariate associations. Variables with $p < 0.20$ were entered into multivariable logistic regression models to identify independent factors after adjusting for potential confounders. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported, with $p < 0.05$ considered statistically significant.

Validity and Reliability

Content validity was assessed by three public health experts using the Index of Item-Objective Congruence (IOC), with a final IOC of 0.96. Items with IOC ≥0.70 were retained, while lower-scoring items were revised based on expert feedback. Construct validity was supported by adapting the knowledge items from studies in India, Jordan, and Oman (14-16) and the perception items from a Saudi Arabian HBM-based instrument (18). Internal consistency was acceptable, with Cronbach's alpha of 0.81 for perception and KR-20 of 0.75 for knowledge.

RESULTS

Among 319 participants, most were aged 30–39 years (40.1%), had college education or above (68.3%), were manual or non-manual workers (43.9%), were Bamar (72.4%), and were Buddhist (87.8%). Only 40.8% had received breast health education, while 46.4% perceived breast health services as very expensive.

Table 1 Sociodemographic, reproductive health, and healthcare accessibility characteristics of participants (n = 319)

Socio–demographic factors	Study participants (n = 319)	
	No.	%
Age		
20-29	110	34.5
30-39	128	40.1
40-49	81	25.4
Education level		
≤High school	101	31.7
≥College/bachelor	218	68.3
Marital Status		
Single	175	54.9
Married	110	34.5
Divorced/widowed	34	10.7
Occupation		
Dependent	100	31.3
Manual/non-manual	140	43.9
High-level professional	79	24.8

Socio–demographic factors	Study participants (n = 319)	
	No.	%
Ethnicity		
Bamar	231	72.4
Others	88	27.6
Religion		
Buddhism	280	87.8
Others	39	12.2
Monthly Household Income		
<500,000 kyats	59	18.5
500,000-1,000,000 kyats	115	36.1
1,000,001-500,000 kyats	95	29.8
>1,500,000 kyats	50	15.7
Age at menarche		
Early	9	2.8
Normal	253	79.3
Late	57	17.9
Menstrual history		
Regular	276	86.5
Irregular	43	13.5
Pregnant history		
Yes	219	68.7
No	100	31.3
Previous breast problems		
Yes	41	12.9
No	278	87.1
Family/friend with history of breast cancer		
Yes	133	41.7
No	186	58.3
Informational accessibility: Received breast health education/counselling		
Yes	130	40.8
No	189	59.2
Financial accessibility: Affordability of breast health services		
Very expensive	148	46.4
Expensive but affordable	103	32.3
Affordable/free	68	21.3

Exchange rate (1$ = 4200kyats)

In Figure 1, 75.5% of participants demonstrated poor knowledge, while only 5.6% had good knowledge. For perceptions toward breast cancer and BSE, more than half of the participants (58.3%) demonstrated negative perceptions.

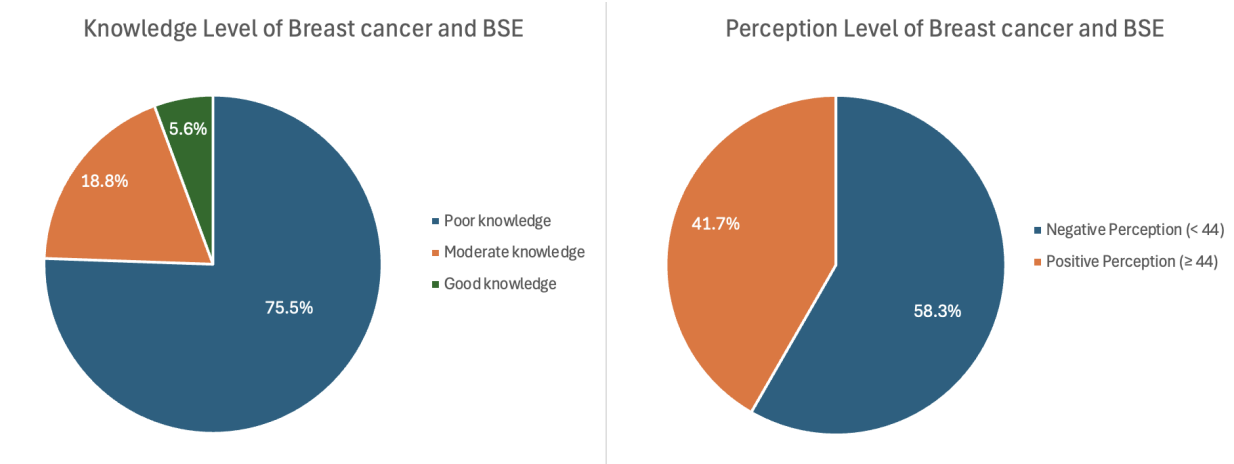

Figure 1 Level of Knowledge and Perception regarding Breast Cancer and BSE (n=319)

Table 2 Analysis of perception scores based on HBM construct (n = 319)

HBM construct	No. of items	Observed total-score range	Total score, mean ± SD
Perceived susceptibility	2	2–8	4.10 ± 1.42
Perceived severity	3	3–12	8.49 ± 1.53
Self-efficacy	3	3–12	7.97 ± 1.47
Perceived benefits	3	6–12	8.60 ± 1.15
Perceived barriers	3	4–12	8.36 ± 1.63
Health motivation	2	3–8	6.29 ± 0.86

Among HBM constructs in Table 2, perceived susceptibility had the lowest mean score (4.10 ± 1.42), whereas perceived benefits had the highest (8.60 ± 1.15). Health motivation was also relatively high (6.29 ± 0.86), suggesting that participants recognized prevention benefits and were motivated to maintain breast health, but perceived their personal susceptibility as relatively low.

Table 3 Factors associated with knowledge and perceptions of breast cancer and BSE

Characteristic	Knowledge:			p-value	Perception:		p-value
	Poor n (%)	Moderate n (%)	Good n (%)		Negative n (%)	Positive n (%)	
Age		$\chi2$= 7.659		0.105	$\chi2$= 5.539		0.063
20-29	88 (80.0)	18 (16.4)	4 (3.6)		58 (52.7)	52 (47.3)	
30-39	87 (68.0)	32 (25.0)	9 (7.0)		72 (56.3)	56 (43.8)	
40-49	66 (81.5)	10 (12.3)	5 (6.2)		56 (69.1)	25 (30.9)	
Education level		$\chi2$= 9.421		0.121	$\chi2$= 3.920		0.048*
≤High school	77 (76.2)	22 (21.8)	2 (2.0)		67 (66.3)	34 (33.7)	
≥College/bachelor	164 (75.2)	38 (17.4)	16 (7.3)		119 (54.6)	99 (45.4)	
Marital Status		$\chi2$= 1.684		0.794	$\chi2$= 0.857		0.652
Single	135 (77.1)	30 (17.1)	10 (5.7)		98 (56.0)	77 (44.0)	
Married	79 (71.8)	24 (21.8)	7 (6.4)		67 (60.9)	43 (39.1)	
Divorced/widowed	27 (79.4)	6 (17.6)	1 (2.9)		21 (61.8)	13 (38.2)	

Characteristic	Knowledge:			p-value	Perception:		p-value
	Poor n (%)	Moderate n (%)	Good n (%)		Negative n (%)	Positive n (%)	
Occupation		χ2=31.981		<0.001*	χ2=10.861		0.004*
Dependent	69 (69.0)	25 (25.0)	6 (6.0)		51 (51.0)	49 (49.0)	
Manual/non-manual	123 (87.9)	17 (12.1)	0 (0.0)		96 (68.6)	44 (31.4)	
High-level professional	49 (62.0)	18 (22.8)	12 (15.2)		39 (49.4)	40 (50.6)	
Ethnicity		χ2=1.579		0.454	χ2=2.571		0.109
Bamar	175 (75.8)	41 (17.7)	15 (6.5)		141 (61.0)	90 (39.0)	
Others	66 (75.0)	19 (21.6)	3 (3.4)		45 (51.1)	43 (48.9)	
Religion		χ2=5.420		0.06	χ2=5.459		0.019*
Buddhism	206 (73.6)	56 (20.0)	18 (6.4)		170 (60.7)	110 (39.3)	
Others	35 (89.7)	4 (10.3)	0 (0.0)		16 (41.0)	23 (59.0)	
Monthly Household Income		χ2=23.840		<0.001*	χ2=14.153		0.003*
<500,000 kyats	49 (83.1)	8 (13.6)	2 (3.4)		41 (69.5)	18 (30.5)	
500,000-1,000,000 kyats	99 (86.1)	15 (13.0)	1 (0.9)		72 (62.6)	43 (37.6)	
1,000,001-1,500,000 kyats	63 (66.3)	24 (25.3)	8 (8.4)		55 (57.9)	40 (42.1)	
>1,500,000 kyats	30 (60.0)	13 (26.0)	7 (14.0)		18 (36.0)	32 (64.0)	
Age at menarche		χ2=14.394		0.001a*	χ2 38.022		<0.001*
Early Menarche	6 (66.7)	2 (22.2)	1 (11.1)		4 (44.4)	5 (55.6)	
Normal Menarche	181 (71.5)	55 (21.7)	17 (6.7)		128 (50.6)	125 (49.4)	
Late Menarche	54 (94.7)	3 (5.3)	0 (0.0)		54 (94.7)	3 (5.3)	
Menstrual history		χ2=3.108		0.211	χ2=0.475		0.491
Regular	213 (77.2)	49 (17.8)	14 (5.1)		163 (59.1)	113 (40.9)	
Irregular	28 (65.1)	11 (25.6)	4 (9.3)		23 (53.3)	20 (46.5)	
Pregnant history		χ2=2.179		0.336	χ2=4.528		0.033*
Yes	165 (75.3)	39 (17.8)	15 (6.8)		119 (54.3)	100 (45.7)	
No	76 (76.0)	21 (21.0)	3 (3.0)		67 (67.0)	33 (33.0)	
Previous breast problems		χ2=2.775		0.250	χ2=0.972		0.324
Yes	27 (65.9)	10 (24.4)	4 (9.8)		21 (51.2)	20 (48.8)	
No	214 (77.0)	50 (18.0)	14 (5.0)		165 (59.4)	113 (40.6)	
Family/friend history BC		χ2=3.026		0.220	χ2=1.097		0.295
Yes	95 (71.4)	31 (23.3)	7 (5.3)		73 (54.9)	60 (45.1)	
No	146 (78.5)	29 (15.6)	11 (5.9)		113 (60.8)	73 (39.2)	
Received BC education		χ2=20.968		<0.001*	X2=9.851		0.024*
Yes	81 (62.3)	37 (28.5)	12 (9.2)		66 (50.8)	64 (49.2)	
No	160 (84.7)	23 (12.2)	6 (3.2)		120 (63.5)	69 (36.5)	
Affordability of BC services		χ2=15.451		0.004*	χ2=6.202		0.045*
Very expensive	123 (83.1)	20 (13.5)	5 (3.4)		97 (65.5)	51 (34.5)	
Expensive but affordable	64 (62.1)	30 (29.1)	9 (8.7)		52 (50.5)	51 (49.5)	
Affordable/free	54 (79.4)	10 (14.7)	4 (5.9)		37 (54.4)	31 (45.6)	

**p-value < 0.05,* χ2=Chi-square value, a= Fisher exact test

In Table 3, bivariate analysis showed that knowledge was significantly associated with occupation (p < 0.001), monthly household income (p < 0.001), age at menarche (p = 0.006), informational accessibility (p < 0.001), and financial accessibility (p = 0.004). Perception was

significantly associated with education (p = 0.048), occupation (p = 0.004), religion (p = 0.019), monthly household income (p = 0.003), age at menarche (p < 0.001), pregnancy history (p = 0.033), informational accessibility (p = 0.024), and financial accessibility (p = 0.045).

Both logistic regression models demonstrated adequate fit. For the knowledge model, the Hosmer–Lemeshow goodness-of-fit test was non-significant (p = 0.943), with Cox and Snell R^2 = 0.260 and Nagelkerke R^2 = 0.388. The omnibus test was significant (p < 0.001). For the perception model, the Hosmer–Lemeshow test was also non-significant (p = 0.780), with Cox and Snell R^2 = 0.248 and Nagelkerke R^2 = 0.330; the omnibus test was significant (p < 0.001).

Table 4 Multivariable logistic regression analysis of determinants for knowledge and perception

Characteristics	Knowledge		Perception	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Age group				
20-29	1 (Ref)	0.094	1 (Ref)	0.287
30-39	1.93 (0.93–3.99)	0.076	0.81 (0.43–1.54)	0.524
40-49	0.89 (0.37–2.16)	0.796	0.52 (0.23–1.18)	0.117
Education				
≤High school	1 (Ref)		1 (Ref)	
≥College/bachelor	0.72 (0.34–1.52)	0.383	1.17 (0.62–2.20)	0.625
Occupation				
Dependent	1 (Ref)	0.013*	1 (Ref)	0.234
Manual/non-manual	0.33 (0.15–0.72)	0.005*	0.62 (0.32–1.19)	0.151
High professional	0.90 (0.39–2.08)	0.809	1.06 (0.49–2.29)	0.888
Ethnicity				
Others	-	-	1 (Ref)	
Bamar	-	-	0.98 (0.52–1.82)	0.939
Religion				
Buddhism	1 (Ref)		1 (Ref)	
Others	0.20 (0.06–0.70)	0.011*	2.76 (1.14–6.66)	0.024*
Family Household income				
<500,000 kyats	1 (Ref)	0.116	1 (Ref)	0.532
500,000-1,000,000 kyats	0.69 (0.24–1.95)	0.484	1.14 (0.52–2.52)	0.740
1,000,001-1,500,000 kyats	1.83 (0.65–5.20)	0.254	1.33 (0.56–3.16)	0.514
>1,500,000 kyats	1.41 (0.43–4.63)	0.573	2.02 (0.75–5.50)	0.167
Age at Menarche				
Early	1 (Ref)	<0.001*	1 (Ref)	<0.001*
Normal	0.66 (0.13–3.43)	0.623	0.63 (0.14–2.93)	0.559
Late	0.03 (0.004–0.25)	0.001*	0.02 (0.003–0.16)	<0.001*
Pregnant history				
Yes	-	-	1 (Ref)	
No	-	-	0.71 (0.34–1.50)	0.371
Information access				
Yes	1 (Ref)		1 (Ref)	
No	0.20 (0.10–0.39)	<0.001*	0.41 (0.23–0.75)	0.004*

Characteristics	Knowledge		Perception	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Financial access				
Very Expensive	1 (Ref)	0.103	1 (Ref)	0.375
Expensive but affordable	1.97 (0.91–4.28)	0.088	1.53 (0.76–3.08)	0.232
Affordable/free	0.86 (0.34–2.14)	0.741	1.54 (0.74–3.21)	0.251

**p-value < 0.05. Dashes (-) indicate variables not included in the model for that specific outcome.*
AOR = Adjusted Odds Ratio; CI = Confidence Interval; Ref = Reference category, *p < 0.05

Multivariable logistic regression analysis (Table 4) identified occupation, religion, age at menarche, and informational accessibility as factors associated with knowledge. Manual and non-manual workers had lower odds of adequate knowledge than dependent women (AOR = 0.33, 95% CI: 0.15–0.72, p = 0.005). Non-Buddhist participants also had lower odds than Buddhist participants (AOR = 0.20, 95% CI: 0.06–0.70, p = 0.011), while late menarche was associated with lower odds of adequate knowledge (AOR = 0.03, 95% CI: 0.004–0.252, p = 0.001). Women without breast health education had lower odds of adequate knowledge (AOR = 0.20, 95% CI: 0.10–0.39, p < 0.001).

For perception, religion, age at menarche, and informational accessibility remained significant. Non-Buddhist participants had higher odds of positive perceptions (AOR = 2.76, 95% CI: 1.14–6.66, p = 0.024), while women without breast health education had lower odds of positive perceptions (AOR = 0.41, 95% CI: 0.23–0.75, p = 0.004). Late menarche remained strongly associated with perception (p < 0.001).

DISCUSSION

This study found poor knowledge (75.5%) and predominantly negative perceptions (58.3%) regarding breast cancer and BSE. The high prevalence of poor knowledge is consistent with findings from Nepal, Cameroon, India, and Ethiopia (13, 19-21). Previous studies in Myanmar reported limited breast cancer knowledge and misconceptions that delayed healthcare-seeking (22). These findings highlight the continued need for breast cancer education and awareness programs among women in the community.

Although most participants recognized the benefits of BSE and reported high motivation to maintain breast health, perceived susceptibility was low. According to the HBM, perceived susceptibility is an important determinant of preventive health behavior (23). Previous studies have similarly shown that women with greater perceived susceptibility, perceived benefits, and self-efficacy are more likely to engage in breast health practices (11, 24, 25). Therefore, education should address perceived risk, confidence in performing BSE, and barriers to preventive action.

Occupation was significantly associated with knowledge, with manual and non-manual workers less likely to have adequate knowledge than dependent women. This may reflect differences in opportunities and access to health information; dependent women in Myanmar may have greater flexibility to seek information, whereas employed women may have fewer opportunities because of work commitments. Differences in educational background may also contribute. Similar associations between socio-demographic characteristics and breast health awareness have been reported (24, 26, 27). Breast health promotion should therefore target working women through workplace education, mobile health messages, and social media.

Informational accessibility was strongly associated with both knowledge and perception. Women who had received breast health education or counselling were more likely to have adequate knowledge and positive perceptions. This may reflect the role of education in providing accurate information, correcting misconceptions, and strengthening confidence in breast health practices in Myanmar. Similar findings have been reported in Thailand, Bangladesh, and Indonesia (28-30). Accessible and culturally appropriate

breast health education is therefore important in Myanmar.

Financial accessibility was significantly associated with both outcomes in the bivariate analysis but was not significant after adjustment, suggesting that the observed bivariate relationships may partly reflect other correlated socioeconomic or healthcare-access factors. Nevertheless, financial barriers may still limit access to breast health services, as reported in Myanmar and Kenya (31, 32).

Religion was significantly associated with both outcomes, showing a negative association with knowledge but a positive association with perception. Cultural and religious beliefs may influence women's understanding of breast cancer, perceived susceptibility, and preventive practices, as reported in Qatar and Ghana (33, 34). However, the mechanisms cannot be established from the cross-sectional study, particularly given the relatively small proportion of non-Buddhist participants.

Age at menarche was also associated with both outcomes; however, this finding should be interpreted cautiously, as age at menarche is not a direct measure of knowledge or perceptions and may act as a proxy for unmeasured reproductive, socioeconomic, or health-related factors. The small early-menarche group may also have contributed to the strong association and wide confidence intervals. Further studies with larger samples are needed to clarify this relationship and account for potential confounding factors.

CONCLUSION

Poor knowledge and negative perceptions regarding breast cancer and BSE remain important public health concerns among women aged 20–49 years in Yangon. Occupation, religion, age at menarche, and informational accessibility were associated with knowledge, while religion, age at menarche, and informational accessibility were associated with perceptions. Informational accessibility was consistently associated with both outcomes, highlighting the importance of breast health education and counselling.

RECOMMENDATIONS

These findings support targeted breast health promotion strategies and educational interventions for women in Myanmar. Breast health education should be integrated into primary and reproductive healthcare services, while community campaigns, workplace-based education, and social media should be used to improve access to accurate breast cancer information. Efforts to reduce financial barriers to breast health services are also needed. Future research should include rural populations and evaluate educational interventions.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Chulalongkorn University (COA No. 115/69).

STRENGTHS AND LIMITATIONS

This study provides community-based evidence among reproductive-age women in Yangon, a population less frequently examined in Myanmar. The HBM strengthened the interpretation of perception-related findings and supports theory-based intervention development.

However, the cross-sectional design limits causal inference. Convenience sampling through an online survey may have introduced selection bias, as women with greater social media activity, internet access, or interest in breast health may have been more likely to participate. Thus, the sample may not fully represent women aged 20–49 years in Yangon, particularly those with limited digital access or lower exposure to health information. Self-reported responses may also be affected by recall and social desirability biases. As the study was conducted only in Yangon, the generalizability to other regions, particularly rural populations, may be limited.

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EXPERIENCE OF GENDER-BASED VIOLENCE (GBV) AND GBV PREVENTION DURING DISASTERS AMONG WOMEN IN JAPAN: A MIXED METHODS STUDY

Sae Iino[1], Montakarn Chuemchit[1]*

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand

***Corresponding Author**: Montakarn Chuemchit, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand. E-mail: montakarn.ch@chula.ac.th*

ABSTRACT

Introduction: Gender-based violence (GBV) may increase during disasters because displacement, overcrowding, and weakened protection systems heighten vulnerability. Disasters in Japan have raised concerns about harassment, assault, stalking, and inadequate protection in evacuation settings. However, little is known about how GBV-related knowledge and attitudes translate into preventive action.

Objectives: To examine GBV experiences, knowledge, attitudes, preventive practices, and barriers to prevention among women and gender-diverse adults affected by the 2024 Noto Peninsula Earthquake.

Methodology: A sequential explanatory mixed-methods study was conducted in Ishikawa Prefecture. Quantitative data from 424 participants, almost all of whom were women (99.8%), were analyzed using descriptive statistics, chi-square or Fisher's exact tests, and multivariable binary logistic regression. Five survey respondents completed follow-up interviews. The interview transcripts were analyzed thematically, and member checking was conducted to support the credibility of the interpretations.

Results: Overall, 63.9% of participants scored above the mean knowledge score, and 48.3% scored above the mean attitude score, while 31.4% engaged in at least one preventive practice at least sometimes. Evacuation experience (AOR = 1.98, 95% CI = 1.23–3.19, p = .005), suburban or rural residence (AOR = 1.79, 95% CI = 1.13–2.84, p = .013), prior IPV/GBV experience (AOR = 3.33, 95% CI = 1.20–9.22, p = .020), social media exposure (AOR = 2.05, 95% CI = 1.04–4.06, p = .039), poster exposure (AOR = 5.41, 95% CI = 1.38–21.18, p = .015), and attitude score (AOR = 1.25 per one-point increase, 95% CI = 1.08–1.45, p = .004) were associated with greater preventive engagement. Knowledge score was not independently associated with engagement (AOR = 1.00, 95% CI = 0.97–1.03, p = .906). Interviews highlighted limited actionable information, overcrowding, lack of privacy, competing survival priorities, and declining vigilance.

Conclusion: Disaster-related GBV prevention should extend beyond awareness by providing practical guidance, safer evacuation environments, and timely, actionable information.

Keywords:
Gender-Based Violence; Disasters; Preventive Practices; Knowledge-Practice Gap; Japan

INTRODUCTION

Gender-based violence (GBV) is a major public health and human rights concern. Approximately one in three women experience physical or sexual violence during their lifetime (1). In Japan, GBV is substantially underreported, and gender-diverse populations may face elevated victimization risks (2; 3). Victim-blaming attitudes may further discourage reporting (4).

Disasters can increase GBV risk through displacement, overcrowding, weakened protection systems, and reduced service access (5; 6). Sexual violence, harassment, and intimate partner violence have been documented after major disasters internationally (7; 8), reflecting gender inequalities that may intensify during crises (9; 10). Similar concerns followed the Great East Japan, Kumamoto, and 2024 Noto Peninsula earthquakes (11; 12; 13; 14; 15; 16). Evacuation shelters may lack privacy and gender-sensitive support, while affected populations receive limited prevention information (17; 18; 19; 20).

Few studies have integrated quantitative and qualitative evidence on how knowledge, attitudes, and contextual barriers shape preventive practices. This study addressed these gaps after the Noto earthquake.

METHODOLOGY

Research design and study population

This sequential explanatory mixed-methods study was conducted in Ishikawa Prefecture. A cross-sectional online survey was followed by interviews designed to explain survey patterns. Quantitative findings informed the interview guide, and both phases were compared during interpretation for convergence, complementarity, and divergence.

Eligible participants were women and gender-diverse individuals aged ≥18 years who resided in Ishikawa at the time of the earthquake. The quantitative sample size used Cochran's formula with a 10% allowance for missing data, and participants were recruited by convenience sampling through an incentive-based online platform. Survey respondents could volunteer for follow-up interviews; five participated and were not selected according to their quantitative results. Because only one survey participant identified as LGBTQIA+, quantitative findings primarily reflect women's experiences and should not be generalized to gender-diverse populations.

Measurement tool and data collection

The questionnaire covered socio-demographic characteristics; IPV/GBV before, during, and after the disaster; information sources; knowledge; attitudes; and preventive practices. Three experts reviewed it, and 20 residents pilot-tested it for clarity and content validity. Knowledge (37 items) was scored correct/incorrect, attitudes (6 items) used a three-point scale, and practices (11 items) used a five-point Likert scale. Data were collected online from 1–7 November 2024.

Because no externally validated cut-offs existed for the study-specific knowledge and attitude measures, sample means categorized scores for descriptive and bivariate analyses. Practice scores were highly skewed with a median of zero; score 0 indicated no engagement and score >0 indicated engagement in at least one preventive practice.

The semi-structured interview guide was developed after quantitative analysis, particularly to explore the knowledge-practice gap. Five volunteers were interviewed via Zoom for 40–90 minutes; interviews were audio-recorded with consent and transcribed verbatim.

Data Analysis

SPSS was used for quantitative analysis. Descriptive statistics summarized participant characteristics and KAP scores. Associations with preventive engagement were examined using Pearson's chi-square or Fisher's exact tests. Variables significant at $p < .05$ were entered into a multivariable binary logistic regression model. The outcome was coded 1 for engagement in at least one preventive practice and 0 for no engagement. AORs with 95% CIs were reported; knowledge and attitude were modeled continuously to avoid information loss from dichotomization.

The qualitative phase provided explanatory insight rather than comprehensive representation. The primary researcher coded transcripts inductively and grouped related codes into themes. Recurrent patterns were identified, but comprehensive saturation was not claimed. Member checking supported credibility by allowing participants to review interpretations for consistency with their experiences. Findings from both phases were integrated during interpretation.

RESULTS

Quantitative Findings: Descriptive analysis

Sociodemographic Characteristics

The study included 424 participants. Most identified as women (99.8%), and the mean age was 45.1 years (SD = 12.1). Participant characteristics are summarized in Table 1.

Table 1 Sociodemographic characteristics of participants (N = 424)

Characteristics	n (%)	Characteristics	n (%)
Gender identity		**Evacuation, 1 April to survey date**	
Woman	423 (99.8)	Yes	98 (23.1)
LGBTQIA+	1 (0.2)	No	326 (76.9)
Age (years)		**Education**	
18-30	53 (12.5)	High school	147 (34.7)
31-40	99 (23.3)	Vocational school	86 (20.3)
41-50	122 (28.8)	Undergraduate	146 (34.4)
51-60	107 (25.2)	Graduate	3 (0.7)
>=61	43 (10.1)	Other	42 (9.9)
Mean +/- SD	45.1 +/- 12.1		
Residence during the disaster		**Employment**	
Kanazawa City	185 (43.6)	Employed/self-employed	311 (73.3)
Suburban/rural areas	239 (56.4)	Not employed	113 (26.7)
Evacuation, 1-31 January		**Primary source of income**	
Yes	115 (27.1)	Employment/self employment	
No	309 (72.9)	Pension	247 (58.3)
		Savings	22 (5.2)
		Unemployment benefit	19 (4.5)
		Employment adjustment subsidy	1 (0.2)
		Public assistance	1 (0.2)
		Spouse/relative	1 (0.2)
		Other	90 (21.2)
			43 (10.1)
Evacuation, 1-29 February		**Marital status**	
Yes	32 (7.5)	Single	124 (29.2)
No	392 (92.5)	In a relationship	22 (5.2)
		Married	236 (55.7)
		Separated	1 (0.2)
		Divorced	29 (6.8)
		Widowed	6 (1.4)
		Other	6 (1.4)

IPV/GBV Experience before and during disasters

Before the disaster, 18 participants (4.2%) reported IPV/GBV. During January 2024, one participant (0.2%) reported IPV/GBV, and two (0.5%) reported IPV/GBV from February 2024 to the survey date; two participants (0.5%) reported witnessing IPV/GBV during the disaster period (Table 2).

Table 2 IPV/GBV experience of Participants (N = 424)

Characteristics	Yes, n (%)	No, n (%)
IPV/GBV before the disaster	18 (4.2)	406 (95.8)
IPV/GBV during 1-31 January 2024	1 (0.2)	423 (99.8)
IPV/GBV from 1 February 2024 to the survey date	2 (0.5)	422 (99.5)
Witnessed IPV/GBV during the disaster period	2 (0.5)	422 (99.5)

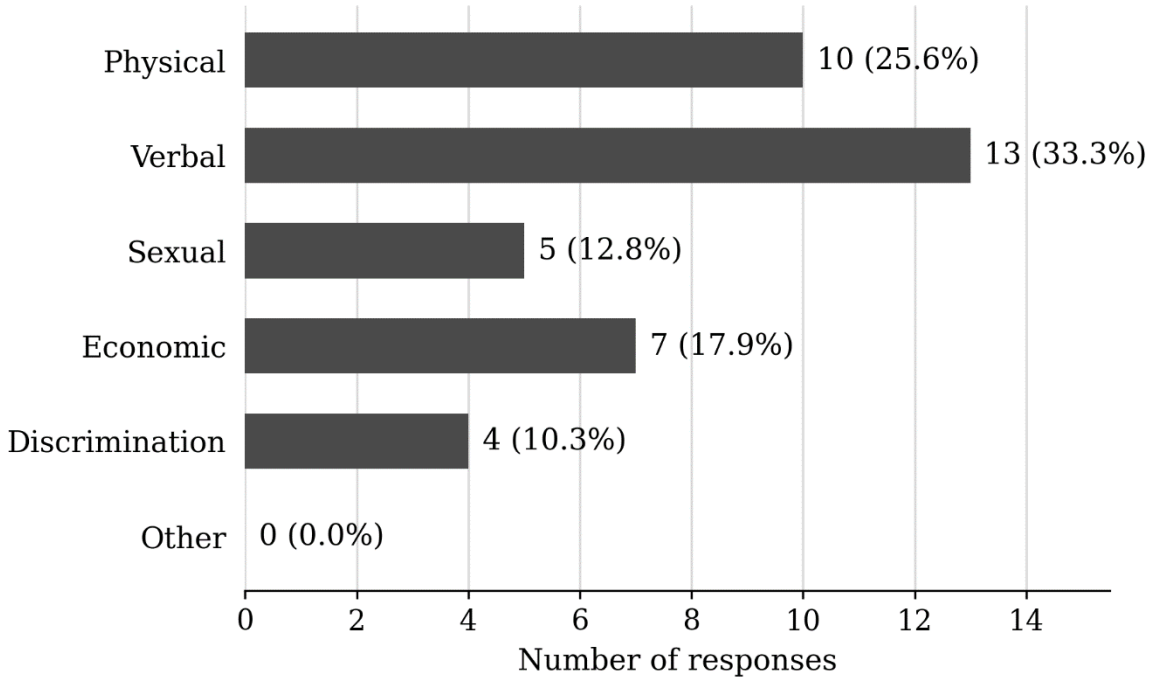

Figure 1. Experience of IPV/GBV before disasters (N = 18) Multiple Answers

Source of Information regarding IPV and GBV

Media was the most frequently reported source of GBV-related information, followed by social media. However, 61.7% reported receiving no GBV-related information, indicating a substantial communication gap (Figure 2).

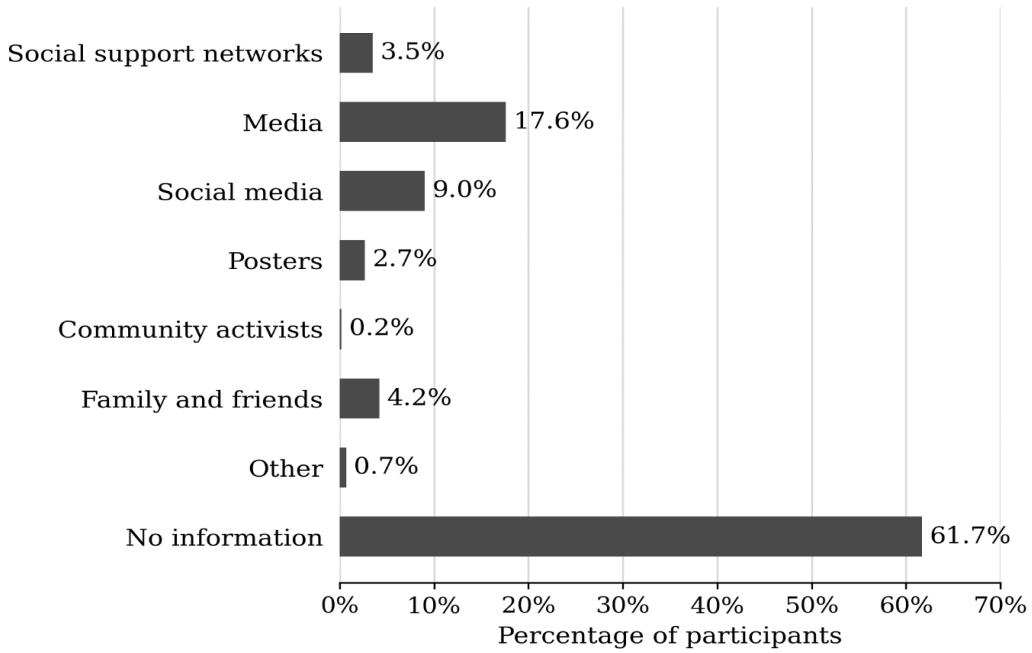

Figure 2. Sources of Information Regarding IPV/GBV During Disasters (N = 424)

Note. Multiple responses were permitted; therefore, percentages do not sum to 100%.

Knowledge of GBV Risks and Prevention

The mean knowledge score was 24.9; 271 participants (63.9%) scored above the mean (Table 3). Overall awareness of GBV risks and prevention was relatively high, although gaps remained regarding support systems and response mechanisms.

Table 3 Knowledge level of GBV risks (N = 424)

Knowledge score category	n (%)
At or below the mean (<=24.9)	153 (36.1)
Above the mean (>24.9)	271 (63.9)
Observed range	8-37

Attitude Toward GBV

The mean attitude score was 3.18. Of 424 participants, 205 (48.3%) scored above the mean and 219 (51.7%) at or below it (Table 4).

Table 4 Attitude score of GBV risks (N = 424)

Attitude score category	n (%)
At or below the mean (<=3.18)	219 (51.7)
Above the mean (>3.18)	205 (48.3)
Observed range	0-6

Practice on GBV prevention

Preventive engagement was limited. The median practice score was 0 (IQR = 1): 291 participants (68.6%) reported no preventive practice at least sometimes, whereas 133 (31.4%) reported at least one such practice (Table 5).

Table 5 Practice Regarding GBV Prevention During Disasters (N = 424)

Practice score category	n (%)
No practice performed at least sometimes (score = 0)	291 (68.6)
At least one practice performed at least sometimes (score > 0)	133 (31.4)
Median (IQR)	0 (1)
Observed range	0-11

Quantitative Findings: Chi-Square Analysis of Association toward Engagement in GBV prevention Practices during Disasters

Bivariate analyses identified significant associations between preventive engagement and evacuation experience (χ^2 = 11.13, p = .001), residence (χ^2 = 5.42, p = .020), prior IPV/GBV experience (χ^2 = 7.72, p = .x005), social media exposure (χ^2 = 9.97, p = .002), knowledge category (χ^2 = 4.74, p = .029), and attitude category (χ^2 = 8.23, p = .004). Poster exposure was also associated with engagement (Fisher's exact p = .001) (Table 6).

Table 6 Variables significantly associated with engagement in GBV preventive practices (chi-square analysis)

Variable	Engaged, n (%)	Not engaged, n (%)	chi-square	p value
Overall evacuation experience			**11.13**	**.001**
Yes	52 (43.3)	68 (56.7)		
No	81 (26.6)	223 (73.4)		
Residence			**5.42**	**.020**
Suburban/rural areas	86 (36.0)	153 (64.0)		
Kanazawa City	47 (25.4)	138 (74.6)		
IPV/GBV before the disaster			**7.72**	**.005**
Yes	11 (61.1)	7 (38.9)		
No	122 (30.0)	284 (70.0)		
Social media exposure			**9.97**	**.002**
Yes	23 (52.3)	21 (47.7)		
No	110 (28.9)	270 (71.1)		
Poster exposure			—	**.001**[a]
Yes	10 (76.9)	3 (23.1)		
No	123 (29.9)	288 (70.1)		
Knowledge score category			**4.74**	**.029**
Above mean (>24.9)	95 (35.1)	176 (64.9)		
At/below mean (≤24.9)	38 (24.8)	115 (75.2)		
Attitude score category			**8.23**	**.004**
Above mean (>3.18)	78 (38.0)	127 (62.0)		
At/below mean (≤3.18)	55 (25.1)	164 (74.9)		

Note. Percentages are row percentages. Pearson's chi-square tests were used unless otherwise indicated. [a]Fisher's exact test was used for poster exposure because one expected cell count was below five.

Multivariable Binary Logistic Regression Analysis of Factors Associated with Engagement in GBV Preventive Practices During Disasters. Multivariable binary logistic regression identified several factors independently associated with preventive engagement. Evacuation experience (AOR = 1.98, 95% CI = 1.23–3.19, p = .005), suburban/rural residence (AOR = 1.79, 95% CI = 1.13–2.84, p = .013), prior IPV/GBV experience (AOR = 3.33, 95% CI = 1.20–9.22, p = .020), social media exposure (AOR = 2.05, 95% CI = 1.04–4.06, p = .039), and poster exposure (AOR = 5.41, 95% CI = 1.38–21.18, p = .015) were associated with higher odds of engagement.

Knowledge score was not independently associated with engagement (AOR = 1.00, 95% CI = 0.97–1.03, p = .906), whereas each one-point increase in attitude score was associated with 25% higher adjusted odds of engagement (AOR = 1.25, 95% CI = 1.08–1.45, p = .004). The wide CIs for prior IPV/GBV and poster exposure indicate limited precision and warrant cautious interpretation.

Table 7. Multivariable binary logistic regression of factors associated with engagement in GBV preventive practices (N = 424)

Variable	AOR (95% CI)	p value
Overall evacuation experience		
Yes	**1.98 (1.23–3.19)**	**.005**
No	Ref.	
Residence		
Suburban/rural areas	**1.79 (1.13–2.84)**	**.013**
Kanazawa City	Ref.	
IPV/GBV before the disaster		
Yes	**3.33 (1.20–9.22)**	**.020**
No	Ref.	
Social media exposure		
Yes	**2.05 (1.04–4.06)**	**.039**
No	Ref.	
Poster exposure		
Yes	**5.41 (1.38–21.18)**	**.015**
No	Ref.	
Knowledge score (per one-point increase)	1.00 (0.97–1.03)	.906
Attitude score (per one-point increase)	**1.25 (1.08–1.45)**	**.004**

Note. AOR = adjusted odds ratio; CI = confidence interval; Ref. = reference category. The outcome was coded as 1 = engagement in at least one preventive practice at least sometimes (practice score > 0; n = 133) and 0 = no such engagement (practice score = 0; n = 291). Knowledge and attitude were modeled as continuous scores.

Qualitative Results

Five interviews provided contextual insight into GBV prevention. Integration occurred when quantitative findings informed the interview guide and again during interpretation, when both phases were compared. Participant characteristics are shown in Table 8.

Table 8. Key information of participants from in-depth interviews on GBV prevention during disasters

	Interview 1	Interview 2	Interview 3	Interview 4	Interview5
Age	44	45	44	25	40
Marital Status	Single	Married	Married	Single	Single
Education	Univ Grad	HS Grad	Univ Grad	Univ Grad	HS Grad
Occupation	Self-employed/ Worker	Self-employed/ Worker	Part-time/ Temp	Part-time /Temp	Part-time /Temp

Evacuation Experiences during Disasters

"The shelter was full, and hygiene seemed poor. I didn't want my daughter to get sick before her exams, so we stayed in the car." (Interviewee 2)

Awareness of GBV Risks during Disasters

"I heard that GBV incidents happened during past disasters, but there was never concrete advice on how to prevent them." (Interviewee 4)

Privacy and Security Concerns in Evacuation Settings

"Ensuring privacy in shelters is extremely important. Women and children often have no personal space, which creates stress and insecurity." (Interviewee 1)

Barriers to GBV Preventive Actions

"Looking back, I realize I focused more on basic needs. At the time, GBV prevention just didn't feel like an immediate concern." (Interviewee 2)

Perceived GBV Prevention Strategies

"Information spreads fast on social media. If something happens, people need to know right away." (Interviewee 4)

Table 9. Key themes from in-depth interviews on GBV prevention during disasters

Themes	Summary of Findings
Evacuation experiences	Participants reported diverse evacuation choices, often shaped by concerns over overcrowding, privacy, and resource access. Some opted for alternative locations rather than designated shelters.
Awareness of GBV Risks	Awareness of GBV risks during disasters was generally low. Information was often vague, and media coverage prioritized theft and property crimes over GBV prevention.
Sources of Information	Social media, messaging apps, and news outlets were primary sources, but actionable preventive guidance was rare. Official government communication was mentioned but not widely accessed.
Privacy and Security Concerns	Participants highlighted the need for improved safety measures in evacuation shelters, including gender-segregated spaces and better lighting. Night-time security was a significant concern.
Barriers to Preventive Actions	Lack of knowledge, prioritization of other survival needs, and gradual complacency over time were key barriers to engaging in GBV prevention measures.
Suggested Preventive Strategies	Participants suggested increasing community vigilance as practical preventive measures.

Integration of Quantitative and Qualitative Findings

Integrated findings showed that knowledge alone did not predict preventive engagement, whereas more favorable attitudes did. Interviews described limited actionable guidance, privacy and security concerns, and competing survival priorities. Evacuation and information exposure were also associated with engagement, consistent with interview accounts of shelter risks and the importance of timely communication (Table 10).

Table 10. Joint display of quantitative and qualitative findings

Quantitative finding	Qualitative finding	Integrated interpretation
Knowledge score was not independently associated with preventive engagement (AOR = 1.00, 95% CI = 0.97–1.03, p = .906).	Participants described general awareness of GBV but limited access to specific and actionable preventive guidance.	General knowledge alone may be insufficient to promote preventive action without practical guidance.

Quantitative finding	Qualitative finding	Integrated interpretation
Higher attitude scores were associated with greater preventive engagement (AOR = 1.25, 95% CI = 1.08–1.45, p = .004).	Participants emphasized the importance of privacy, security, and community vigilance.	More prevention-oriented attitudes may contribute to greater motivation to engage in protective behaviors.
Evacuation experience was associated with higher engagement (AOR = 1.98, 95% CI = 1.23–3.19, p = .005).	Participants described overcrowding, limited privacy, insecurity, and other risks in evacuation settings.	Direct exposure to evacuation conditions may increase recognition of GBV-related risks and preventive needs.
Social media and poster exposure were associated with higher engagement (AOR = 2.05 and 5.41, respectively).	Participants described the importance of rapid information but noted that actionable guidance was often limited.	Timely and visible communication may facilitate preventive action, particularly when it provides concrete guidance.
Prior IPV/GBV experience was associated with higher engagement (AOR = 3.33, 95% CI = 1.20–9.22, p = .020).	No clear qualitative explanation for this association emerged from the interviews.	Prior experience may heighten risk awareness, although the mechanism could not be established from the qualitative data.

DISCUSSION

Preventive engagement was limited despite relatively high knowledge: only 31.4% reported at least one preventive practice at least sometimes. Knowledge was not independently associated with engagement, whereas higher attitude scores were, suggesting that awareness and prevention-oriented attitudes may influence behavior differently.

Evacuation experience, suburban/rural residence, prior IPV/GBV, and exposure to information through social media or posters were also associated with greater engagement. Interviews contextualized these findings through accounts of overcrowding, limited privacy, inadequate practical guidance, and competing survival priorities. The association with prior IPV/GBV may reflect heightened risk awareness, but interviews did not directly explain this relationship and the estimate was imprecise.

The findings can be interpreted through the Capability, Opportunity, and Motivation–Behavior (COM-B) model. Limited practical guidance may constrain capability; shelter conditions, privacy, security, and information access shape opportunity; and attitudes, immediate survival priorities, and declining vigilance may influence motivation. Thus, awareness alone may be insufficient.

CONCLUSION

GBV preventive engagement during the 2024 Noto Peninsula Earthquake was limited. Knowledge was not independently associated with engagement, whereas attitudes, evacuation experience, residence, prior IPV/GBV, and social media or poster exposure were. Interviews highlighted limited practical guidance, privacy and security concerns, and competing survival priorities.

RECOMMENDATION

Disaster preparedness programs should provide concrete, behavior-oriented GBV prevention guidance rather than awareness alone. Evacuation shelters should strengthen lighting, privacy, confidential reporting and referral pathways, and gender-sensitive management. Timely information should be disseminated through both social media and visible on-site materials so that people with limited internet access are not excluded. Future

studies should recruit more diverse and community-based samples and include larger qualitative samples.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Research Ethics Review Committee, College of Public Health Sciences, Chulalongkorn University, in August 2024 (Certificate of Approval No. 184/67). All participants provided voluntary informed consent. Confidentiality and anonymity were maintained, and participants were informed of their right to withdraw at any time.

LIMITATIONS

This study has several limitations. Convenience sampling through an incentive-based online platform may have underrepresented people with limited internet access, severe disaster impacts, socioeconomic hardship, or unstable living conditions; therefore, the sample is not representative of all people affected by the Noto Peninsula Earthquake. The cross-sectional, self-reported data also limit causal interpretation and may be affected by recall or reporting bias. Only one survey participant identified as LGBTQIA+, limiting generalizability to gender-diverse populations. Finally, the qualitative phase included only five volunteers and was intended to provide explanatory insight rather than comprehensive representation; data saturation was not claimed.

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FACILITATORS AND BARRIERS TO ACCESS SEXUAL AND REPRODUCTIVE HEALTH INFORMATION SERVICES AMONG YOUNG PEOPLE IN THE INTERNALLY DISPLACED POPULATION, MYANMAR

Nang Hawm Hseng Khurh[1], Jongjit Rittirong[1*], Dusita Phuengsamran[1], Kyu Kyu Than[2]

[1]Institute for Population and Social Research, Mahidol University, Salaya, Phutthamonthon Nakhon Pathom, 73170, Thailand

[2]Burnet Institute Myanmar, No.226, 4th Floor, Wizaya Plaza, U Wisara Rd, Yangon, Myanmar (Burma)

***Corresponding Author**: Jongjit Rittirong, Institute for Population and Social Research, Mahidol University, Nakhon Pathom, 73170, Thailand, E-mail: jongjit.rit@mahidol.ac.th*

ABSTRACT

Introduction: Young people in Myanmar's internally displaced persons (IDP) communities face multiple barriers accessing sexual and reproductive health (SRH) information. Since the 2021 Myanmar military coup, disruptions to healthcare and education have increased reliance on non-governmental organizations (NGOs) and Ethnic Health Organizations (EHOs). However, evidence remains limited on how sociocultural factors-specifically stigma, gender norms, and marital-status inequalities-influence information engagement in protracted displacement settings.

Objective: This study explores how young people access Sexual and Reproductive Health (SRH) information and examines how sociocultural factors, particularly gender norms and marital status, influence access to SRH information in IDP communities, Southern Shan State, Myanmar.

Methods: A qualitative exploratory study was conducted between May and June 2026 using semi-structured in-depth interviews with 16 young people aged 18-24 years and eight key informants across two open camps. Participants were purposively recruited across gender and marital-status groups. Data were analyzed thematically using a hybrid inductive-deductive approach guided by the Social Ecological Model (SEM).

Results: Young people accessed SRH information through family, peers, healthcare providers, humanitarian organizations, and digital platforms. However, access was constrained by camp remoteness, weak digital infrastructure, and restricted services. Sociocultural norms framed SRH information as appropriate only for married individuals. Never-married young women faced significant barriers due to stigma, community expectations, and concerns over sexual purity. Information availability alone did not guarantee equitable access, as parental monitoring and gendered inequalities restricted young people's willingness and ability to seek SRH information.

Conclusion: To improve equitable SRH access, interventions should address stigma, restrictive gender norms, family communication, and marital-status-related inequalities through inclusive, youth-friendly, and culturally appropriate interventions.

Keywords:

Sexual and Reproductive Health; Internally Displaced Persons; Young People; Sociocultural Factors; Myanmar

INTRODUCTION

Sexual and reproductive health (SRH) is a fundamental component of health and well-being, enabling young people to make informed decisions, prevent adverse reproductive health outcomes, and exercise their sexual and reproductive rights (1-3). Equitable access to SRH information is essential for achieving universal health coverage and the Sustainable Development Goals (SDGs). However, access to accurate SRH information remains unequal, particularly among young people living in humanitarian and conflict-affected settings where healthcare, education, and social support services are disrupted (4-7).

Armed conflict and forced displacement have reached unprecedented levels worldwide, with millions of people living in humanitarian settings where access to essential healthcare and social services remains severely disrupted (6, 7). Young people living in IDP communities face heightened risks of poor sexual and reproductive health outcomes inside the displacement settings. Population mobility, limited health services, and restrictive sociocultural environments create multiple challenges that hinder young people's further access to SRH information (5, 6, 8).

Myanmar continues to experience one of the most complex humanitarian crises in Southeast Asia. Since the 2021 military coup, escalating armed conflict has resulted in widespread internal displacement and substantial disruptions to healthcare and education systems (2, 4, 5, 8). Southern Shan State remains a conflict-affected area where many internally displaced persons (IDPs) experience prolonged displacement, limited humanitarian access, and reduced availability of essential health services. In these settings, non-governmental organizations (NGOs), Ethnic Health Organizations (EHOs), and community-based health providers have become important sources of SRH information and services. Nevertheless, conflict-related infrastructure constraints and sociocultural expectations continue to influence young people's access to timely and appropriate SRH information.

Although previous studies have highlighted SRH challenges among conflict-affected populations, evidence remains limited regarding the experiences of internally displaced young people in Myanmar. Existing research has largely focused on service availability or refugee populations, with comparatively little qualitative evidence examining how facilitators and barriers interact to shape access to SRH information.

Few qualitative studies have explored these experiences from the perspectives of young people together with key community stakeholders. Addressing these knowledge gaps is essential for developing contextually appropriate, youth-friendly, and culturally responsive interventions that improve equitable access to SRH information in humanitarian settings.

This study was guided by the Social Ecological Model (SEM) (9, 10), recognizing that access to SRH information is shaped by interacting influences at the individual, interpersonal, community, and structural levels. The SEM served as a conceptual framework to guide the exploration of selected sociocultural factors relevant to the study objectives rather than analyzing all factors across levels.

This study examines how selected sociocultural factors, particularly gender norms and marital status, influence access to SRH information in Southern Shan displacement settings. By providing qualitative evidence on the lived experiences of young people and key community stakeholders, this study contributes context-specific knowledge to support humanitarian organizations, healthcare providers, and policymakers in developing a more inclusive, culturally appropriate, and youth-friendly approach to designing equitable access to SRH information.

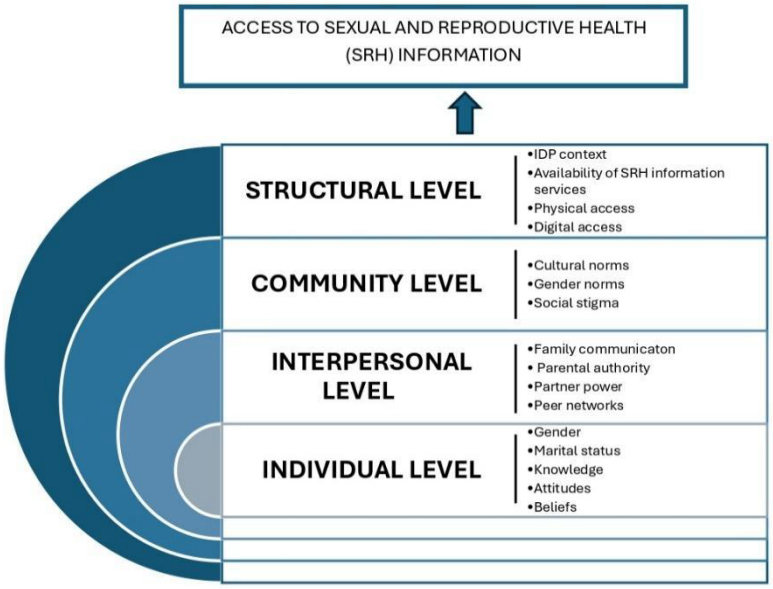

Figure 1 Conceptual framework of the study (Based on the social ecological model, Bronfenbrenner, 1979)

METHODOLOGY

Study Design

A qualitative exploratory design using semi-structured in-depth interviews (IDIs) to explore how young people access SRH information and how sociocultural factors influence access in internally displaced communities in Southern Shan State, Myanmar. The study was guided by the Social Ecological Model (SEM), which offered a framework for exploring participants' lived experiences, perceptions, and social contexts. It examined how individual, interpersonal, community, and structural factors interact to shape access to information.

Study Setting and Participants

The study was conducted in two purposively selected open camps in southern Shan State, Myanmar: Wan Mai Laeng Tai (WMLT) Camp in Mong Nai Township and Wan Mai Zom Zeng (WMZZ) Camp in Kunhing Township. Both camps were established following the 2021 military coup. The camps differed in population characteristics, geographic accessibility, living conditions, and sociocultural contexts, allowing comparison of diverse experiences of accessing SRH information among internally displaced young people. WMLT Camp was located closer to the township and had limited access to electricity, whereas WMZZ Camp was more geographically isolated and had no electricity.

Despite these differences, similar health services were available through humanitarian organizations and local health providers. Both camps were managed by local committees and supported by humanitarian organizations.

A total of 24 participants were recruited through purposive sampling, comprising 16 young individuals aged 18-24 years and eight key informants, including community leaders and clinic volunteers. Young participants were purposively selected to ensure variation across gender and marital status. Community leaders and clinic volunteers were recruited because of their roles in community leadership and SRH information provision. Eligible participants had lived in the selected camps for at least 12 months; individuals younger than 18 years were excluded.

Data Collection

Data were collected between May and June 2026 through semi-structured, face-to-face interviews conducted in private locations within the camps to ensure confidentiality and

encourage open discussion of sensitive topics. Interview guides were developed based on the study objectives and informed by the SEM. Separate interview guides were prepared for youth participants and key informants. Interviews were conducted in the Shan language, audio-recorded with participants' consent, transcribed verbatim, translated into English, and cross-checked to preserve accuracy and participants' intended meanings.

Data Analysis

Data were analysed thematically following Braun and Clarke (11). Interview transcripts were manually coded in Microsoft Excel using a hybrid inductive–deductive approach. Inductive coding allowed themes to emerge from participants' narratives, while deductive coding was guided by the study's objectives, research questions, and the Social Ecological Model. Codes were iteratively reviewed, compared across participant groups, and refined into categories and themes through constant comparison.

Data Saturation

The planned sample size was achieved through purposive sampling. During data collection, later interviews produced similar responses and no substantially new information. This was confirmed during data analysis, where no new codes or themes were identified, indicating thematic saturation.

RESULTS

A total of 24 participants were included, comprising sixteen young people aged 18-24 years, four community leaders, and four clinic volunteers. The findings were consistently identified across all participant groups. Although the two camps differed in accessibility and living conditions, the main themes were consistent across both settings. Overall, participants described that access to SRH information internally was shaped by the interaction of multiple facilitators and barriers across sociocultural and humanitarian contexts.

The Social Ecological Model (SEM) guided the deductive analysis, while the themes emerged inductively from participants' lived experiences. As a result, each theme reflects interactions among factors across multiple SEM levels rather than at a single level.

The demographic characteristics of the study participants, young people, and key informants are presented in Tables 1 and 2.

Table 1 Demographic characteristics for participants from Camp 1 and Camp 2

Participant's ID	Place of Living	Gender	Age	Education	Marital Status	Year at camp	Occupation
Y1	Camp 1	Female	20	Primary school	Ever married	3	Agriculture
Y2	Camp 1	Female	18	No formal schooling	Never married	3	Agriculture
Y3	Camp 1	Female	18	Middle school	Never married	5	Student
Y4	Camp 1	Male	18	Primary school	Never married	2	Student
Y5	Camp 1	Male	19	Primary school	Never married	4	Agriculture
Y6	Camp 1	Male	24	Monastery school	Ever married	3	Agriculture

Participant's ID	Place of Living	Gender	Age	Education	Marital Status	Year at camp	Occupation
Y7	Camp 1	Male	22	High school	Ever married	5	Agriculture
Y8	Camp 1	Female	23	University	Ever married	1.5	Agriculture
Y9	Camp 2	Male	21	Primary school	Ever married (Divorce)	5	Timber labor
Y10	Camp 2	Male	18	Middle school	Never married	5	Student
Y11	Camp 2	Female	22	Primary school	Ever married	5	Agriculture
Y12	Camp 2	Female	19	Primary school	Ever married	4	Agriculture
Y13	Camp 2	Male	24	Primary school	Ever married	5	Agriculture
Y14	Camp 2	Female	20	Primary school	Never married	4	Agriculture
Y15	Camp 2	Female	18	Middle school	Never married	5	Agriculture
Y16	Camp 2	Male	20	Middle school	Never married	4	Student

Y= Young People, Camp 1= Wan Mai laeng Tai (WMLT), Camp 2= Wan Mai Zom Zeng (WMZZ)

Table 2 Characteristics of key informants- community leaders and clinic volunteers

Participant's ID	Camp	Gender	Age	Education	Marital Status	Year at camp	Position
CL1	Camp 1	Female	40	Primary	Ever married	3	Deputy of the female leader
CL2	Camp 1	Male	51	Monastery school	Ever married	4	Head of the village
CL3	Camp 2	Male	43	Primary	Ever married	5	Head of the village
CL4	Camp 2	Male	41	No formal schooling	Never married	5	Female leader
CV1	Camp 1	Female	24	Graduate	Ever married	2	Clinic In-charge
CV2	Camp 1	Female	19	Middle	Never married	4	Administration Clerk
CV3	Camp 2	Male	23	Monastery school	Ever married	3	Clinic In-charge

Participant's ID	Camp	Gender	Age	Education	Marital Status	Year at camp	Position
CV4	Camp 2	Female	22	Middle	Ever married	3	Administration Clerk

CL= Community leader, CV= Clinic Volunteer, Camp 1= Wan Mai laeng Tai (WMLT), Camp 2= Wan Mai Zom Zeng (WMZZ)

Theme 1: Multiple Pathways of Accessing Sexual and Reproductive Health (SRH) Information

Participants described multiple pathways for accessing SRH information, including family members, peers, healthcare providers, clinic volunteers, humanitarian organizations, printed educational materials, and digital platforms. However, participants indicated that the availability and accessibility of these information sources varied depending on individual circumstances, trust, familiarity, and opportunities for information.

Mothers were the first source of SRH information during adolescence. However, topics related to sexual and reproductive health were rarely discussed and generally limited to menstruation, marriage, and pregnancy. As one ever-married female participant explained:

"When I was an adolescent, my mother provided the information...later....got married and pregnant, I received information from clinic volunteers." (Y1, Ever-married female, Camp 1)

Participants' sources changed across life stages, with family members providing early information and clinic volunteers becoming more important after marriage and pregnancy.

"During Infant and Young Child Feeding (IYCF) activities, I also provide antenatal and postnatal information." (CV1, female, 24, clinic in-charge, Camp 1)

Because communication within families remained limited, many participants sought additional information from their peers. Never-married male participants, in particular, discussed with close male friends, while opportunities among female peers were more limited because such conversations were often considered inappropriate. One never-married male participant described:

"I mostly discuss with a male friend, do self-learning with a mobile phone, and use an online platform." (Y5, Never-married male, Camp 1)

Healthcare providers and ethnic health organizations became important sources of information following displacement. Participants explained that shared ethnicity, familiarity, and previous relationships build trust and encouraged information-seeking. As one ever-married female participant shared:

"I trust the clinic volunteers in this camp...escaped from the village like me....are Shan (the same ethnic group), and we know each other well." (Y8, Ever-married female, Camp 1)

Community-based health education sessions, booklets, and pamphlets distributed by humanitarian organizations also provided opportunities to obtain information. Digital platforms were additional sources, but access remained limited because electricity, mobile phone ownership, and internet connectivity had only recently become available in some camps.

Theme 2: Sociocultural Norms Restricting Access to SRH Information

Participants identified deeply embedded sociocultural beliefs and community expectations as major barriers to accessing SRH information. Parents commonly believed that discussing SRH before marriage was inappropriate, and feared that providing such information might encourage premarital sexual relationships. Consequently, communication between parents and children regarding SRH remained limited. As one ever-married female participant explained:

"Parents teach their children... control their virginity before marriage. Young people can't talk about sexuality and reproductive health freely....the community assumes they have lost their virginity." (Y8, Ever-married female, Camp 1)

Community beliefs that SRH education should only be provided after marriage

reinforced restrictions on discussing SRH and limited access before young people became sexually active.

Community leaders expressed similar viewpoints. One female community leader, who has been married, shared her thoughts:

"Regarding SRH, people only learn about it after marriage, ... If young, never-married people learn or study this topic, they might apply it and make mistakes." (CL1, Female community leader, Camp 1)

Fear, embarrassment, community gossip, and negative judgment discouraged many young people from openly discussing or seeking information. These social pressures often led them to avoid discussing it and reduced their willingness to seek information, even when information sources were available.

Theme 3: Gender and Marital Status Shaping Access to SRH Information

Sexual and Reproductive Health information was appropriate primarily for married individuals, heavily shaping how gender roles and marital status acted as gates to information. Ever-married women generally experienced greater acceptance because pregnancy, childbirth, menstruation, and family planning were considered appropriate reasons to engage with healthcare providers. In contrast, never-married young people, particularly women, experienced greater hesitation because seeking SRH information was often perceived as socially inappropriate. One participant shared:

"My husband is not going to support me in obtaining information related to SRH. He disagreed with the implant insertion when I wanted it. He believes and wants to have more children." (Y1, Ever-married female, Camp 1)

Although marriage increased women's access to SRH information, household gender norms continued to influence reproductive health decisions and family planning. This finding was also reflected in clinic volunteers' accounts. One clinic volunteer explained:

"As for never-married youth, they feel embarrassed and do not dare to come and discuss issues related to sexuality and reproductive health." (CV3, Ever-married male clinic volunteer, Camp 2)

Overall, these findings indicate that gender norms, marital status, and household decision-making shaped young people's access to SRH information, particularly for family planning and contraceptive use.

Theme 4: Humanitarian and Structural Barriers to Accessing SRH Information

Several humanitarian and structural conditions also limited access. Geographic isolation, transportation challenges, limited health infrastructure, poor digital connectivity, and economic hardship reduced opportunities to obtain information and services. One participant described:

"I don't know where to go...learning about this... here no phone signal or internet access....a village far away from the town....added to the difficulties." (Y7, Ever-married male, Camp 1)

Humanitarian conditions and limited infrastructure restricted opportunities to access information. One clinic volunteer further explained that work and household responsibilities also become limited.

"The youth themselves...prioritize work over health,.....some do not realize ...health is important, while others...don't have time to come see us." (CV2, Never-married female clinic volunteer, Camp 1)

Theme 5: Emotional Responses Influencing Information-Seeking Behaviors

Across all participant groups, feelings of embarrassment, fear, shame, and low self-confidence influenced young people's information-seeking behaviours. Participants explained that concerns about criticism from family members and the wider community often discouraged them from discussing SRH openly or seeking available services. As one never-married male participant explained:

"Sexuality and reproductive health are private matters, so young people should not discuss them in front of others." (Y10, Never-married male, Camp 2)

These emotional responses influenced when and whether young people sought SRH

information. Many delayed seeking information until marriage or when reproductive health needs became more immediate, while others perceived SRH as irrelevant to their current lives. A clinic volunteer also described similar experiences:

"Some youth feel embarrassed because we live in the same village, so instead of coming to us, they go to see a doctor in town." (CV2, Never-married female clinic volunteer, Camp 1)

Together, these findings indicate that emotional responses were closely shaped by the broader sociocultural and humanitarian context, influencing confidence and willingness to share information.

DISCUSSION

Access to information was influenced by both facilitators and barriers operating within sociocultural and humanitarian contexts. Despite multiple sources, persistent sociocultural and structural barriers continued to shape young people's experiences of accessing SRH information in displacement settings.

Participants obtained information from multiple pathways, but access remained unequal across participant groups, leading many to rely on peers and trusted healthcare providers for additional information. This finding is consistent with previous studies reporting that young people often seek SRH information from trusted informal networks when communication within families is limited (12, 13). However, providing multiple sources alone did not ensure equitable access, as sociocultural expectations continue to influence whether young people felt comfortable seeking information.

Sociocultural norms strongly influenced family communication and young people's information-seeking behaviors. This finding is consistent with previous studies describing stigma and cultural taboos surrounding SRH information and suggests that family communication and community expectations reinforced these beliefs and restricted access in displacement settings (12, 14).

Marital status functioned as a powerful social determinant of health literacy. However, this access was simultaneously constrained by household decision-making and gendered power relations that restricted women's autonomous reproductive choices.

In contrast, never-married young women remained highly reluctant to seek SRH information because community norms framed any premarital interest in sexuality as socially inappropriate. These findings align with existing literature while illustrating how rigid gender norms and marital status inequities compound the vulnerabilities of conflict-affected, internally displaced populations (15, 16). This study further suggests that they faced a double barrier, with limited access to SRH information reinforced by social silence and community judgment.

Humanitarian conditions, including geographic, transportation, economic hardship, and digital connectivity, also shaped access to information. Overall, improving equitable access to SRH information in displacement settings requires addressing both sociocultural and structural barriers together rather than in isolation.

LIMITATION

This study was conducted only in two IDP camps with a relatively small number of participants; the findings are not intended to be statistically generalizable to all internally displaced populations in Myanmar. Data collection was undertaken in conflict-affected and remote settings, where logistical challenges, including difficult transportation during the rainy season, long travel distances, and participants' work commitments, influenced the data collection process and scheduling of interviews. Identifying quiet, private interview locations was also challenging due to limited infrastructure in the camps, though community leaders and clinic volunteers made considerable efforts to provide suitable spaces for interviews.

In addition, translating Shan into English may have resulted in some loss of contextual meaning, and social desirability bias may have influenced participants' willingness to discuss sensitive SRH-related topics openly. Despite

these limitations, this study provides valuable context-specific insights into the sociocultural and humanitarian factors influencing young people's access to SRH information in internally displaced communities.

CONCLUSION

Although young people in internally displaced communities accessed SRH information through multiple pathways, sociocultural, gender-related, and humanitarian barriers continued to constrain equitable access. Improving SRH information access in displacement settings therefore requires addressing both the availability of information and the sociocultural and structural conditions that shape young people's access and engagement.

RECOMMENDATIONS

The findings suggest several practical implications for strengthening SRH information among young people living in displaced settings. Humanitarian organizations, Ethnic Health Organizations (EHOs), community leaders, local healthcare providers, and relevant policymakers should continue strengthening youth-friendly SRH education through culturally appropriate, confidential, and community-based approaches.

Programmes should promote family communication, engage community leaders to reduce stigma surrounding SRH discussions, and encourage inclusive participation regardless of gender or marital status. Stronger collaboration among humanitarian organizations, camp committees, and community stakeholders is needed to improve youth-friendly SRH information services.

Future research should examine the quality, accuracy, and reliability of information obtained from different sources in conflict-affected and displacement settings. Interventions should address persistent sociocultural stigma, restrictive gender norms, marital-status-related inequalities, and structural barriers simultaneously, as improving information availability alone is unlikely to achieve equitable access.

ETHICAL DECLARATION

Ethical approval was obtained from the Institutional Review Board (IRB) of the Institute for Population and Social Research (IPSR), Mahidol University (COA No. 2026/04-023). Written informed consent was obtained from all participants before data collection. Participants were informed of the study objectives, that participation was voluntary, information would be kept confidential, and that they could withdraw from the study at any stage without consequence. Participant anonymity was maintained with identification codes, and all interview data were securely stored with access restricted to the research team.

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FACTORS ASSOCIATED WITH KNOWLEDGE AND PERCEPTION REGARDING CERVICAL CANCER SCREENING AMONG NEVER-SCREENED WOMEN AGED 30-49 YEARS IN YANGON REGION, MYANMAR

Khin Kyi Thar Win[1], May Chan Oo[1]*

[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand*

***Corresponding author:** May Chan Oo,College of Public Health Sciences, Chulalongkorn University, Bangkok, 10330, Thailand, Email: 6874001253@student.chula.ac.th, maychan.o@chula.ac.th*

ABSTRACT

Introduction: Cervical cancer is a leading, preventable health issue for women in Myanmar, yet screening uptake remains low. Understanding how women's knowledge and perceptions influence their health-seeking behaviours is crucial, as unfavourable perceptions and limited awareness act as barriers to screening. Identifying these factors is important for developing targeted interventions to improve preventive efforts in Myanmar.

Objective: To assess knowledge and perceptions regarding cervical cancer screening, determine their correlation, and identify associated factors among never-screened women aged 30-49 years in Yangon Region, Myanmar.

Methodology: A cross-sectional online survey was conducted among 432 never-screened women aged 30-49 years in Yangon Region, Myanmar, using convenience sampling. Knowledge and perception were assessed using a validated, adapted questionnaire, and health literacy using the standardized HLS-SF 12. Descriptive statistics summarized participant characteristics, followed by Chi-square tests, Spearman's correlation, and multinomial logistic regression adjusting for confounders, with inclusion at $p < 0.20$ and significance at $p < 0.05$. The study was approved by Chulalongkorn University's Research Ethics Review Committee (COA No. 154/69).

Results: Among 432 participants, poor, moderate, and good knowledge levels regarding cervical cancer and screening were 38.9%, 25.9%, and 35.2%, respectively. Meanwhile, low, moderate, and high perception levels were 29.2%, 24.5%, and 46.3%. Knowledge and perception were positively correlated ($\rho = 0.406$, $p<0.001$). Multinomial logistic regression identified education level, occupation, place of residence, contraceptive use, health literacy, and travel distance as factors associated with knowledge. Notably, low health literacy significantly reduced the odds of good knowledge (AOR = 0.07, 95% CI: 0.02–0.21, $p < 0.001$). Meanwhile, age, marital status, education level, family income, place of residence, contraceptive use, and travel distance were significantly associated with perception. Specifically, the lowest family income reduced the odds of high perception (AOR = 0.19, 95% CI: 0.07–0.52, $p = 0.001$), while contraceptive use significantly increased the odds of high perception (AOR = 2.98, 95% CI: 1.34–6.66, $p = 0.008$).

Conclusion: Knowledge and perception regarding cervical cancer and screening were positively correlated and associated with multiple factors. Although online convenience sampling limits broader generalizability, improving women's knowledge may contribute to more favourable perceptions regarding cervical cancer and screening. Therefore, designing targeted health education programs is a critical step to improve screening awareness among women in Myanmar.

Keywords:

Cervical Cancer Screening; Health Literacy; Knowledge; Perception; Myanmar

INTRODUCTION

Cervical cancer remains a major public health concern among women worldwide, particularly in low-and middle-income countries, with an estimated 662,301 new cases and 348,874 deaths in 2022 (1). Although cervical cancer is largely preventable through human papillomavirus (HPV) vaccination, regular screening, and timely treatment of precancerous lesions, many women continue to develop and die from the disease because of inadequate service access and low screening coverage (2, 3).

Myanmar experiences a considerable cervical cancer burden; according to GLOBOCAN 2022, cervical cancer is a leading female malignancy, accounting for approximately 7,028 new cases and 4,374 deaths annually (4). Despite national preventive efforts, screening uptake remains low compared with global targets, which leaves a large proportion of eligible women unscreened (5).

Knowledge and perception regarding cervical cancer and screening are important determinants of preventive health behaviour. Adequate knowledge of cervical cancer risk factors, symptoms, and prevention methods enhances personal risk recognition and screening uptake (6, 7). Similarly, positive perception of screening benefits encourages participation, whereas misconceptions, fear, embarrassment, or perceived barriers discourage health utilization (8, 9). Consequently, both constructs strongly influence women's health-seeking practices (6, 8).

However, evidence from Myanmar remains limited and fragmented, often focusing solely on screening practices or baseline awareness while neglecting women's perceptions (10, 11). Furthermore, most studies have examined these factors separately, which fail to capture how knowledge and perception interact. Understanding this relationship among women in the priority screening age group of 30-49 years in Myanmar is crucial because knowledge alone does not automatically translate into positive perceptions or favourable preventive behaviours (5, 11). Addressing this information gap is vital for developing evidence-based cervical cancer prevention strategies in Myanmar.

To address these gaps, this study assessed knowledge and perception regarding cervical cancer and screening among never-screened women aged 30-49 years in Yangon Region, Myanmar, and explored their correlation and associated factors. The findings may provide actionable evidence to design targeted health education interventions and strengthen national cervical cancer preventive efforts.

METHODOLOGY

Study design, study setting and population

A cross-sectional online survey was conducted among women aged 30-49 years in Yangon Region, Myanmar**,** which has a relatively higher concentration of healthcare and screening services compared to other regions. Eligible participants were women aged 30-49 years residing in Yangon Region for at least six months. Women with a history of cervical cancer screening, current pregnancy, or who had undergone hysterectomy were excluded from the study.

Data Collection

The minimum sample size, calculated using Cochran's formula and adjusted for 10% non-response rate, was 422 participants. Convenience sampling was used to recruit eligible women through social media platforms such as Facebook, Viber, and Telegram. Data were collected using a Google Form questionnaire after obtaining electronic informed consent. To minimize duplicate submissions, the Google Form was configured to allow only one response per email address. Of 680 responses received, ineligible and incomplete responses were excluded, yielding a final sample of 432 participants.

Research instruments

The self-administered online questionnaire, adapted from prior studies and standardized tools, assessed sociodemographic and reproductive characteristics, cervical cancer screening accessibility, knowledge and perception regarding cervical cancer and screening, and

health literacy. Knowledge was assessed using positively and negatively worded items (Correct = 1; Incorrect/Don't Know = 0). Perception was evaluated using a 4-point Likert scale. Health literacy was measured using the 12-item European Health Literacy Survey Questionnaire Short Form (HLS-SF12). Following translation into Burmese and content validation by three experts, a pilot study (n=43) was conducted for instrument reliability. Cronbach's alpha coefficients were 0.715 for perception, 0.907 for health literacy, while the KR-20 coefficient for knowledge was 0.849.

Statistical analysis

Data were analysed using IBM SPSS Statistics version 29.0.2.0. Categorical variables were summarized using frequencies and percentages, while continuous variables were presented as medians and interquartile ranges (IQR) before being categorized for analysis. Knowledge scores were categorized into poor, moderate, and good levels using Bloom's cutoff points; perception scores were categorized into low, moderate, and high levels based on the non-normal distribution of the data; and health literacy scores were categorized into adequate, problematic, sufficient, and excellent levels according to the HLS-SF12 guidelines.

Spearman's rank correlation coefficient assessed the relationship between knowledge and perception. Chi-square tests examined associations between independent and outcome levels. Variables with p-values less than 0.2 in the bivariate analysis were included in multinomial logistic regression models to control for potential confounders and identify factors independently associated with knowledge and perception. Adjusted odds ratio (AOR) and 95% confidence intervals (CI) were reported. Statistical significance was set at $p<0.05$.

RESULTS

Participant Characteristics

The characteristics of 432 study participants, women aged 30-49 years, are presented in Table 1. The median age was 36 years (IQR: 32–42). Most were married (55.6%), possessed a high level of education or above (56.7%), and were classified as dependents 54.6%. Approximately half reported a monthly family income of 300,000-700,000 MMK (50.9%) and resided in rural areas 52.3%. Regarding reproductive characteristics, 46.5% had experienced pregnancy and 36.1% were current contraceptive users. Additionally, 37.0% had inadequate health literacy. The median travel distance and travel time to the nearest cervical cancer screening facility were 5 km (IQR: 3.2–40.2) and 60 minutes (IQR: 30–90), respectively.

Regarding the primary outcomes, 38.9% of participants demonstrated poor knowledge, 25.9% moderate knowledge, and 35.2% good knowledge. For perception levels, 29.2% displayed low perception, 24.5% moderate perception, and 46.3% high perception.

Table 1. Characteristics of study participants (n=432)

Characteristics	Study participants (n=432)	
	Number	Percentage (%)
Age (Years)		
≤32 years	111	25.7
33-41 years	207	47.9
≥42 years	114	26.4
Min–Max = 30–49, Median (Q1–Q3) = 36 (32–42)		
Marital status		
Single	157	36.3
Married	240	55.6
Others (Widow, Divorce)	35	8.1

Characteristics	Study participants (n=432)	
	Number	Percentage (%)
Education level		
Primary school and below	103	23.8
Middle school	84	19.5
High school	124	28.7
College or University and above	121	28.0
Occupation		
Dependent	236	54.6
Manual worker	37	8.6
Non-manual worker	111	25.7
High-level professional	48	11.1
Family income		
<300,000 MMK	83	19.2
300,000-700,000MMK	220	50.9
>700,000MMK	129	29.9
Place of residence		
Urban	206	47.7
Rural	226	52.3
History of pregnancy		
Yes	201	46.5
No	231	53.5
Contraceptive use		
Yes	156	36.1
No	276	63.9
Level of health literacy		
Inadequate (0-25)	160	37.0
Problematic (>25-33)	148	34.3
Sufficient and Excellent (>33-50)	124	28.7
Distance to nearest screening facility		
≤5km	218	50.5
>5km	214	49.5
Travel time to nearest screening facility		
≤30 minutes	133	30.8
31-89 minutes	160	37.0
≥90 minutes	139	32.2
Min–Max= 2–300, Median (Q1–Q3) = 60 (30–90)		

Bivariate Analysis of Knowledge and Perception Levels by Participant Characteristics

Table 2 presents the bivariate analysis of factors associated with knowledge and perception levels. Significant associations were observed between both outcomes and age group, marital status, educational level, occupation, family income, place of residence, history of pregnancy, contraceptive use, health literacy level, travel distance, and travel time to the nearest screening facility (all p-values<0.05).

The proportion of participants with good knowledge was higher among women aged ≥42 years (45.6%), married women (42.9%), those who had experienced pregnancy (48.3%), and contraceptive users (46.2%). Similarly, high perception was notably more common among women with a history of pregnancy (60.7%) and contraceptive users (58.3%). Furthermore, rural residents and participants living more than 5 km from a screening facility had higher proportions of good knowledge and high perception than their counterparts.

Table 2. Bivariate analysis of knowledge and perception level by participant characteristics (n=432)

Characteristics	Study Participants (n=432)							
	Knowledge			p - value	Perception			p - value
	Poor n (%)	Mod n (%)	Good n (%)		Low n (%)	Mod n (%)	High n (%)	
Age group (Years)	**χ^2=19.323**			<0.001**	**χ^2=25.803**			<0.001**
≤32 years	45(40.5)	25(22.5)	41(36.9)		31(27.9)	27(24.3)	53 (47.7)	
33-41 years	97(46.9)	51(24.6)	59(28.5)		81(39.1)	44(21.3)	82 (39.6)	
≥42 years	26(22.8)	36(31.6)	52(45.6)		14(12.3)	35(30.7)	65 (57.0)	
Marital status	**χ^2=38.135**			<0.001**	**χ^2=24.45**			<0.001**
Single	89(56.7)	34(21.7)	34(21.7)		65(41.4)	37(23.6)	55 (35.0)	
Married	73(30.4)	64(26.7)	103 (42.9)		58(24.2)	56(23.3)	126 (52.5)	
Others (Widow, Divorce)	6(17.1)	14(40.0)	15(42.9)		3(8.6)	13(37.1)	19 (54.3)	
Education level	**χ^2=79.24**			<0.001**	**χ^2=34.9**			<0.001**
Primary school and below level	21(20.4)	50(48.5)	32(31.1)		18(17.5)	30(29.1)	55 (53.4)	
Middle school	18(21.4)	13(15.5)	53(63.1)		12(14.3)	24(28.6)	48 (57.1)	
High school	62(50.0)	28(22.6)	34(27.4)		58(46.8)	24(19.4)	42 (33.9)	
College or University and above	67(55.4)	21(17.4)	33(27.3)		38(31.4)	28(23.1)	55(45.5)	
Occupation	**χ^2=25.96**			<0.001**	**χ^2=16.74**			0.01*
Dependent	73(30.9)	67(28.4)	96(40.7)		51(21.6)	66(28.0)	119 (50.4)	
Manual worker	16(43.2)	4(10.8)	17(45.9)		13(35.1)	10(27.0)	14 (37.8)	
Non-manual worker	61(55.0)	28(25.2)	22(19.8)		44(39.6)	23(20.7)	44 (39.6)	
High-level professional	18(37.5)	13(27.1)	17(35.4)		18(37.5)	7(14.6)	23 (47.9)	
Family income	**χ^2=19.03**			<0.001**	**χ^2=25.74**			<0.001**
<300,000 MMK	41(49.4)	21(25.3)	21(25.3)		37(44.6)	21(25.3)	25 (30.1)	
300,000-700,000MMK	88(40.0)	65(29.5)	67(30.5)		70(31.8)	48(21.8)	102 (46.4)	
>700,000MMK	39(30.2)	26(20.2)	64(49.6)		19(14.7)	37(28.7)	73(56.6)	
Place of residence	**χ^2=153.38**			<0.001**	**χ^2=79.15**			<0.001**
Urban	142(68.9)	35(17.0)	29(14.1)		102(49.5)	34(16.5)	70 (34.0)	
Rural	26(11.5)	77(34.1)	123 (54.4)		24(10.6)	72(31.9)	130 (57.5)	

Characteristics	Study Participants (n=432)							
	Knowledge			p - value	Perception			p - value
	Poor n (%)	Mod n (%)	Good n (%)		Low n (%)	Mod n (%)	High n (%)	
History of pregnancy	**χ^2=53.06**			<0.001**	**χ^2=49.01**			<0.001**
Yes	42(20.9)	62(30.8)	97(48.3)		27(13.4)	52(25.9)	122 (60.7)	
No	126(54.5)	50(21.6)	55(23.8)		99(42.9)	54(23.4)	78(33.8)	
Contraceptive use	**χ^2=26.26**			<0.001**	**χ^2=19.42**			<0.001**
Yes	36(23.1)	48(30.8)	72(46.2)		27(17.3)	38(24.4)	91(58.3)	
No	132(47.8)	64(23.2)	80(29.0)		99(35.9)	68(24.6)	109 (39.5)	
Level of health literacy	**χ^2=32.57**			<0.001**	**χ^2=15.8**			0.003*
Inadequate (0-25)	79(49.4)	51(31.9)	30(18.8)		54(33.8)	45(28.1)	61(38.1)	
Problematic (>25-33)	47(31.8)	29(19.6)	72(48.6)		30(20.3)	42(28.4)	76(51.4)	
Sufficient and Excellent (>33-50)	42(33.9)	32(25.8)	50(40.3)		42(33.9)	19(15.3)	63(50.8)	
Distance to nearest screening facility		**χ^2=127.57**		<0.001**	**χ^2=66.99**			<0.001**
≤5km	139(63.8)	48(22.0)	31(14.2)		102(46.8)	44(20.2)	72(33.0)	
>5km	29(13.6)	64(29.9)	121(56.5)		24(11.2)	62(29.0)	128 (59.8)	
Travel time to nearest screening facility		**χ^2=36.02**		<0.001**	**χ^2=20.5**			<0.001**
≤30 minutes	77(57.9)	33(24.8)	23(17.3)		56(42.1)	26(19.5)	51(38.3)	
31-89 minutes	46(28.7)	42(26.3)	72(45.0)		38(23.8)	35(21.9)	87(54.4)	
≥90 minutes	45(32.4)	37(26.6)	57(41.0)		32(23.0)	45(32.4)	62(44.6)	

*p < 0.05, **p < 0.001

Correlation between knowledge and perception

Spearman's rank correlation showed a significant positive correlation between knowledge and perception scores (ρ =0.406, p<0.001) in Table 3.

Table 3. Correlation between knowledge and perception scores

Variables	Perception	
	ρ (rho)	***p-value***
Knowledge	0.406	<0.001**

**p < 0.001

Multivariable Analysis of Factors Associated with Knowledge and Perception levels

Prior to multinomial logistic regression analysis, variance inflation factor (VIF) confirmed no multicollinearity among the independent variables. Table 4 presents the final model identifying independent predictors for both knowledge and perception. The overall model was statistically significant (χ^2=346.11, p <0.001).

Regarding knowledge, lower odds of good knowledge were observed among dependent women (AOR= 0.15, 95%CI: 0.04–0.56, p=0.005), urban residents (AOR= 0.06, 95%CI: 0.02–0.17. p<0.001), women with inadequate health literacy (AOR= 0.07, 95%CI:0.02–0.21, p<0.001) and those living within 5 km of a screening facility (AOR=0.14, 95%CI: 0.06–0.37, p<0.001). Conversely, a travel time of 31–89 minutes was positively associated with good knowledge (AOR= 2.47, 95%CI: 1.00–6.09, p=0.049).

Regarding perception level, lower odds of having high perception were observed among women aged 33-41years (AOR=0.32, 95%CI: 0.14–0.74, p=0.008), married women (AOR= 0.19, 95%CI: 0.04–0.87, p=0.032), those with high school education (AOR=0.40, 95%CI: 0.18–0.86,p=0.020), participants with the lowest family income (AOR=0.19, 95%CI:0.07–0.52, p=0.001), urban residents (AOR=0.29, 95%CI: 0.13–0.65, p=0.03), and those living within 5 km of a screening facility (AOR=0.37, 95%CI: 0.16–0.87, p=0.023). In contrast, women with a history of pregnancy (AOR=2.61, 95%CI: 1.08–6.30, p=0.032) and contraceptive users (AOR=2.98, 95%CI: 1.34–6.66, p=0.008) were significantly more likely to have high perception.

Table 4. Multinomial logistic regression analysis of factors associated with knowledge and perception levels (n=432)

Independent Variables	Knowledge Level (Reference: Poor Knowledge)		Perception Level (Reference: Low Perception)	
	Moderate Knowledge AOR (95% CI)	Good Knowledge AOR (95% CI)	Moderate Perception AOR (95% CI)	High Perception AOR (95% CI)
Age Group (Years)				
≥42 years	1 (Ref)		1 (Ref)	
≤32 years	0.80 (0.29,2.21)	0.78 (0.27, 2.26)	0.67 (0.24,1.88)	0.78 (0.30, 2.06)
33-41 years	0.75 (0.32, 1.77)	0.57 (0.23, 1.41)	0.30 (0.12,0.74)**	0.32 (0.14, 0.74)*
Marital status				
Others (Widow, Divorce)	1 (Ref)		1 (Ref)	
Single	0.446 (0.10, 2.08)	0.51 (0.10, 2.67)	0.67 (0.24, 1.88)	0.64 (0.14, 3.00)
Married	0.39 (0.09, 1.69)	0.58 (0.13, 2.70)	0.30 (0.12, 0.74)**	0.19 (0.04, 0.87)*
Education level				
College or University and above	1 (Ref)		1 (Ref)	
Primary school and below level	6.61 (1.91, 22.91)*	0.68 (0.18, 2.62)	0.36 (0.10, 1.27)	0.68 (0.21, 2.22)
Middle school	3.51 (1.07, 11.53)*	1.90 (0.53, 6.85)	0.81 (0.25, 2.61)	1.40 (0.47, 4.15)
High school	1.88 (0.79, 4.49)	0.93 (0.36, 2.41)	0.35 (0.15, 0.84)*	0.40 (0.18, 0.86)*
Occupation				
High-level professional		1 (Ref)	1 (Ref)	
Dependent	0.13 (0.04, 0.45)*	0.15 (0.04, 0.56)*	2.50 (0.68, 9.16)	1.03 (0.36, 2.98)
Manual worker	0.06 (0.01, 0.33)*	0.17 (0.03, 0.92)*	0.78 (0.16, 3.70)	0.30 (0.08, 1.15)
Non-manual worker	0.31 (0.11, 0.89)*	0.10 (0.03, 0.30)**	1.13 (0.36, 3.61)	0.60 (0.24, 1.51)
Family income				
>700,000MMK	1 (Ref)		1 (Ref)	
<300,000MMK	0.86 (0.29, 2.50)	0.69 (0.23, 2.11)	0.22 (0.07, 0.63)*	0.19 (0.07, 0.52)*
300,000-700,000MMK	0.93 (0.41, 2.10)	0.50 (0.22, 1.15)	0.30 (0.13, 0.69)*	0.39 (0.18, 0.83)*
Place of residence				
Rural	1 (Ref)		1 (Ref)	
Urban	0.13 (0.06, 0.31)**	0.06(0.02, 0.17)**	0.14 (0.06, 0.34)**	0.29 (0.13, 0.65)*

Independent Variables	Knowledge Level (Reference: Poor Knowledge)		Perception Level (Reference: Low Perception)	
	Moderate Knowledge AOR (95% CI)	Good Knowledge AOR (95% CI)	Moderate Perception AOR (95% CI)	High Perception AOR (95% CI)
History of pregnancy				
No	1 (Ref)		1 (Ref)	
Yes	1.53 (0.57, 4.09)	1.91 (0.66, 5.53)	1.33 (0.50, 3.51)	2.61 (1.08, 6.30) *
Contraceptive use				
No	1 (Ref)		1 (Ref)	
Yes	3.35 (1.35, 8.36)*	2.50 (0.93, 6.73)	2.99 (1.21, 7.43)	2.98 (1.34, 6.66)*
Health Literacy Level				
Sufficient & Excellent	1 (Ref)		1 (Ref)	
Inadequate	0.28 (0.11, 0.71)*	0.07 (0.02, 0.21)**	1.78 (0.73, 4.37)	0.49 (0.22,1.09)
Problematic	0.50 (0.22, 1.17)	0.29 (0.12, 0.69)*	2.12 (0.90, 4.99)	0.87 (0.41, 1.82)
Distance to nearest screening facility				
>5km	1 (Ref)		1 (Ref)	
≤5km	0.52 (0.21, 1.29)	0.14 (0.06, 0.37)**	0.57 (0.23, 1.43)	0.37 (0.16, 0.87)*
Travel time to nearest screening facility				
≥90 min	1 (Ref)		1 (Ref)	
≤30 minutes	1.30 (0.51, 3.32)	1.33 (0.461, 3.83)	1.24 (0.50, 3.07)	1.53 (0.66, 3.55)
31-89 min	1.12 (0.47, 2.60)	2.47 (1.00, 6.09)*	0.85 (0.368, 1.98)	1.47 (0.66, 3.29)

AOR = Adjusted Odds Ratio; CI = Confidence Interval; Ref = Reference category. *$p < 0.05$, **$p < 0.001$

DISCUSSION

The present study revealed a significant positive correlation between knowledge and perception scores (ρ=0.406, $p<0.001$), with greater knowledge associated with more favorable perceptions regarding cervical cancer screening. This may reflect that knowledgeable individuals are equipped to recognize cervical cancer as preventable and understand the benefits of early detection. Better knowledge may also be associated with fewer misconceptions and greater awareness of the importance of early detection, which may be associated with more favorable perceptions toward cervical cancer screening. Previous studies have similarly highlighted the important roles of knowledge and perception in influencing cervical cancer screening behaviors among women (6, 8, 12).

Regarding reproductive factors, women with a history of pregnancy or contraceptive use demonstrated more favourable perceptions. Routine contact with maternal and reproductive healthcare services may provide opportunities for counselling, which may be associated with positive perceptions toward screening (13, 14). Additionally, higher health literacy was independently associated with better knowledge. Women with greater ability to obtain, understand, and utilize health information are better positioned to make informed decisions regarding cervical cancer prevention, consistent with previous literature (15).

Regarding geographic accessibility, rural residents and women living further from screening facilities demonstrated higher knowledge and perception levels, while longer travel times were associated specifically with good knowledge. Although previous studies have emphasized the importance of geographic accessibility in cervical cancer screening services (8) and suggested that urban areas typically offer better healthcare access (7, 16), this study suggests a different dynamic. Rural women may have had greater exposure to community-based health promotion or outreach activities, while women living farther from screening facilities may place greater importance on maintaining their health and actively seeking health information because accessing healthcare requires greater time and effort (17). These findings support the continued implementation of community-based health education and outreach programs to improve awareness and encourage cervical cancer screening uptake.

CONCLUSION

This study identified several sociodemographic, reproductive, health literacy, and accessibility-related factors associated with knowledge and perception regarding cervical cancer screening among never-screened women aged 30-49 years in Yangon Region, Myanmar. The significant positive correlation between knowledge and perception suggests that women with higher knowledge tended to have more favourable perceptions of cervical cancer screening. Therefore, targeted health education interventions should be prioritized, particularly for women with lower knowledge and perception and limited reproductive healthcare engagement to strengthen national cervical cancer prevention efforts. Future studies involving larger, geographically diverse populations are recommended to validate these findings and optimize nationwide screening strategies.

RECOMMENDATION

This study possesses notable strengths. It is one of the few studies in Myanmar to concurrently evaluate both knowledge and perception as well as their correlation among the priority screening age group. By utilizing standardized, validated instruments, this study addresses a critical gap in behavioural health data, providing robust, context-specific evidence necessary for designing targeted national cervical cancer prevention programs.

ETHICAL DECLARATION

Ethical approval for this study was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn

University, Thailand (COA No.154/69). Electronic informed consent was obtained from all participants. Participation was voluntary, anonymous, and respondents could withdraw at any time. All data were kept confidential and used solely for research purposes.

LIMITATIONS

This unexpected finding highlights a primary study limitation. The use of online convenience sampling may have introduced selection bias, as women with limited internet access or lower engagement with social media platforms were less likely to participate. Consequently, the findings may not be fully representative of all women aged 30–49 years in Yangon Region.

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FACTORS ASSOCIATED WITH MENSTRUAL HYGIENE PRACTICES AMONG REPRODUCTIVE-AGE WOMEN IN YANGON, MYANMAR: A CROSS-SECTIONAL STUDY

Moe Aung @ Moe Aung Myin[1] and Nutta Taneepanichskul[1*]

[1]College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330.
Email: moeaungmyin@gmail.com
[*]Corresponding Author: Nutta Taneepanichskul, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10330, E-mail: Nutta.T@chula.ac.th

ABSTRACT

Introduction: Menstrual health is an important public health problem since poor menstrual hygiene increases the risk of reproductive tract infections and negatively impacts women's overall well-being. In Myanmar, recent economic and political crises have made it more difficult to access and afford menstrual products, which may lead women to poor practices. Despite this growing issue, research targeting adult women in urban areas like Yangon remains limited.

Objective: This study aimed to explore the levels of knowledge, attitudes, and practices regarding menstrual hygiene, and to identify factors associated with menstrual hygiene practices among reproductive-age women in Yangon, Myanmar.

Methodology: A cross-sectional quantitative study was conducted among 453 women aged 18–49 living in Yangon, Myanmar. Participants were recruited through convenience sampling and completed an anonymous online questionnaire between November 14 and November 30, 2025. Menstrual hygiene practices were evaluated using a 14-item questionnaire, dividing results into "good" or "poor" categories based on a median cut-off. Binary logistic regression was used to find independent predictors of good practices.

Results: Overall, 70.4% of women demonstrated good menstrual hygiene practices. Just above half (51.9%) had good knowledge, and 78.8% held neutral attitudes. Women were significantly more likely to have good practices if they had completed high school or higher education (AOR=2.35, 95% CI: 1.05–5.22), had a monthly household income above 1,000,000 MMK (AOR=4.01, 95% CI: 1.33–12.10), or could afford menstrual products (AOR=10.11, 95% CI: 1.74–58.83). Physical infrastructure, such as having soap in home toilets (AOR=2.17, 95% CI: 1.04–4.52) and covered disposal bins in toilets outside the home setting (AOR=3.17, 95% CI: 1.58–6.35), also predicted good practices. Moreover, neutral (AOR=3.25) and positive attitudes (AOR=4.52) were associated with better practices, whereas longer social media use (>4 hours per day) was associated with lower odds of good practices (AOR=0.39).

Conclusion: Most participants reported good menstrual hygiene practices. Menstrual hygiene practices in Yangon are influenced by socioeconomic conditions, physical infrastructure, attitude levels, and social media use. Therefore, interventions should prioritize menstrual product affordability, access to sanitation facilities, and education and community engagement that support positive menstrual attitudes.

Keywords:
Menstrual Hygiene; Menstrual Health; Reproductive Health; Determinants of Menstrual Hygiene Practices; Myanmar.

INTRODUCTION

Menstruation is a normal physiological process that every female encounters throughout their reproductive life cycle. Menstrual health refers to physical, mental, and social well-being in relation to menstruation, which comprises proper access to information, materials, supportive facilities, and an enabling environment (1). When those conditions are missing, menstruation can become a source of distress, social restriction, and

poor reproductive health outcomes. Moreover, poor menstrual hygiene practices may increase the risk of urogenital and reproductive tract infections when women cannot manage menstruation safely and privately (2). Previous studies from South Asia and sub-Saharan Africa suggest that factors that influence menstrual hygiene practices include education, household resources, access to menstrual materials, and availability of sanitation facilities, since these factors enable women and girls to manage menstruation as frequently and as necessary as required (3, 4).

Moreover, global estimates and monitoring reports indicate that many girls and women, especially in low and middle-income countries, have difficulties in accessing required menstrual products, sanitation facilities, and safe disposal options (5). For instance, a systematic review and meta-analysis in sub-Saharan Africa showed that fewer than 50% of adolescent girls reported good menstrual hygiene practices because of these difficulties (4).

Myanmar is an important setting for this problem since menstrual health challenges in the country have been described in previous studies. These studies highlighted persistent problems such as inadequate knowledge and limited information, secrecy, and stigma, as well as physical barriers such as limited materials and resources, difficult access to sanitation facilities, which are usually required for proper menstrual hygiene practices (6-10). In addition, due to recent political instabilities and the decline in the country's economic situation, a diverse segment of the population cannot acquire appropriate sanitary products even in urban areas, which may lead these women to poor practices (11).

However, the available studies have largely focused on adolescents, schoolgirls, and other specific populations rather than adult women living in urban settings. In addition, Yangon possesses the largest proportion of the female population, around 4 million (approximately 23% of the country's female population), living with diverse socio-demographic characteristics, with uneven access to facilities that may have various influences on their menstrual hygiene practices (12, 13). Without a proper understanding of how these women understand, perceive, and manage their menstruation, public officials and policymakers may not have a full understanding of the extent of menstrual health needs among reproductive women in the country.

Therefore, this study aims to fill the research gap by exploring knowledge, attitudes, and practices, as well as factors associated with menstrual hygiene practices among reproductive-age women in Yangon, Myanmar. The findings are intended to provide baseline data for designing appropriate health education programs, improving sanitation facilities, and policy and interventions addressing affordability and access.

METHODOLOGY

Study design and population

A cross-sectional quantitative study was conducted in November 2025 in Yangon Region (including Yangon City Development Committee areas and other townships), which is one of the most urbanized regions and has the largest female population. The study population was adult women aged between 18 and 49, residing in Yangon, Myanmar. Eligible participants were women who had experienced menarche, could read and write the Myanmar language, and had access to digital devices and an internet connection, currently living in Yangon for at least six months at the time of data collection. Exclusion criteria involved not providing informed consent, withdrawal during completion of the survey questionnaire, being currently pregnant, or not having experienced any menstruation during the previous 12 consecutive months.

Sample size and sampling technique

The sample size was calculated using Cochran's formula with a 95% confidence interval for an unknown population with an unknown prevalence. The total minimum target for data collection was 422, after adding a 10% non-response adjustment, and a total of 453 women

completed the survey questionnaire. Participants were recruited using convenience sampling. The questionnaire was distributed through online community groups via various social media platforms and channels such as Facebook, Telegram, and Viber, to reach wider populations and reduce social desirability bias due to the privacy advantages of self-completion on a sensitive topic area. Real-time data response was monitored daily to identify and resolve potential problems.

Measurement tool, validity, and reliability

The data were collected through a self-administered online questionnaire via Google Form. Online administration was chosen for its feasibility, accessibility, cost-effectiveness, and safe data collection during the ongoing political crisis in Myanmar. The first survey page explained the study's purpose and obtained digital informed consent. Screening questions were then used to confirm eligibility before participants proceeded to the questionnaire. The questionnaire was self-developed through an extensive literature review and adapted from previous studies and guidelines to meet the local context (3, 8, 10, 14-16).

It comprised six sections, namely: general characteristics; menstruation and menstrual health-related factors; menstrual hygiene management facilities; knowledge; attitudes; and practices. The knowledge section contained 11 items scored from 0 to 11 and classified using Bloom's cut-off into poor, moderate, and good knowledge. The attitude section was composed of 18 Likert-scale statements, including both positive and negative questions, and was grouped into negative, neutral, and positive attitude levels using the median and interquartile range. The practice section was assessed via 14 question items and was classified as good or poor using the median cut-off. Since our data did not follow a normal distribution and no universally validated threshold was available for study-specific attitude and practice scores, the sample median was selected as a transparent, distribution-based operational cut-off, consistent with approaches used in previous studies (3, 8, 16).

The questionnaire tool was reviewed for content validity using item-objective congruence (IOC) scores by three experts, and the overall IOC score was 0.90. The questionnaire was translated into the Myanmar language, and back-translation was done by different experts. Pilot testing was conducted using 10% of the target sample from a population in a different area with similar demographic characteristics. Pilot testing showed acceptable internal consistency; Cronbach's alpha was 0.73 for knowledge, 0.81 for attitudes, and 0.71 for practices.

Variables

The dependent variable was menstrual hygiene practices and was assessed in terms of material choice, correct changing frequency and disposal method, proper place of disposal, consistent hand and genital washing, and other hygienic practices. However, menstrual material choice was used only for descriptive purposes and was not considered in scoring since materials can be both hygienic and unhygienic depending on changing frequency and other cleaning practices.

The independent variables consisted of 5 main groups: (1) general characteristics (age, education level, residential and socio-economic status, and social media usage), (2) menstruation and menstrual health-related factors (awareness before menarche, age at menarche, type and average duration of menstruation), (3) menstrual hygiene management facilities (water, sanitation and hygiene; WASH facilities and access to menstrual materials), (4) knowledge (participants' understanding of menstruation and hygiene related questions), (5) attitudes (participants' perception and opinion about menstruation and hygiene-related questions).

Data analysis

The data were downloaded, cleaned in Microsoft Excel, and analyzed using SPSS version 29. For descriptive statistics, categorical variables were summarized using frequency and

percentage, while continuous variables were described with median and interquartile range (since data were not normally distributed). Bivariate associations with menstrual hygiene practices were examined using chi-square or Fisher's exact test and simple logistic regression. Variables with P<0.2 (in the bivariate model), together with theoretically important covariates, were included in the multivariate logistic model and were reported using adjusted odds ratios and 95% confidence intervals. Our final logistic regression model had a Nagelkerke R-squared of 0.58, indicating that the included variables explained approximately 58% of the variation in good menstrual hygiene practices. The Hosmer–Lemeshow goodness-of-fit test showed no evidence of poor model fit (P>0.05). Multicollinearity diagnostics indicated that the included variables met the specified VIF assumption.

RESULT

A total of 453 women participated in the study. According to Table 1, the largest age group was 35–49 years (40.0%). More than two-thirds had at least high school education, 96.7% were living in urban areas, and 52.5% reported a household monthly income of 500,000–1,000,000 MMK. More than half used social media for 2–4 hours per day, and 18.5% reported daily use of >4 hours.

Regarding menstruation and menstrual health-related characteristics, 57.4% reported awareness of menstruation before menarche, and mothers were the most common first source of information for prior awareness. Most women had regular menstruation and an average duration of 3-6 days.

Access to facilities for menstrual hygiene management was unequal. Lockable doors and clean water were present in almost all toilets in home and outside home settings (approximately 85%-99%). However, soap in home toilets was reported by 73.7% of participants, but covered bins were only available to 40.8% of households. For toilets outside home settings, 66.9% reported soap, and 72.0% reported covered bins with lids. Most participants reported menstrual materials were universally available (96.2%) and affordable, but about 7.9% still reported affordability problems.

Table 1 Frequencies and distribution of sample characteristics among reproductive-age women in Yangon, Myanmar (n=453)

General Characteristics	Frequencies	Percentage
Age (years)		
18-24	123	27.2
25-34	149	32.9
35-49	181	40.0
Median (IQR) = 30 (24-39), Min-Max = 18-49		
Education		
Middle School or Lower	147	32.4
High School or Higher	306	67.5
Resident Status		
Urban	438	96.7
Rural	15	3.3
Household Monthly Income (MMK*)		
<500,000	122	26.9
500,000-1,000,000	238	52.5
>1,000,000	93	20.5
Median (IQR) = 700,000 (450,000-1,000,000), Min-Max = 100,000-20,000,000		

General Characteristics	Frequencies	Percentage
Social Media Usage (Hours)		
<2	136	30
2-4	233	51.4
>4	84	18.5
Median (IQR) = 3 (1-5), Min-Max = 0-16		
2. Menstruation and Menstrual Health-Related Factors		
Awareness before menarche		
Yes	260	57.4
No	145	32.0
Do not remember	48	10.6
Age of First Period (Menarche)		
9-12 years	67	15.0
13-14 years	240	53.0
>14 years	145	32.0
Median (IQR) = 14 (13-15), Min-Max = 9-16		
Type of Menstruation **		
Regular	327	72.2
Irregular	106	23.4
I am not sure/do not track	20	4.4
Average Duration of Menstruation		
Less than 3 days	130	28.7
3-6 days	304	67.1
7 days or more	19	4.2
3. Menstrual Hygiene Management Facilities		
Soap available in-home toilet		
Yes	334	73.7
No	119	26.3
Covered bin with lid in home toilet		
Yes	185	40.8
No	268	59.2
Soap available in toilet outside home		
Yes	303	66.9
No	150	33.1
Covered bin with lid in toilet outside home		
Yes	326	72.0
No	127	28.0
Menstrual materials affordable		
Yes	417	92.1
No	36	7.9

* MMK= Myanmar Kyats* (Approximately 1 USD = 3568 MMK and 1 THB = 113.81 MMK according to the market trading rate of the Central Bank of Myanmar)

**Regular = the period comes at consistent intervals (typically every 21 to 35 days), and Irregular = the period timing varies significantly and unpredictably each month **

Levels of knowledge, attitudes, and practices are described in Table 2. Good knowledge was reported by 51.9% of participants, while 29.6% had moderate knowledge and 18.5% had poor knowledge. Attitudes were mostly neutral (78.8%). Overall, 70.4% of participants reported having good menstrual hygiene practices.

Table 2 Level of knowledge, attitude, and menstrual hygiene practices among reproductive-age women in Yangon, Myanmar (n=453)

Category	Score range	Frequencies	Percentage
Level of knowledge			
Good (80-100%)	9-11	235	51.9
Moderate (60-79%)	7-8	134	29.6
Poor (<60%)	<7	84	18.5
	Median (IQR) = 9 (7-10), Min-Max = 3-11		
Level of attitude			
Positive	≥77	61	13.5
Neutral	76-56	357	78.8
Negative	≤55	35	7.7
	Median (IQR) = 66 (61-72), Min-Max = 42-89		
Level of practice			
Good	≥8	319	70.4
Poor	<8	134	29.6
	Median (IQR) = 8 (7-10), Min-Max = 0-13		

The multivariable model is shown in Table 3. Good menstrual hygiene practices were associated with higher education, higher household income, availability of soap in home toilets, covered bins with lids in outside home toilets, affordability of menstrual materials, and better attitudes. Social media use of more than 4 hours per day was associated with lower odds of good practices.

Table 3 Factors associated with menstrual hygiene practices among reproductive age women in Yangon, Myanmar (n=453)

Independent Variable	P-value*	AOR[a]	Confidence-Interval (CI 95%)
Age (years)			
18-24			Ref
25-34	0.494	1.331	0.586-3.024
35-49	0.818	1.107	0.465-2.639
Education			
Lower Education (Middle School and Lower)			Ref
Higher Education (High School and Higher)	**0.036**	**2.347**	**1.056-5.215**
Occupation			
Student			Ref
Unemployed/Housewife/Dependency/Retirement	0.278	1.887	0.600-5.936
Daily Laborer	0.218	2.174	0.631-7.491
Merchant or own-account business	0.318	2.016	0.509-7.992
Others (Government, Private, Non-profit sector employee)	0.526	1.381	0.509-3.750
Family Type			
Nuclear (parents and their children only)			Ref
Extended (parents, children, and other relatives	0.521	0.793	0.390-1.610

Independent Variable	P-value*	AOR[a]	Confidence-Interval (CI 95%)
Skip-generation (grandparents with grandchildren, no parents)	0.772	1.242	0.286-5.389
Other (living alone or with non-family members)	0.986	1.008	0.400-2.541
Household Leader			
Male-headed			Ref
Female-headed	0.429	0.766	0.395-1.484
Father's Education			
Lower Education (Middle School and Lower)			Ref
Higher Education (High School and Higher)	0.342	0.708	0.346-1.445
Mother's Education			
Lower Education (Middle School and Lower)			Ref
Higher Education (High School and Higher)	0.191	1.634	0.783-3.409
Household Monthly Income (Myanmar Kyats)			
<500,000			Ref
500,000-1,000,000	0.230	1.556	0.756-3.202
>1,000,000	**0.014**	**4.013**	**1.331-12.102**
Social Media Usage (Hours per day)			
<2			Ref
2-4	0.169	0.604	0.295-1.239
>4	**0.048**	**0.388**	**0.151-0.993**
Type of Menstruation			
Regular			Ref
Irregular	0.906	0.961	0.491-1.879
Lockable Door (Home Toilet)			
No			Ref
Yes	0.425	0.696	0.286-1.696
Soap (Home Toilet)			
No			Ref
Yes	**0.039**	**2.169**	**1.039-4.527**
Covered Bin (with lid) (Home Toilet)			
No			Ref
Yes	0.193	1.581	0.793-3.151
Soap (Outside Home Toilet)			
No			Ref
Yes	0.372	1.365	0.689-2.706
Covered Bin (with lid) (Outside Home Toilet)			
No			Ref
Yes	**0.001**	**3.169**	**1.582-6.347**
Availability of Local Shops			
No			Ref
Yes	0.783	0.771	0.122-4.896
Affordability of Menstrual Materials during Menstruation			
No			Ref
Yes	**0.010**	**10.108**	**1.737-58.832**

Independent Variable	P-value*	AOR[a]	Confidence-Interval (CI 95%)
Knowledge Level			
Poor			Ref
Moderate	0.286	0.630	0.270-1.472
Good	0.418	1.340	0.660-2.723
Attitude Level			
Negative			Ref
Neutral	**0.023**	**3.250**	**1.173-9.007**
Positive	**0.038**	**4.516**	**1.084-18.816**

Significant P<0.05 are in bold
[a] AOR= adjusted odds ratio

DISCUSSION

The study found that more than two-thirds of reproductive-age women in Yangon reported good menstrual hygiene practices. This prevalence is higher than that of other studies conducted among adolescents and in low-resource settings (3, 4, 10, 17, 18). The possible explanation could be due to differences in sample size, study setting, study period, and sociocultural contexts; women from our study in an urban setting may have better access to menstrual materials and facilities.

In our study, better education and higher household income were independently associated with good practices. These findings are consistent with previous studies conducted in Southeast Asia and Africa that indicated socio-economic status shapes how women manage their menstrual hygiene (3, 4, 18). The possible explanation for these findings is that women with higher education may have stronger health literacy and better confidence in menstrual hygiene management, while households with higher income may be able to spend more on required menstrual materials that support recommended changing frequency.

Moreover, affordability emerges as the strongest predictor of good menstrual hygiene practices in our study. Women who reported the affordability of menstrual materials had approximately 10 times the odds of having good menstrual hygiene practices. However, a wide confidence interval indicates limited precision; therefore, the magnitude of association should be interpreted with caution. This finding was consistent with a study in India in which affordability is significantly associated with good practices (18). The plausible explanation for the finding in our study is that although most women reported affordability of menstrual materials, women from very low-income families who perceived menstrual materials as not affordable reduced pad use or resorted to alternative menstrual materials, leading to inadequate changing frequency that CONTRIBUTES to poor hygienic practices. This finding was further supported by a previous survey in Myanmar that current inflation induced by political crisis caused these women to reduce or substitute unhygienic materials, especially at home or during nighttime (11).

Our findings also highlighted the importance of access to proper toilet facilities in both home and outside-home environments in maintaining good menstrual hygiene practices. In our study, soap availability in home toilets and covered bins with lids in toilets in outside-home settings were independently associated with good practices. These findings were comparable to previous studies in Indonesia, Ethiopia, and Ghana that indicated menstrual hygiene practices were also dependent on access to supportive WASH facilities (16, 19, 20). The possible explanation for our study is that even in an urban setting, incomplete toilet support can make regular changing, cleaning, and disposal more difficult which may lead to poor practices.

In our study, attitudes remained significantly associated with good practices, whereas knowledge did not. Women with neutral and positive attitudes were more likely to have good practices compared to those with negative attitudes. This is comparable to a study conducted in Indonesia, where attitudes are the strongest predictor of good menstrual hygiene practices and girls with positive attitudes were 4 times more likely to have good practices (16). This finding may also be considered in relation to the Theory of Planned Behavior, which proposes that attitudes toward a behavior can influence behavioral intention and subsequent behavior, which suggests that knowledge alone may not be enough to change to good practices if menstruation is still shaped by shame, restriction, and stigma; earlier work from Myanmar and Indonesia suggested that stigma, social norms and menstrual attitudes can influence practice (10, 16, 24). The findings in our study could explain that attitudes surrounding menstruation could probably remain as a milder form of shame and secrecy (for example, while most women held neutral attitudes, about half of the women still agreed women should not discuss menstruation with men), which may lead women to poor practices.

One notable finding in our study is that women who used social media longer (>4 hours/day) were associated with lower odds of good practices compared to those who used social media less (<2hours/day). According to our understanding, very few previous studies establish such a direct association between social media usage and menstrual hygiene practices. Our finding contrasts with a study in Bangladesh, where longer social media usage (2-5 hours) had a higher menstrual knowledge score compared to shorter social media usage (<2 hours) in bivariable linear regression; however, it did not directly associate with practice scores (3).

The negative association between social media usage and menstrual practices in our study could possibly be explained by digital access models, which require devices, platforms, and literacy skills (21). Because our online study required device and platform access, we hypothesize that our participants may generally lack digital health literacy that involves the ability to evaluate health information and avoid online misinformation or stigma (22, 23). Consequently, prolonged social media use may increase users' exposure and susceptibility to false information, resulting in poorer menstrual hygiene practices. However, our study did not measure online menstrual content, misinformation exposure, digital health literacy, or reasons for extended use; therefore, our current hypothesis of such an association should be explored in future research to establish a clear association.

CONCLUSION

Most participants reported having good menstrual hygiene practices. Good practices were associated with higher education, greater household income, affordability of menstrual materials, availability of soap in home toilets, covered disposal bins in toilets outside the home, and better attitudes toward menstruation. These findings suggest that menstrual hygiene management in Yangon is influenced by socioeconomic factors, enabling environments, and personal attitudes. Therefore, interventions require not only education and awareness programs, but also practical support that enables women to manage their menstruation safely, affordably, and with dignity.

RECOMMENDATIONS

Interventions should prioritize addressing the affordability of menstrual materials for women, especially in low-income families; hence, short-term interventions such as targeted free pad distribution or subsidized sanitary products, as well as long-term policy interventions, are recommended. However, these intervention programs need prior assessment for feasibility, effectiveness, costs, and acceptability with relevant stakeholders. Menstrual health programs should also improve

access to basic WASH support facilities in both home and outside-home environments to be "Menstrual Hygiene Management, MHM-friendly". Education and community engagement programs considering male involvement are also recommended since it is important not only to improve knowledge, but also to reduce stigma and support positive attitudes toward menstruation. Future research should consider more inclusive design and should evaluate the relationship between digital health literacy skills and health information seeking behaviors of these women specific to menstrual hygiene management.

ETHICAL DECLARATION

Ethical approval was obtained from the Ethical Committee for Research Involving Human Subjects, Health Science Group 1 of Chulalongkorn University, with approval number 313/68 on 10, November 2025.

LIMITATION

The cross-sectional design could not establish a causal relationship. Convenience sampling may affect generalizability and representativeness since our data may be skewed toward the major population with higher literacy and better resources. Since about 97% of participants were urban residents, we acknowledge that women with lower digital access and socioeconomic status may be underrepresented due to online convenience sampling, which could potentially lead to an underestimation of menstrual hygiene practices, especially in women from rural areas or the wider population in Myanmar. Our study also acknowledges possible recall bias and social desirability bias, since data were self-reported and due to internalized stigmas and taboos surrounding the topics. We also acknowledge the limitation of our measurement tool, which may limit comparability with other studies that used standardized tools. Moreover, we acknowledge that our research did not explore the digital environment context specific to menstrual hygiene management. Lastly, some estimates, such as the association between affordability, attitudes, and good practices, had wide confidence intervals, which may limit precision and require cautious interpretation.

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FACTORS ASSOCIATED WITH SEXUAL AND REPRODUCTIVE HEALTH LITERACY AMONG ADOLESCENTS IN KARENNI STATE, MYANMAR

Tun Hla Phyu[1], Jukkrit Wungrath[1], Orapin Laosee[1], Syarifah Aqilah[1]*

[1]ASEAN Institute for Health Development, Mahidol University, 73170, Thailand

***Corresponding Author:** Syarifah Aqilah, ASEAN Institute for Health Development, Mahidol University, 73170,Thailand, E-mail: syarifah.aqi@mahidol.ac.th*

ABSTRACT

Introduction: Adolescents in conflict-affected regions face elevated risks of unintended pregnancy, HIV, and other sexual and reproductive health (SRH) issues. Karenni State, Myanmar, has experienced prolonged armed conflict, leading to disrupted health systems, damaged healthcare facilities, displacement of healthcare workers, and interrupted formal education. However, little is known about their SRHL, as levels and associated factors in conflict settings remain undocumented despite evidence from stable settings.

Objective: This study aimed to examine the association between demographic factors, information access, and sociocultural factors with SRHL levels among adolescents in Karenni State, Myanmar.

Methodology: A school-based cross-sectional survey was conducted among adolescents aged 10-19 years from middle and high schools in Demoso and Mese townships, Karenni State. Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB) (COA No. MU 2026/297.2206). SRHL was measured using a culturally adapted version of the HLS-EU-Q47 questionnaire (47 items, 4-point Likert scale). The tool was adapted to the local context through expert review, translation from English into Myanmar with consultation with a local expert, and pretesting. An index score (0-50) was calculated using the formula: (mean - 1) × (50/3). Scores < 25 were categorized as "limited SRHL" and ≥ 25 as "adequate SRHL." Key independent variables included age, sex, grade, field of study, ethnicity, and SRH communication with peers, parents, and health providers. Binary logistic regression was used to identify associated factors, with statistical significance set at $p < 0.05$.

Results: Preliminary results from 352 adolescents showed that the mean age of participants was 15.20 ± 2.02 years; 66.2% were female, and 84.7% (n=298) had limited SRHL. Most participants were of Karen ethnicity (52.0%). Chi-square analysis revealed significant associations between SRHL and informal SRH information sources, overall SRH communication, and perceived healthcare access barriers (all $p<0.001$). Bivariate logistic regression showed that adolescents who used informal SRH sources (parents, friends, internet) had 69% lower odds of limited SRHL compared to those who did not use these sources (COR = 0.306; 95% CI: 0.155-0.603). High overall SRH communication was associated with 70% lower odds of limited SRHL (COR = 0.305; 95% CI: 0.166-0.563), while perceiving high healthcare barriers was associated with more than three times the likelihood of limited SRHL (COR = 3.562; 95% CI: 1.623-7.821).

Conclusion: Nearly nine in ten adolescents in Karenni State had limited SRHL. The finding indicated that informal SRH information sources, SRH communication, and perceived healthcare access barriers are key factors associated with SRHL. These results provide baseline evidence to inform interventions that strengthen peer and parent communication, improve access to reliable SRH information, and reduce healthcare barriers in conflict-affected settings.

Keywords:
Sexual and Reproductive Health Literacy; Adolescents; Conflict-Affected; SRH Communication

INTRODUCTION

Adolescence is the phase of life between childhood and adulthood, from ages 10 to 19. It is a unique stage of human development and an important time for laying the foundations of good health (1). During this period, Sexual and Reproductive Health (SRH) is essential for the current and future well-being of adolescents and has been recognized as a global public health priority under Target 3.7 of the 2030 Sustainable Development Goals (2).

Globally, adolescent SRH challenges are substantial. An estimated 21 million adolescent girls aged 15-19 become pregnant annually in low- and middle-income countries (LMICs), with approximately half of these pregnancies being unintended; 2.2 to 4.0 million of these end in unsafe abortion, contributing to 10-13% of global maternal deaths (3). Additionally, 140,000 adolescents acquire HIV each year, with girls accounting for three-quarters of new infections (4). Inadequate SRHL contributes to these adverse outcomes by limiting adolescents' ability to access, understand, evaluate, and apply SRH information (5).

Health literacy refers to the cognitive and social skills needed to access, understand, evaluate, and apply health information (6). Sexual and Reproductive Health Literacy (SRHL) extends this concept to SRH, comprising functional, interactive, and critical competencies for informed decisions and healthy behaviours (7). School-based SRH education is effective in increasing contraceptive use, promoting STI testing, encouraging safer sexual behaviours, and improving health practices (8, 9).

In the ASEAN region, inadequate SRHL affects 65.5–91.7% of adolescents in Lao PDR and 50.8% of female secondary students in southern Thailand (10, 11). In Myanmar, nearly half of university students in Magway had inadequate SRHL, with cultural taboos, shame, and fear of judgment as major barriers (12). Previous studies have recommended comprehensive sexuality education, peer-led interventions, culturally sensitive SRH communication, and youth-friendly health services. However, evidence from conflict-affected settings remains scarce. In Myanmar, 5,800 new HIV infections occurred among young people; 38.0% of adolescents are unaware that pregnancy can occur from a single act of intercourse, and only 16.67% of youth aged 15-24 have correct HIV prevention knowledge (13). These findings suggest persistent gaps in SRH knowledge and literacy among young people.

In Karenni State, these challenges are intensified by longstanding armed conflict, displacement, disrupted formal education, and limited healthcare access (14). Since the 2021 military coup, the formal healthcare and education systems have been severely disrupted. In resistance-controlled areas, essential services are provided by the Karenni State Interim Executive Council (IEC), ethnic service providers, Civil Disobedience Movement (CDM) professionals, and humanitarian organizations. However, ongoing conflict, damaged infrastructure, and resource shortages continue to affect healthcare and education access (15-17). Cultural and social norms - including taboos around discussing sexuality, traditional beliefs, and limited parent-adolescent communication - may also influence adolescents' SRHL differently from other regions of Myanmar (18, 19). Despite these factors, no previous study has examined SRHL among adolescents in conflict-affected ethnic minority communities in Karenni State.

Therefore, this study aimed to: (1) determine the level of SRHL and (2) examine the association between demographic factors, information access, and sociocultural-based communication factors and SRHL among adolescents in Karenni State, Myanmar.

METHODOLOGY

Study Design and Study Area

A school-based cross-sectional study was conducted among adolescents aged 10-19 years in Karenni State, Myanmar. Demoso and Mese townships were selected by simple random sampling from eligible townships with functioning middle and high schools, urban and

rural representation, and internally displaced persons (IDP) populations.

Study Population and Sampling

The study included middle and high school students aged 10-19 years in Demoso and Mese townships who were willing to participate and provided written assent and guardian consent. Students absent on the day of data collection were excluded.

A multi-stage stratified random sampling design with lottery-based selection was employed. First, Demoso and Mese townships were selected from the six eligible townships in Karenni State, based on criteria including the presence of functioning middle and high schools, representation of both urban and rural settings, and inclusion of internally displaced persons (IDP) populations to capture diverse adolescent living contexts. Second, within each selected township, schools were stratified according to student population size and school characteristics (School size, student demographics, and availability of health education resources). From these, four schools in Demoso and two in Mese were randomly selected. Third, eligible students within each selected school were stratified by grade level, sex, and residency status. A total sample of 460 students was proportionally allocated across the six schools and randomly selected from each stratum.

Sample Size

The sample size was calculated using the single population proportion formula: $n = (Z^2 \times P \times (1-P)) / d^2$, where Z = 1.96 (95% confidence level), P = 0.5 (assumed prevalence of low SRHL due to lack of prior data), and d = 0.05 (margin of error). The calculated minimum sample size was 384, and after adding 20% for non-response, the final target was 460.

This manuscript reports preliminary findings from 352 adolescents, with data collection ongoing.

Research Instrument

The questionnaire adapted from the HLS-EU-Q47 (47 items, 4-point Likert scale) covered four health literacy dimensions: access, understand, appraise, and apply SRH information across health promotion, disease prevention, and service utilization. The questionnaire was translated from English into Myanmar by the research team, and a local content expert was consulted to review the translated version for linguistic accuracy, cultural relevance, and conceptual equivalence, ensuring the tool was both linguistically and contextually appropriate for the target population. Content validity was assessed using the Index of Item-Objective Congruence (IOC) by a panel of three experts, with items scoring ≥ 0.50 considered acceptable. Reliability was assessed through a pilot test among 30 adolescents from non-participating schools, with Cronbach's alpha ≥ 0.70 considered acceptable.

Variables and Measurements

Dependent Variable: SRHL was measured using 47 items rated on a 4-point Likert scale (1 = Very difficult to 4 = Very easy). An index score (0-50) was calculated using the formula: (mean - 1) × (50/3). Scores < 25 were categorized as "limited SRHL" and ≥ 25 as "adequate SRHL."

Independent Variables: Independent variables included: (1) demographic factors-age, sex, grade, field of study, ethnicity; (2) information access factors-informal SRH sources (Obtaining SRH information from parents, friends, and the internet); (3) perceived healthcare access barriers (fear of judgement or lack of confidentiality), and (4) sociocultural factors - SRH communication with parents, peers, and healthcare providers across eight topics (function of reproductive organs, puberty, menstruation, pregnancy, contraception, STIs, condom use, and relationships.

Data Collection Procedure

The researcher contacted selected schools to arrange meetings with school principals and focal teachers to explain the study objectives, procedures, inclusion criteria, and ethical requirements. With support from the school, an eligible student list was prepared, and the required number of students was randomly selected according to the sampling plan. Parents or guardians of the selected students were provided with a participant information sheet explaining the study purpose, procedures, risks, benefits, and their rights before providing informed consent. Students who had returned signed guardian consent forms and provided written assent were invited to participate.

Data were collected by trained research assistants using a structured, paper-based questionnaire administered in a quiet classroom setting during school hours. Before questionnaire administration, the research assistants explained the study purpose, study procedures, estimated completion time, and instructions for completing the questionnaire. Research assistants remained available throughout the survey to clarify questions, when necessary, without influencing participants' responses. Completed questionnaires were reviewed for completeness on the same day.

Data Analysis

Data were entered and analysed using SPSS version 31.0.1.0. Descriptive statistics included frequencies, percentages, means, and standard deviations. Chi-square tests were used to assess associations between independent variables and SRHL levels. Binary logistic regression was employed to identify factors associated with limited SRHL, with statistical significance set at $p < 0.05$.

RESULTS

Demographic Characteristics

As shown in Table 1, participants ranged in age from 10 to 19 years, with 64.5% classified as late adolescents (15-19 years). Approximately two-thirds of the participants were female (66.2%). Participants were almost equally distributed between middle school (52.8%) and high school (47.2%). Most participants were enrolled in fields other than science (60.2%), and just over half belonged to the Karen ethnic group (52.0%). In the Myanmar education system, middle school comprises Grades 6-9, while high school comprises Grades 10-12. At the high school level, students in the "science" stream receive greater emphasis on biology, chemistry, and physics, whereas students in the "other" streams focus mainly on social sciences (history, geography, and ecology). Thus, science-stream students generally have greater exposure to biological and health-related subjects.

Table 1 Demographic characteristics of participants

Categories	Frequency (n)	Percentage (%)
Age (years)		
Early adolescent (10–14 years)	125	35.5
Late adolescent (15–19 years)	227	64.5
Sex		
Male	119	33.8
Female	233	66.2
School level		
Middle school (Grade 6-9)	186	52.8
High school (Grade 10-12)	166	47.2

Categories	Frequency (n)	Percentage (%)
Field of study		
Science	140	39.8
Other (Social Science + Other)	212	60.2
Ethnicity		
Karen	183	52.0
Others	169	48.0

Factors Associated with SRHL

The overall prevalence of limited SRHL was 84.7% (298 out of 352 participants). Table 2 presents the chi-square associations between independent variables and SRHL level. Informal SRH information sources showed a strong association ($p < 0.001$), with 77.8% of those with adequate SRHL using informal sources compared to 51.7% of those with limited SRHL. High overall SRH communication was reported by 66.7% of adolescents with adequate SRHL versus 37.9% of those with limited SRHL. Perceived healthcare access barriers showed a significant association ($p < 0.001$), with 85.2% of those with adequate SRHL reporting low barriers compared to 61.7% of those with limited SRHL.

No significant associations were found between SRHL and sex (p=0.586), age group (p=0.197), school level (p=0.453), field of study (p=0.095), or ethnicity (p=0.363).

Table 2 Association between independent variables and level of SRHL using Chi-square test

Variables	Level of SRHL (n, %)				P-Value
	Adequate		Limited		
SRHL Level	54	15.3%	298	84.7%	
Age group					
Early adolescent (10-14 yrs)	15	27.8%	110	36.9%	0.197
Late adolescent (15-19 yrs)	39	72.2%	188	63.1%	
Sex					
Male	20	37.0%	99	33.2%	0.586
Female	34	63.0%	199	66.8%	
School level					
Middle school	26	48.1%	160	53.7%	0.453
High school	28	51.9%	138	46.3%	
Field of study					
Science	27	50.0%	113	37.9%	0.095
Other (Social Science + Other)	27	50.0%	185	62.1%	
Ethnicity					
Karen	25	46.3%	158	53.0%	0.363
Others	29	53.7%	140	47.0%	
Informal SRH information sources					
No	12	22.2%	144	48.3%	**< 0.001 *****
Yes	42	77.8%	154	51.7%	

Variables	Level of SRHL (n, %)				P-Value
	Adequate		Limited		
SRH communication frequency					
Low (score 0-3)	23	42.6%	167	56.0%	0.068
High (score 4-9)	31	57.4%	131	44.0%	
Overall SRH communication (8 topics)					
Low (≤5)	18	33.3%	185	62.1%	**< 0.001** ***
High (>5)	36	66.7%	113	37.9%	
Perceived healthcare access barriers					
Low (score 2-5)	46	85.2%	184	61.7%	**< 0.001** ***
High (score 6-8)	8	14.8%	114	38.3%	

Bivariate Logistic Regression

Table 3 presents the results of binary logistic regression analysis. Adolescents who used informal SRH information sources had 69% lower odds of limited SRHL compared to those who did not (COR = 0.306; 95% CI: 0.155-0.603; p < 0.001). High overall SRH communication was associated with a 70% lower likelihood of limited SRHL (COR = 0.305; 95% CI: 0.166-0.563; p < 0.001). Conversely, perceiving high healthcare barriers was associated with more than three times the odds of limited SRHL (COR = 3.562; 95% CI: 1.623-7.821; p = 0.002). SRH communication frequency (score 0-3 vs. 4-9) showed a nearly significant association (COR = 0.582; 95% CI: 0.324-1.046; p = 0.070).

Table 3 Logistic regression of factors associated with SRHL level

Variables	COR	95% CI		P-Value
		Lower	Upper	
Age group				
Early adolescent (10-14 yrs)	1(Ref)			
Late adolescent (15-19 yrs)	1.521	0.802	2.886	0.199
Sex				
Male	1(Ref)			
Female	0.846	0.463	1.545	0.586
School level				
Middle school	0.801	0.448	1.431	0.453
High school	1(Ref)			
Field of study				
Science	1(Ref)			
Other (Social Science + Other)	0.611	0.341	1.094	0.097
Ethnicity				
Karen	0.764	0.427	1.366	0.364
Others	1(Ref)			
Informal SRH information sources				
No	**0.306**	**0.155**	**0.603**	<0.001
Yes	1(Ref)			
SRH communication frequency				
Low (score 0-3)	0.582	0.324	1.046	0.070
High (score 4-9)	1(Ref)			

Variables	COR	95% CI		P-Value
		Lower	Upper	
Overall SRH communication (8 topics)				
Low (≤5)	**0.305**	**0.166**	**0.563**	<0.001
High (>5)	1(Ref)			
Perceived healthcare access barriers				
Low (score 2-5)	**3.562**	**1.623**	**7.821**	0.002
High (score 6-8)	1(Ref)			

DISCUSSION

This study provides the first evidence on SRHL and its associated factors among adolescents in conflict-affected Karenni State, Myanmar. Four key findings emerged. First, the prevalence of limited SRHL was high, affecting 84.7% of adolescents. Second, adolescents who used informal SRH information sources were significantly less likely to have limited SRHL. Third, higher levels of overall SRH communication were associated with lower odds of limited SRHL, whereas perceived healthcare access barriers were associated with increased odds of limited SRHL. Finally, demographic characteristics, including age, sex, school level, field of study, and ethnicity, were not significantly associated with SRHL.

The high prevalence of limited SRHL (84.7%) indicates a substantial public health concern and is comparable to findings from other low- and middle-income countries, including Lao PDR (10) and Eastern Ethiopia (11, 20). However, it was higher than that reported among university students in Magway, Myanmar (12). This may reflect the prolonged conflict in Karenni State, which has disrupted education and healthcare services, displaced communities, and limited access to comprehensive SRH education. Cultural taboos surrounding sexuality and reproductive health may further restrict access to reliable information. These findings highlight the need to prioritize SRHL within adolescent health and education programs in conflict-affected settings.

Adolescents using informal SRH information sources, including parents, friends, and the internet, had lower odds of limited SRHL. This is consistent with previous studies in Myanmar showing that parent and peer communication can improve access to SRH information and reduce misconceptions (19). In Karenni State, disruptions to formal education and health services may increase reliance on informal sources. However, information quality may vary, particularly from peers and unverified online platforms. Strengthening the capacity of parents and peer educators and promoting reliable digital resources may therefore improve access to accurate SRH information.

Higher overall SRH communication across eight topics was also associated with lower odds of limited SRHL, consistent with evidence that open communication with parents and peers supports adolescents' understanding and informed decision-making (10, 21). In this study, adolescents with limited SRHL were less likely to report frequent communication with the peer or, parents, or healthcare providers across multiple SRH topics, suggesting that opportunities to discuss SRH remain limited. In Karenni State, cultural norms, embarrassment, and parents' discomfort in discussing sexuality may further restrict such communication. The disruption of school-based health education due to conflict may also reduce opportunities for adolescents to receive accurate SRH information through teachers or health professionals. These findings highlight the importance of strengthening parent-adolescent communication, peer education, and school-based SRH education using culturally appropriate approaches.

Perceived healthcare access barriers were associated with more than three times the odds of limited SRHL. This is particularly concerning in conflict-affected Karenni State, where healthcare services are constrained by

insecurity, displacement, and limited infrastructure (14). Previous studies in Myanmar have documented that fear of judgment, shame, and stigma discourage young people from seeking SRH information and services (19, 22). Interventions should therefore address both physical barriers through mobile and community-based services and psychosocial barriers through youth-friendly, confidential, and non-judgmental healthcare.

No significant associations were observed between SRHL and demographic characteristics. This finding differs from studies conducted in more stable settings, where older adolescents and higher educational attainment have been associated with better SRHL (10, 12). The absence of significant demographic differences in this study may reflect the widespread impact of armed conflict on adolescents across different population groups. Disruptions to education, limited access to health information, and reduced healthcare availability may have affected adolescents similarly regardless of their demographic background. These findings suggest that interventions to improve SRHL in Karenni State should initially target all adolescents rather than specific demographic subgroups.

CONCLUSION

This study provides the first evidence on SRHL among adolescents in conflict-affected Karenni State, Myanmar. Limited SRHL was highly prevalent, affecting nearly nine in ten adolescents. Informal SRH information sources, SRH communication, and perceived healthcare access barriers are key associated factors. These findings provide important baseline evidence to inform the development of strategies to improve adolescents' SRHL in conflict-affected settings.

RECOMMENDATIONS

Based on the findings of this study, Policymakers and education authorities should strengthen comprehensive and culturally appropriate SRH education in schools, particularly in conflict-affected areas, while encouraging parent-adolescent communication and peer-supported learning. Given that SRH communication and informal information sources were associated with better SRHL, interventions should focus on training parents and peer educators to provide accurate SRH information, and strengthening school-based SRH programs may further improve adolescents' SRHL. Healthcare providers should expand youth-friendly, confidential, and non-judgmental SRH services, including mobile and community-based approaches, to reduce access barriers. Future research should include out-of-school adolescents, examine causal relationships using longitudinal designs, and evaluate the effectiveness of interventions to improve SRHL in conflict-affected settings.

ETHICAL DECLARATION

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB) (COA No. MU-CIRB 2026/297.2206) and permission from relevant education authorities and school administrators in Karenni State. Written informed guardian consent and written student assent were obtained prior to participation. Participation was voluntary, confidentiality was maintained throughout the study, no personal identifiers were collected, and participants could withdraw from the study at any time without penalty. Data was stored securely on password-protected computers; paper forms were kept in locked cabinets.

STRENGTHS AND LIMITATIONS

This study contributes important evidence on SRHL among adolescents in a conflict-affected setting in Myanmar, addressing a significant research gap. The use of a culturally adapted and validated instrument strengthens the measurement of SRHL. In addition, the multi-stage stratified sampling design enhanced population diversity across school types, grade levels, and residency statuses.

This study also has several limitations. First, as this was a school-based study, adolescents who were not attending school were

not included and may have experienced different or greater barriers to SRH information and services. Second, the cross-sectional design does not allow causal relationships to be established between the identified factors and SRH literacy. Third, self-reported data may be affected by social desirability and recall bias. Fourth, these preliminary findings are based on 352 participants and may change slightly with the final sample. Finally, findings from Karenni State may not be generalizable to other conflict-affected settings with different cultural, social, or political contexts.

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FROM DISCOMFORT TO DIAGNOSIS: EXAMINING BHUTANESE WOMEN'S PERCEPTIONS AND CHALLENGES IN SEEKING URINARY TRACT INFECTION TREATMENT

Sherab Zhiden Yezer[1]*

[1]Population and Sexual and Reproductive Health, Institute for Population and Social Research (IPSR), Mahidol University, Thailand, 73170

***Corresponding Author**: Sherab Zhiden Yezer, Institute for Population and Social Research (IPSR), Mahidol University, Nakhon Pathom, Thailand, E-mail: zhidenyezer@gmail.com*

ABSTRACT

Introduction: Urinary tract infections (UTIs) are a common health concern among women, yet women's perceptions, beliefs, and everyday experiences can influence how symptoms are understood and when treatment is sought. In Bhutan, limited understanding and social and cultural factors may further shape women's responses to UTI symptoms.

Objectives: This study examined how Bhutanese women perceive, interpret, and respond to UTI symptoms and explored the social, emotional, and practical factors influencing their decisions to seek care, using the Health Belief Model (HBM) as a guiding framework.

Methodology: A qualitative approach was used, involving in-depth interviews with 15 Bhutanese women aged 19–60 years. Participants shared their experiences of UTI symptoms, previous diagnoses, and health-seeking decisions. The interview data were analyzed thematically, with the HBM guiding the interpretation of participants' beliefs and health-related decisions.

Results: The findings showed that many women endured burning sensations, discomfort, or frequent urination before considering professional care. Some perceived these symptoms as an expected part of ageing, while others found urinary health too private or embarrassing to discuss, particularly with male health workers. Limited understanding of UTI causes, and practices such as low water intake and prolonged urine holding also influenced symptom interpretation. Many participants initially relied on familiar home remedies and sought medical care only when symptoms persisted or became severe.

Conclusion: Bhutanese women's responses to UTI symptoms were influenced by their knowledge, cultural and social beliefs, privacy concerns, and perceptions of symptom severity. Improving UTI awareness, reducing stigma and embarrassment, and strengthening culturally and gender-sensitive health communication may encourage earlier treatment-seeking.

Keywords:

Urinary Tract Infection (UTI); Women's Health; Health-Seeking Behaviour; Health Belief Model; Stigma and Embarrassment; Bhutan

INTRODUCTION

Urinary tract infections (UTIs) are among the most common bacterial infections affecting women worldwide. Beyond the physical discomfort, recurrent UTIs can disrupt women's daily routines, productivity, and overall well-being, making them a significant but often underestimated public health concern (1). Although UTIs are treatable, women's experiences with them frequently involve a complex interaction between biological, behavioral, and social factors. Research shows that many women struggle to identify early symptoms correctly, interpret them as harmless or routine, or attempt to self-manage the condition before seeking professional care (2). Emotional responses such as embarrassment, anxiety, and uncertainty, as well as structural issues like limited access to female-friendly health services, further shape how women respond to UTIs (3). These patterns highlight that understanding UTIs requires more than clinical knowledge; it also requires attention to women's perceptions, beliefs, and everyday decision-making processes.

Women's experiences with UTIs are shaped by cultural and social environments that influence how symptoms are interpreted and discussed. Urinary symptoms may be considered private or sensitive, leading women to rely on family, friends, or online sources rather than seek professional care. These influences can affect treatment-seeking and symptom management, creating gaps between recommended care and actual health-seeking behavior (4). Using the Health Belief Model as a guiding framework, this study examines these behavioral and contextual factors to inform culturally responsive health interventions and education.

Significance of the Study

This study provides a detailed, qualitative understanding of how Bhutanese women perceive and respond to urinary tract infections (UTIs), a topic that has received little attention in national research and policy discussions. By documenting women's lived experiences, the study generates evidence that goes beyond clinical statistics and reveals the social, cultural, and personal factors that shape their health decisions.

Objectives

The study aimed to explore Bhutanese women's knowledge, beliefs, and lived experiences related to urinary tract infections (UTIs); identify cultural, social, and structural factors influencing their decisions to seek treatment; and apply the Health Belief Model to analyze how perceptions of risk, severity, and barriers shape health-seeking behavior.

Global and Regional Context

Across diverse settings, including the United States, South Asia, and Sub-Saharan Africa, patterns of care commonly involve self-treatment, use of over-the-counter medications, or reliance on pharmacies without diagnostic testing. Such practices contribute to rising antimicrobial resistance, a growing public health threat in both high- and low-income countries. In several regions, especially those with limited laboratory capacity, the routine use of antibiotics remains common, leading to recurrent infections and reduced treatment effectiveness (5).

Globally, these trends illustrate that UTIs are not only a clinical concern but also a persistent public health issue. Poor diagnostic capacity, limited awareness, and inconsistent treatment practices contribute to prolonged illness and rising antibiotic resistance. Understanding these global patterns provides an essential foundation for examining how UTI-related challenges unfold in specific contexts such as Bhutan.

Bhutanese Context

Bhutan has made notable progress in expanding primary healthcare, particularly through the establishment of Basic Health Units (BHUs) that provide free essential services across both urban and remote regions. These efforts have contributed to improvements in maternal and child health, reflecting the country's commitment to equitable healthcare under the principles of Gross National Happiness (GNH) (6). Despite these achievements, national health priorities continue to focus largely on maternal care, communicable diseases, and nutrition, leaving other aspects of women's health, including urinary tract infections (UTIs), insufficiently addressed. Currently, there are no national surveys or routine surveillance systems that capture the prevalence, recurrence, or community-level burden of UTIs among Bhutanese women. This lack of systematic data makes it difficult to assess the scale of the problem or to design targeted prevention and education initiatives. Previous qualitative studies suggest that women's UTI-related health-seeking behavior is influenced not only by symptom severity but also by knowledge, previous experiences, social support, stigma, and perceived barriers to healthcare. However, existing studies have largely focused on healthcare access and recurrent UTIs in Western settings, with limited attention to how cultural expectations and gender norms shape women's interpretation of urinary symptoms. Evidence from Bhutan remains particularly limited. This gap highlights the need to examine how Bhutanese

women understand UTI symptoms and how their beliefs and social contexts influence decisions to seek care.

The Health Belief Model

The Health Belief Model: An Overview. The Health Belief Model (HBM) was developed in the 1950s by social psychologists in the U.S. Public Health Service to explain why people do or do not take actions to prevent illness. It remains one of the most widely used theoretical models in health behavior research.

The HBM assumes that individuals are more likely to engage in health-promoting behavior if they believe they are susceptible to a condition (perceived susceptibility), believe the condition has serious consequences (perceived severity), believe that taking action would reduce their susceptibility or severity (perceived benefits), believe that the benefits of taking action outweigh the barriers (perceived barriers), are exposed to triggers or motivators that encourage action (cues to action), and feel confident in their ability to act (self-efficacy).

The HBM is particularly useful for analyzing preventive health behavior in contexts where formal healthcare is available but underutilized, as is often the case with UTI management (7). In this study, the Health Belief Model (HBM) was used as a guiding theoretical framework rather than as a rigid coding structure. The six established HBM constructs, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, were used to interpret participants' beliefs and health-related decisions.

METHODOLOGY

Research Design

This study employed a qualitative research design to explore women's lived experiences with UTI symptoms. A qualitative approach allows for in-depth understanding of beliefs, emotions, and social influences that shape health behavior.

Participants and Sampling

A total of 15 Bhutanese women aged between 19 and 60 years participated in the study. Participants were selected using purposive and snowball sampling to ensure diversity in age, education, and background. After 15 interviews, the responses became repetitive, and no new ideas or perspectives were emerging. This point is known as data saturation. Since additional interviews were unlikely to add new insights, data collection was stopped at 15. To protect participants' confidentiality, pseudonyms were used throughout the manuscript and in all participant quotations.

Inclusion Criteria: Participants were eligible for the study if they were Bhutanese women aged 18 years or older, had experienced one or more symptoms of UTIs within the past year, and were able and willing to provide informed consent and participate in an interview.

Exclusion Criteria: Pregnant women and women with chronic urinary or kidney conditions unrelated to UTIs were excluded from the study.

Table 1 Socio-demographic characteristics of participants (n = 15)

Sociodemographic Characteristics	(n=15)
Age	
19–24	7
25–29	2
30–34	1
35–39	2
45–49	1
50–54	1
55–60	1

Sociodemographic Characteristics	(n=15)
Gender	
Female	15
Residence in Bhutan	
Thimphu	6
Tashigang	3
Tsirang	2
Punakha	1
Wangduephodrang	1
Samtse	1
Paro	1
Occupation	
Housewife	3
Unemployed	3
Student	2
Civil Servant	2
Teacher	2
Hotel Manager	1
Shop Keeper	1
Care Taker	1
Highest Level of Education	
Uneducated	1
Primary School	1
Middle School	2
High school	2
Bachelors Degree	7
Post Diploma	2
Monthly Income	
No Income	9
Less than 10,000 THB	3
10,000 to 20,000 THB	3

Data Collection

Data were collected through semi-structured, in-depth interviews. The interviews explored participants' understanding of symptoms, perceived causes, and experiences with treatment-seeking. Interviews were conducted in Dzongkha, English, or Sharchop, depending on participant preference, and lasted between eight and forty-five minutes.

Data Analysis

Thematic analysis followed Braun and Clarke's six-phase approach. The researcher familiarized herself with the interview data, manually coded meaningful segments, and grouped similar codes into themes. The HBM guided interpretation of perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy, while allowing data-driven themes to emerge. All interviews followed the same semi-structured guide. Although interview duration varied, shorter interviews were retained when sufficient relevant information was provided. Data saturation was reached after 15 interviews, with no substantially new themes emerging, indicating that the sample was sufficient to address the study objectives.

RESULTS

Perceived Susceptibility

Women's awareness and knowledge of urinary tract infections were not uniform or standardized. Rather than learning about the condition through formal health education or biomedical explanations, most women described developing their understanding through personal bodily experiences, informal conversations, and shared knowledge within families and communities.

"I didn't know the details, but I just heard of the disease called UTI. I didn't know its symptoms or anything of the sort, just the disease." Sonam, 54 years old.

As a result, awareness often emerged only after symptoms appeared rather than before illness occurred. This has implications for perceived susceptibility within the Health Belief Model, as women may not recognize themselves as being at risk until the condition becomes physically distressing.

Perceived Causes

Rather than identifying a single cause, participants often described urinary symptoms as the result of several everyday factors occurring together over time. Women explained these causes through personal observation, advice from family members, and commonly shared beliefs within the community. These explanations did not always align with biomedical explanations of urinary tract infections, but they shaped how women interpreted their symptoms and their sense of vulnerability to illness. Within the Health Belief Model, these beliefs influence perceived susceptibility, as women evaluate their risk based on behaviors and conditions they believe can lead to infection.

"I heard something like if someone unclean sat on a chair, and if you sat at the same chair, your condition would be the same as that person." Tshomo, 48 years old.

Local explanations do not necessarily represent ignorance of biomedical information. Instead, they function as practical frameworks through which women make sense of bodily experiences using culturally familiar concepts. For example, beliefs about cold surfaces entering the body or hygiene practices reflect broader cultural understandings of bodily balance, vulnerability, and environmental exposure.

Perceived Severity of Urinary Symptoms

Participants described urinary symptoms as experiences that ranged from mild discomfort to intense physical pain and emotional distress. Instead of measuring severity through medical terms, women explained how serious the symptoms felt based on how much they disrupted daily life, caused physical suffering, or created fear about their health. Within the Health Belief Model, perceived severity refers to how serious individuals believe an illness and its consequences can be. In this study, women evaluated severity through bodily pain, emotional stress, and the impact symptoms had on their everyday responsibilities.

"Pain was unbearable, and I couldn't control my pee, and it was just overall a bad experience. It affected everything. I couldn't focus on my studies, and even simple daily activities became difficult because the pain was constant." Nima, 24 years old.

Perceived Barriers to Seeking Care

Participants described multiple barriers that influenced whether and when they sought care for urinary symptoms. These barriers were both personal and social, deeply shaped by cultural norms, gendered expectations, and structural factors in healthcare. Within the Health Belief Model framework, perceived barriers include the obstacles that prevent women from taking action, whether practical, emotional, or social. In this study, these barriers were interconnected: embarrassment, stigma, lack of knowledge, discomfort with male providers, and prior negative experiences all combined to delay care-seeking. The following sections describe the key barriers and analyze their broader implications.

"It has more to do with the fact that they have to talk about their symptoms, which will lead

them to talk about their genitals. So it has more to do with talking about their private parts, regardless of what caused the symptom. Even going to the hospital and asking where the gyno departmen itself is can be awkward for some women." Choden, 25 years old.

These experiences created a sense of hesitation toward future healthcare visits. Fear of judgment within healthcare settings also interacts with broader cultural norms surrounding modesty and privacy. Because urinary symptoms involve sensitive body parts, women may already feel vulnerable when discussing them. Negative reactions from healthcare providers, therefore, intensify existing feelings of embarrassment and stigma.

Perceived Benefits and Cues to Action

Participants described several perceived benefits that eventually motivated them to seek medical care for their urinary symptoms. In many cases, these benefits were not recognized immediately. Instead, women initially attempted to manage symptoms through home remedies or by waiting for the discomfort to subside. Care-seeking was often triggered only after symptoms intensified, advice was received from trusted individuals, or participants became aware of the potential consequences of untreated infections. Increased knowledge strengthens perceived benefits and reduces perceived barriers, ultimately encouraging more proactive health behaviors.

"It was becoming unbearable, so I had to go to the hospital." Yoezer, 26 years old.

"Pain was really unbearable; hence it pushed me to seek care." Sangay, 21 years old.

Health-Seeking Behavior

Participants' accounts reveal that care-seeking rarely occurred as an immediate or single decision. Instead, women often followed a stepwise care-seeking pathway, moving through several stages before consulting biomedical healthcare providers. This pathway typically began with symptom monitoring and self-management strategies, including home remedies or over-the-counter medications. When these strategies failed to relieve symptoms, women reassessed the seriousness of their condition and gradually considered professional medical care. Many women adopted preventive strategies only after experiencing a UTI, suggesting that direct experience increased perceived susceptibility and severity and motivated protective behaviors.

"The PCM was no longer helping me with the fever and urine control. I got scared and went to the hospital." Tshomo, 48 years old.

DISCUSSION

This study explored how Bhutanese women perceived and responded to UTI symptoms using the Health Belief Model (HBM) as a guiding framework. The findings suggest that health-seeking behavior was shaped by an interaction between knowledge, perceived severity, social and cultural barriers, perceived benefits, cues to action, and self-efficacy. Although healthcare services were generally available, women often delayed professional care because of embarrassment, privacy concerns, limited knowledge, and reliance on self-management. These findings suggest that healthcare access alone may not be sufficient to promote timely UTI treatment.

Perceived Susceptibility

Awareness and knowledge influenced how participants recognized and interpreted UTI symptoms. Women with greater prior exposure to information or personal experience appeared more able to identify symptoms as abnormal and consider professional care. This supports previous research suggesting that limited understanding of UTI symptoms can contribute to self-management and delayed treatment. (2,3) Although awareness and knowledge are not independent HBM constructs, they provide an important context for understanding perceived susceptibility and severity. Women who had greater knowledge appeared better able to recognize their vulnerability and assess when symptoms required attention.

Perceived Causes

Participants' beliefs about the causes of UTIs influenced how they understood their personal risk. Some attributed symptoms to behaviors such as inadequate water intake or prolonged urine holding, while others relied on explanations from family or previous experiences. These beliefs are relevant to the HBM construct of perceived susceptibility because perceptions of personal risk may influence whether symptoms are taken seriously. When women did not perceive themselves as particularly vulnerable, symptoms could be normalized or managed at home rather than prompting immediate care.

Perceived Severity

Perceived severity was strongly influenced by physical pain and the disruption of everyday activities. Participants often recognized the seriousness of their symptoms when pain became difficult to tolerate or interfered with normal responsibilities. This finding is consistent with the HBM, in which perceived severity influences the likelihood of taking health-related action. However, the findings also suggest that severity alone did not always lead to early care-seeking. Women could experience symptoms for some time before seeking treatment, indicating that perceived severity may become influential only after symptoms become sufficiently disruptive.

Perceived Barriers

Perceived barriers were among the strongest influences on care-seeking. Participants described embarrassment, concerns about privacy, discomfort discussing intimate symptoms, and negative experiences with healthcare providers. Consistent with the HBM, these barriers extended beyond physical access to include emotional, social, and practical obstacles to care-seeking. Even when healthcare was available, concerns about privacy and judgment could discourage women from seeking care. This highlights the importance of culturally and gender-sensitive healthcare environments in addition to physical service availability.

Perceived Benefits and Cues to Action

Perceived benefits and cues to action influenced when women moved from self-management to professional care. Participants often initially relied on home remedies or waited for symptoms to improve, but worsening pain, advice from trusted individuals, or concern about untreated infection encouraged them to seek care. Within the HBM, these experiences represent cues to action that prompt movement from intention to behavior. The findings therefore suggest that care-seeking was often reactive rather than preventive, with severe symptoms serving as a stronger trigger than prior awareness.

Self-Efficacy

Self-efficacy refers to women's confidence in recognizing urinary symptoms, deciding on an appropriate response, and seeking care. In this study, self-efficacy developed through personal experience, information, and social support rather than functioning as a fixed trait.

Women with greater knowledge or previous UTI experience appeared more confident in interpreting symptoms and deciding when to seek professional care. Recognizing that symptoms were worsening or that home remedies were ineffective helped participants feel more in control of their healthcare decisions. These findings suggest that successful experiences and increased understanding may strengthen women's confidence in recognizing symptoms and navigating healthcare decisions.

CONCLUSION

This study shows that Bhutanese women's responses to UTI symptoms are shaped by cultural beliefs, gender norms, and everyday experiences. Embarrassment, privacy concerns, and discomfort discussing intimate symptoms created important barriers to care, even where healthcare services were available. Many women

delayed seeking treatment until symptoms became severe, suggesting that physical discomfort was a stronger trigger for care than preventive awareness. Differences in age and education also influenced health-seeking patterns, with younger women more likely to use digital and formal health information, while older and rural women relied more on family and community knowledge. Improving awareness, reducing stigma, and strengthening health communication may support earlier care-seeking.

ETHICAL DECLARATION

This study followed strict ethical guidelines due to the sensitive nature of women's reproductive and urinary health. All participants were informed about the purpose of the study, their rights, and the voluntary nature of participation, with consent obtained verbally or in writing in a language they understood. To protect confidentiality, personal identifiers were removed, and all audio files and transcripts were stored securely and accessible only to the researcher. Findings were reported anonymously and respectfully, and the study received ethical approval from the Mahidol University, IPSR Institutional Review Board (COA No. 2025/06-035, approved on 26 June 2025). Participants were reminded that they could decline to answer any question or stop the interview at any time. Interviews were conducted respectfully, with attention to participants' privacy and comfort when discussing sensitive urinary and reproductive health experiences.

LIMITATIONS

As with qualitative research, this study is subject to interpretive subjectivity, as the researcher was responsible for data collection and analysis. Reflexivity, systematic coding, and verbatim quotations were used to enhance credibility and transparency. The findings are also limited in transferability because participants were recruited through online platforms and may not represent all Bhutanese women, particularly those in remote or marginalized communities. However, the study provides contextual insights that may be relevant to similar settings.

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NEGOTIATING MASCULINITY BEYOND THE BODY: RESPONSIBILITY, RECOGNITION, AND SOCIAL NAVIGATION AMONG SELF-IDENTIFIED TRANSGENDER MEN FROM MYANMAR

Khaing Thinzar Kyaw[1], Dusita Phuengsamran[1*], Pattaphol Yuktadatta[1]
[1]Institute for Population and Social Research (IPSR), Mahidol University, Nakhon Pathom, 73170, Thailand
****Corresponding Author:** Dusita Phuengsamran, Institute for Population and Social Research (IPSR), Mahidol University, Nakhon Pathom, 73170, Thailand, Email: dusita.phu@mahidol.ac.th*

ABSTRACT

Introduction: While transgender women in Myanmar have received increasing attention in research and public discourse, comparatively little is known about the experiences of transgender men. Masculinity is often understood as a socially constructed and culturally regulated set of practices and expectations. For transgender men, navigating masculinity often involves balancing personal identity, gender expression, social recognition, and prevailing gender norms. Understanding these experiences is important for advancing knowledge on gender diversity and informing inclusive policies and institutional responses.

Objectives: To explore how self-identified transgender men from Myanmar understand, experience, and express masculinity, and how they negotiate gender norms and social expectations in their everyday lives.

Methodology: A qualitative study design was employed using semi-structured, in-depth online interviews with eight self-identified transgender men aged 18 years and above from Myanmar. Participants were recruited through purposive and snowball sampling via transgender community organizations and peer networks. The sample size was determined by the principles of information power. Interviews explored understandings of masculinity, gender identity development, gender expression, social recognition, interpersonal relationships, and experiences of acceptance and discrimination. All interviews were audio-recorded, transcribed verbatim, and analyzed manually using Braun and Clarke's thematic analysis. To enhance credibility and trustworthiness, the team repeatedly reviewed transcripts, discussed coding decisions and emerging themes, and refined themes through an iterative analytical process.

Results: Five interconnected themes emerged. First, participants defined masculinity primarily through responsibility, accountability, leadership, and dependability rather than through patriarchal privilege or rigid gender stereotypes. Second, masculinity was embodied through clothing, hairstyles, speech, and, for some participants, medical transition, which helped align physical appearance with gender identity and reduced gender incongruence. Third, social recognition as men was important to participants' well-being, although many described challenges in gaining recognition in everyday interactions. Fourth, participants strategically negotiated gender expression across family, educational, religious, workplace, and public settings to manage social expectations, safety concerns, and institutional constraints. Finally, participants described a life-course trajectory from concealment and compromise during childhood and adolescence toward greater authenticity, self-determination, and more open expression of their identities in adulthood.

Conclusion: Masculinity among transgender men in Myanmar is a negotiated and evolving process rather than a fixed identity. Participants balanced authenticity, social recognition, and contextual constraints while constructing meaningful expressions of masculinity in everyday life. The findings underscore the importance of supportive educational, workplace, healthcare, and community environments, gender-affirming policies, and greater social recognition of transgender masculinities in Myanmar and comparable socio-cultural contexts.

Keywords:
Transgender Men; Masculinity; Gender Negotiation; Myanmar

INTRODUCTION

Research on transgender health and well-being has expanded considerably over the past two decades. However, transgender men remain among the least studied gender-diverse populations, particularly outside Western countries (1, 2). While transgender women's experiences have received scholarly attention, transgender men's lives remain underrepresented in public discourse and academic research, especially in Southeast Asia. Consequently, current knowledge of transgender men's gender identities and masculinities has largely been generated in Western settings, limiting understanding of how these experiences are shaped across diverse cultural, social, and institutional contexts (3).

Myanmar remains an underexplored context, and gender is widely understood within a binary framework reinforced by patriarchal traditions, heteronormative expectations, and religious beliefs (4). These social norms shape expectations about gender roles and acceptable behavior, while transgender people continue to face stigma, discrimination, and limited legal recognition (5-8). Existing research in Myanmar has focused primarily on transgender women (locally known as *'apwint'*), particularly regarding HIV vulnerability, social stigma, and discrimination (4, 9). In contrast, transgender men's experiences remain largely absent from the literature, and knowledge of how they understand, experience, and express their masculinity, and negotiate gender expectations in their daily lives, remains limited.

Gender identity refers to an individual's internal sense of self, whereas masculinity reflects the socially produced ways in which manhood is expressed, recognized, and negotiated (10). Contemporary scholarship increasingly conceptualizes masculinity as a socially and culturally constructed practice rather than a biological characteristic (11, 12). From this perspective, masculinity is produced through everyday interactions and social relationships, rather than being fixed. Global research on transgender men has documented that defining and expressing masculinity is an ongoing process of internal and interpersonal negotiation, including embodiment and social recognition (13-15).

Research from different cultural contexts further demonstrates that masculinity is actively negotiated rather than passively adopted. A comparative study conducted in Poland and the United States found that transgender men balanced dominant masculine ideals while rejecting toxic forms of masculinity (16). Similarly, Aboim and Vasconcelos (17) argued that masculinity is continuously constructed through bodily actions and transformations, rather than being solely a fixed biological or purely social discourse. Collectively, these studies emphasize that masculinity is influenced by individual agency and continuous negotiation.

Negotiation strategies among transgender men vary across social and cultural settings. Unlike the rejection of heteronormative norms observed in Western studies, Saeidzadeh's study of transgender men in Iran found that participants often adopted heteronormative masculine roles to gain social legitimacy and acceptance (18). Likewise, Abelson's study (19) examined how transgender men adjusted masculine behaviors according to perceived safety, adopting 'defensive' behaviors when unsafe around cisgender men and 'transformative' behaviors in safer contexts to challenge gender norms. Extending this, Jeanes and colleagues (20) found that transgender men in workplace settings adopt a 'flexitarian' approach, strategically adapting their gender presentation to ensure safety and facilitate career progression. These studies illustrate that cisnormative gender norms exert powerful pressures on transgender men to conform, often compelling strategic adaptations for safety and acceptance.

Despite growing international scholarship, Southeast Asia remains markedly underrepresented in academic research, particularly research on transgender men in

Myanmar. This study addresses that gap by examining how self-identified transgender men in Myanmar understand, experience, and negotiate masculinity in their everyday social lives. By centering the perspectives of an underrepresented population, the study contributes empirical evidence to broader discussions of transgender masculinities. It offers insights that may inform more inclusive policies, gender-affirming services, and supportive social environments in Myanmar.

METHODOLOGY

A qualitative phenomenological study design was employed to explore how transgender men in Myanmar understand, experience, and express masculinity, and how they navigate gender norms and social expectations in their daily lives. Given the limited research on transgender men in Myanmar and the exploratory nature of the research objective, a qualitative approach was used to capture the depth of participants' subjective experiences.

Eight self-identified transgender men aged 18 years and older participated in the study. Participants were recruited through purposive sampling via transgender community networks, followed by snowball sampling to reach additional individuals. To be included, participants had to self-identify as transgender men, be at least 18 years of age, reside in Myanmar or outside the country during the study period, be able to communicate in Burmese, and be willing to participate in an online interview. Individuals who did not meet these criteria were excluded. Consistent with the principles of information power (21), eight participants were considered sufficient to provide rich, in-depth information.

Data were collected through semi-structured, in-depth online interviews conducted in Burmese between 6 May and 30 May 2026. Each interview lasted approximately 60–90 minutes and explored participants' perceptions of masculinity and how masculinity was expressed and negotiated within family and social contexts. All interviews were audio-recorded with participants' consent and transcribed verbatim. Data were organized in Microsoft Excel and analyzed manually using Braun and Clarke's Thematic Analysis (TA), following the six-phase approach (22). The researcher conducted all interviews and data analysis.

Although the researcher is originally from Myanmar and familiar with the cultural and social contexts, the researcher had no personal relationship with any participants. To support reflexivity and analytical rigor, the researcher maintained reflexive memos throughout the analysis and discussed emerging interpretations with academic advisors.

RESULTS

Socio-demographic characteristics of the participants

Eight self-identified transgender men from Myanmar participated in the study. Participants ranged in age from 23 to 37 years and represented diverse ethnic, religious, and socioeconomic backgrounds. They lived in both urban and rural settings and varied in education, occupation, living arrangements, and stages of gender transition, including social transition, hormone therapy, and medical transition. These varied experiences provided insight into how participants constructed, experienced, and negotiated masculinity across different social contexts.

Table 1. Participant characteristics (*n* = 8)

Characteristic	Category	*n*
Age (years)	23–27	4
	28–32	3
	33–37	1

Characteristic	Category	*n*
Education	Graduate	4
	University student	3
	High school	1
Ethnicity	Myanmar	3
	Kachin	2
	Shan + Myanmar	1
	Kachin + Myanmar	1
	Naga + Kachin	1
Religion	Buddhist	5
	Christian	3
Partnership status	No partner	4
	Having a partner	4
Occupation	Self-employed	5
	Private sector	3
Residence	Urban	5
	Rural	3
Living arrangement	With family	3
	Living alone	3
	With partner	2
Transition status	Social transition	2
	Gender affirming care (Chest reconstruction)	3
	Gender affirming care (Hormone therapy)	3

Overarching theme

Reflexive Thematic Analysis identified five interconnected themes that describe how participants understood and negotiated masculinity. Rather than viewing masculinity as a fixed identity, participants described it as an evolving process shaped by personal values, embodiment, social recognition, and adaptation to social norms. Together, these themes show how participants negotiated masculinity between their internal sense of identity and external social expectations.

Theme 1: Masculinity as responsibility rather than male privilege

Participants rarely defined masculinity as male privilege, authority, or dominance. Instead, they described it as responsibility, dependability, accountability, leadership, and care for others. A 28-year-old participant (P1) explained,

"I don't demand the privileges of a man. I do what needs to be done."

A 24-year-old participant (P7), who became the head of his family after his father's death, shared,

"My family counts on me; that makes me a man."

Similarly, another participant described,

"I define masculinity by my father's example, leading, taking responsibility, being accountable, more than just appearance." (P2, 28 years)

Participants consistently described masculinity as fulfilling responsibilities rather than exercising power. Their narratives suggested that caring for family members and meeting social obligations were central to their understanding of manhood.

Theme 2: Embodying masculinity through physical transition and gender expression

Although participants emphasized that masculinity extended beyond physical appearance, they regarded masculine presentation as an important way to express their gender identity. They described adopting masculine clothing, hairstyles, behaviors, chest binding, hormone therapy, and other gender-affirming practices to align their appearance with their identity.

One participant said,

"I tried to express who I am in every way. The way I dress, speak...behaviors, everything" (P1, 28 years).

Another participant described the effects of hormone therapy,

"Wearing 'paso' (sarong) boosts my confidence, and I feel more manly now due to my voice change and thicker body hair." (P8, 23 years)

Participants reported that these changes increased their confidence, reduced gender incongruence, and enabled them to express their identities more authentically.

Theme 3: Seeking social recognition and legitimacy as men

Participants described social recognition as essential to masculinity. Although they recognized themselves as men, being acknowledged by others validated their identities, whereas persistent misgendering undermined their sense of self. Participant 3 (37 years) recalled,

"They continuously called me 'thamee' (daughter); when I returned, I started using 'kyun-taw' (masculine form) and no longer referred to myself as 'thamee'."

Similarly, participant 4 (27 years) said he had to remind his parent to call him 'son' and use his preferred name. He wanted a manly look with facial and body hair to avoid criticism.

"I wanted a fully manly look with facial and body hair."

Participant 7 (24 years) said,

"After hormones, my voice and appearance changed... I participated in church activities; people stopped judging and respected me."

The findings reveal a tension between internal identity and external recognition. Participants employed various strategies to gain recognition, including using masculine forms of self-reference, taking on leadership roles, engaging in social activities, and pursuing medical transition.

Theme 4: Strategic negotiation of gender expression across social contexts

Participants modified their gender expressions according to social contexts and safety considerations. Participant 1 clarified that he must conceal his gender identity due to religious beliefs that regarded transgender identity as sinful and shameful.

"I have to keep it to myself because they treated it like something shameful."

He also described his strategy for using public washrooms.

"I have to ask my female friend to accompany me or wait until I go home." (P1, 28 years)

Another participant explained that he kept his hair relatively long and carried his ID in case he needed to use it as a safety tool during political instability.

"I purposely keep my hair at some length and carry my ID as a shield to talk my way out." (P2, 28 years).

The workplace also posed significant challenges for transgender men seeking to live authentically. Participant 7 stated,

"I applied for many jobs, but they said my appearance didn't match requirements, so I alternated between female and male appearances for years." (P7, 24 years)

Participants described concealment, selective disclosure, and flexible gender presentation as practical strategies for navigating restrictive social environments while protecting their well-being.

Theme 5: From compromise to authenticity

Participants' stories showed a gradual shift from concealment during childhood and adolescence towards greater authenticity in adulthood. One participant reflected that achieving financial independence greatly improved his ability to live authentically. With his own income, he bought masculine clothing, had top surgery, and resisted family pressures.

"I realized once I was financially independent, I could be who I truly am." (P2, 27 years)

Another participant described years of suppressing his identity before transitioning.

"For 25 years, I lived the way they wanted me to. I was a teacher, so I had to keep my hair long and wore sarongs and traditional women's clothes. Deep down, I wanted to change. But once I arrived in Bangkok, I cut my hair, started wearing binders, took hormones, and underwent top surgery. I finally started living my true self." (P4, 27years)

Participants described financial independence, relocation, and access to gender-affirming healthcare as factors that enabled greater freedom to express their identities more openly.

Taken together, the findings show that masculinity was a dynamic and continuously negotiated process. Participants understood and expressed masculinity through responsibility, embodiment, social recognition, contextual adaptation, and changing circumstances across the life course.

DISCUSSION

This study explored how self-identified transgender men in Myanmar understand, experience, and negotiate masculinity in a context marked by rigid gender norms and limited recognition of gender diversity. Across narratives, masculinity emerged as a dynamic, evolving process shaped by responsibility, embodiment, social recognition, and strategic adaptation. These findings align with the view that masculinity is socially constructed and continually negotiated through everyday interactions rather than determined by biology alone (11, 12).

A prominent finding was that participants defined masculinity primarily through responsibilities, accountability, and commitment to others, rather than dominance, authority, or male privilege. This differs from traditional interpretations of Connell's hegemonic masculinity concept, which emphasize dominance and authority as central characteristics (11). Instead, participants understood masculinity through ethical responsibility and interpersonal commitment. Similar findings have been reported among transgender men in Western contexts, where masculinity is increasingly understood through relational values rather than patriarchal ideals (13-15). This study extends the literature by showing how Myanmar's family-oriented social and cultural context shapes these values.

This finding also highlights the importance of embodiment in affirming masculine identity. In line with previous research, participants described clothing, hairstyles, hormone therapy, and surgery as ways of aligning their external appearance with their gender identity. Meanwhile, bodily changes alone were not considered sufficient to define masculinity. Instead, embodiment enhanced confidence, reduced gender incongruence, and supported authentic self-expression. This finding aligns with Butler's concept of gender performativity, which proposes that gender is produced through repeated bodily practices, appearance, and everyday interaction (12), and with previous studies demonstrating that transgender men's masculinities are constructed through both embodiment and social practices (15, 16, 23).

The findings also highlight a critical aspect of social recognition. Participants described being recognized as men through correct pronouns and everyday interactions as important to affirming their identity, while persistent misgendering undermined their well-being. This finding suggests that participants' internal recognition of themselves as men was accompanied by a desire for recognition from others. These findings reinforce Butler's argument that gender is sustained through social recognition as well as personal identity (12). This aligns with other studies arguing that misgendering results in psychological distress (24-26).

Participants also discussed strategic adaptations in their gender expression across different settings to balance authenticity with safety. Strategies such as selective disclosure, modified appearance, or temporarily

conforming to gender expectations enabled them to navigate family, workplace, religious, and public environments. These findings align with previous studies showing that transgender men negotiate gender expression according to perceived safety and social contexts (18-20). The present study further illustrates how participants' strategies were shaped by social norms, institutional regulations, and political instability in their everyday environments.

Finally, the findings highlight masculinity as a life-course process. Participants described periods of concealment and compromise during childhood and adolescence shaped by family expectations, educational rules, and economic dependence. In adulthood, greater financial independence, relocation to supportive environments, and access to gender-affirming care fostered opportunities for more authentic gender expression. These findings suggest that participants' ability to express masculinity was shaped not only by individual agency but also by changes in their social and material circumstances over time.

CONCLUSION

This study shows that masculinity among transgender men in Myanmar is a dynamic and continuously negotiated process shaped by responsibility, embodiment, social recognition, strategic adaptation, and changing life circumstances. Participants described masculinity not as a fixed identity but as something they understood and expressed through personal values, bodily expression, relationships, and responses to social expectations. Their experiences also showed that the ways they expressed masculinity changed across different social contexts and over the life course.

Overall, the findings demonstrate that masculinity extended beyond physical appearance. While embodiment and gender-affirming practices supported participants' confidence and self-expression, social recognition, family responsibilities, safety, and access to supportive environments also influenced how masculinity was experienced and expressed. The study therefore highlights the importance of understanding transgender masculinities within their specific social and cultural context rather than through physical transition or dominant masculine norms alone.

The findings contribute to the limited literature on transgender men in Myanmar by providing insight into how participants understood, expressed, and negotiated masculinity in everyday life. The findings also highlight the need for supportive educational, workplace, healthcare, and community environments that recognize transgender men's identities and reduce barriers to authentic gender expression.

RECOMMENDATIONS

Based on the findings of this study, several recommendations are proposed. Educational institutions and workplaces should develop clear guidelines on respectful use of preferred names, gender expression, and communication, as well as appropriate mechanisms for addressing discrimination. Healthcare institutions should strengthen confidential and non-discriminatory services and provide healthcare staff with basic training on transgender health and respectful communication. Community-based organizations and peer networks should strengthen confidential support and information-sharing for transgender men. Given the current context of Myanmar, these institutional and community-level measures may provide feasible pathways for improving support rather than relying solely on broader policy reform. Future research should include transgender men from different regions and social backgrounds to examine how their experiences and support needs vary across different contexts.

ETHICAL DECLARATION

Ethical approval was obtained from the Institutional Review Board (IRB) of the Institute for Population and Social Research (IPSR), Mahidol University (COA No. 2026/04-020).

This study followed established ethical standards of research involving human participants. All participants received clear, written, and verbal explanations of the study's objectives, procedures, and their rights. The researcher took additional precautions due to the sensitive nature of the topic, including using pseudonyms, removing identifiable information, and securing data with a password. The researcher obtained informed consent before each interview and strictly maintained privacy and confidentiality throughout the study.

LIMITATIONS

This study has several limitations that should be addressed. First, the small sample of eight participants enabled an in-depth exploration of lived experiences but may not reflect the full diversity of experiences among transgender men in Myanmar. Second, while purposive and snowball sampling are suitable approaches to reach out to hidden populations, recruitment through transgender networks may have favored participants who were more socially connected or open about their identities, introducing potential selection bias. Third, online interviews helped maintain participants' privacy and confidentiality but limited opportunities to observe non-verbal expression during the interviews. Finally, the findings are situated within Myanmar's distinct legal, social, cultural, and religious context and may have limited transferability to other settings.

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PARENTAL KNOWLEDGE ON ADOLESCENT SEXUAL AND REPRODUCTIVE HEALTH AND ITS ASSOCIATED FACTORS AMONG PARENTS OF ADOLESCENTS AGED 10-19 YEARS IN YANGON, MYANMAR

Haymar Aung[1], May Chan Oo[1*]

[1] *College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, 10400.*

[*] ***Corresponding Author:*** *May Chan Oo, College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand, Email: 6874029953@student.chula.ac.th, maychan.o@chula.ac.th*

ABSTRACT

Introduction: Parents, as primary caregivers, play a critical role in supporting adolescent sexual and reproductive health (SRH) by providing accurate guidance and promoting healthy SRH behaviors. However, parental knowledge may be limited, which can reduce effective communication and support. In Myanmar, context-specific evidence on parental SRH knowledge and its associated factors remains limited. Therefore, identifying these factors can inform interventions to strengthen parents' capacity to support adolescents' SRH needs.

Objective: This study aimed to determine the level of parental knowledge on adolescent SRH and identify associated factors among parents of adolescents aged 10-19 years in Yangon, Myanmar

Methodology: A cross-sectional study utilized convenience sampling to recruit 403 parents of adolescents aged 10–19 in Yangon via online platforms. Data were collected using a self-developed, expert-validated questionnaire. Descriptive statistics summarized participant profiles, and Chi-square tests and multivariable logistic regression were used to examine factors associated with parental knowledge while controlling for confounding. Statistical significance was set at $p<0.05$.

Results: Among 403 participating parents (median age: 41 years; 52.1% fathers), 55.3% demonstrated good adolescent SRH knowledge, and 62% reported open communication. In bivariate analyses, good SRH knowledge was associated with age, education, occupation, work schedule, residence, social media use, and school-based support ($p<0.05$). After adjustment, parents with a college degree or higher (aOR=2.52, p=0.005), longer work schedules (aOR=7.22, $p<0.001$), and urban residences (aOR=2.29, p=0.014) had higher odds of good knowledge, whereas manual workers had lower odds (aOR=0.38, p=0.045). Social media use (aOR=0.16, $p<0.001$) and material support (aOR=0.29, p=0.010) retained negative independent associations, whereas family and community influence lost significance.

Conclusion: Parental SRH knowledge in Yangon appears to be shaped by broader socioeconomic, residential, and information-access inequalities. Although convenience sampling limits broader generalizability, these context-specific findings can inform parent-focused SRH education and targeted communication strategies, particularly for parents with fewer educational, occupational, rural, or digital resources.

Keywords:

Parent; Adolescent; Sexual and Reproductive Health; Knowledge; Myanmar

INTRODUCTION

Adolescence is a critical period of physical, psychological, and social growth and development. Access to accurate sexual and reproductive health (SRH) information and services helps adolescents make informed decisions, prevent unintended pregnancy and sexually transmitted infections (STIs) (1, 2). In Myanmar, adolescent SRH remains a public health concern because adolescents constitute over 16% of the total population and continue to face gaps in SRH knowledge, information access, and service utilization (3, 4).

Schools are an important platform for promoting SRH because adolescents spend much of their time in educational settings. Life skills education and school-based health programs can support informed decision-making (5, 6). However, schools alone cannot address all adolescent SRH needs, making family support, especially parental guidance, essential.

Parents, as primary caregivers, influence adolescents' SRH knowledge and behaviors through communication and support (7). Adequate parental knowledge is therefore necessary for providing accurate information and guidance. However, studies in Asia have reported gaps in parental SRH knowledge and communication, often linked to taboos, embarrassment, discomfort, and conservative norms surrounding sexuality. These barriers restrict adolescents' access to correct SRH information and support within the family environment, which highlight the need to strengthen parental knowledge and capacity to guide adolescents on SRH matters, particularly in culturally sensitive contexts (8, 9).

Although parental barriers and knowledge deficits have been documented in neighboring countries, evidence on parental knowledge of adolescent SRH remains limited in Yangon, Myanmar. Previous research has mainly focused on adolescents, while limited attention has been given to parents. Understanding parental knowledge and its associated factors is essential for developing targeted educational interventions and strengthening parental involvement in adolescent SRH promotion. Therefore, this study aims to assess parental knowledge on adolescent SRH and its associated factors among parents of adolescents aged 10-19 years in Yangon, Myanmar.

METHODOLOGY

Study Design and Setting

A quantitative cross-sectional study was conducted in Yangon, Myanmar, in June 2026 using a structured self-administered online questionnaire. Duration of data collection lasted two weeks.

Sample size determination and sampling procedure

The sample size was calculated using Cochran's formula by assuming a 50% proportion of parent knowledge on adolescent SRH, a 95% confidence interval, a 5% margin of error, and a 5% non-response rate. The required sample size was 403 participants. Yangon was purposively selected due to its diverse socioeconomic, educational, and cultural diversity. Parents of adolescents aged 10–19 years were recruited using convenience sampling through online platforms.

Study Population and Inclusion and Exclusion Criteria

One parent, either the father or mother, from each household was invited. Parents who could read Burmese, had lived in Yangon for at least one year, and were living with their adolescent children during data collection were included. Parents who did not provide informed consent or did not meet eligibility criteria were excluded.

Measurement Tools

The structured, self-administered online questionnaire included four sections: sociodemographic characteristics, parent-adolescent communication, and parental SRH knowledge. Social and environmental factors covered social media use, school environment, and family and community engagement, using dichotomous (Yes/No) responses. Parent-adolescent communication was assessed using the 20-item parent form of the Parent-Adolescent Communication Scale (PACS) by Barnes and Olson (1982), using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree); total score ranging from 20–100. As no predefined cut-off was specified, the sample mean was used to categorize scores as open communication (≥ mean) or problematic communication (< mean).

SRH knowledge was assessed using a researcher-developed 10-item questionnaire covering (1) puberty-related changes, (2)

contraceptive methods, (3) unsafe abortion and unintended pregnancy, and (4) sexually transmitted infections. Each correct response received one point, giving a total score of 0–10. Based on Bloom's cut-off criteria, scores of 8–10 were categorized as good knowledge, 6–7 as moderate knowledge, and 0–5 as poor knowledge. The questionnaire was reviewed by three public health experts for content relevance and clarity, with an Item-Objective Congruence value of 0.89. A pretest was conducted among 40 participants for instrument reliability, and Cronbach's alpha values for the knowledge and PACS were 0.785 and 0.822.

Data Collection Process and Data Analysis

The self-administered online questionnaire took 15-20 minutes to complete. The survey link was shared through parenting Facebook groups, Viber, Telegram, and Line.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0.2.0. Descriptive statistics summarized participants' characteristics and study variables. The chi-square test assessed bivariate association between independent variables and parental SRH knowledge. Variables with a p-value <0.25 in the bivariate analysis were entered into multiple logistic regression to identify factors independently associated with parental knowledge while controlling for confounding. Adjusted odds ratios (AORs), 95% confidence intervals (CIs), and p-values were reported, with significance set at p-value <0.05.

RESULTS

A total of 403 parents participated in this study. As shown in Table 1, the median parental age was 41 years, 52.1% were fathers, and 47.9% had college/university and above, and non-manual workers represented the largest occupational group (40.4%). The median age of adolescents was 14 years, 53.1% were male, and 60.0% of participants resided in urban areas. About 69.5% of participants used social media, and among them, 69.6% searched for SRH information through social media. Half reported school-based SRH education (50.1%), and 59.1% reported school encouragement for parent-adolescent SRH discussions, 61.5% reported confidence in discussing SRH because of school support, and 46.4% reported community influence.

Table 1 Number and percent distribution of sociodemographic characteristics, social and environmental factors

Characteristics	Study participants (n = 403)	
	No.	%
Age of parents (Years)		
≤38	115	28.5
39-45	191	47.4
≥46	97	24.1
Median (Q1-Q3) 41(7)		
Age of adolescents (Years)		
10-14	216	53.6
15-19	187	46.4
Median (IQR) 14 (6)		
Sex of parents		
Father	210	52.1
Mother	193	47.9
Sex of adolescents		
Male	214	53.1
Female	189	46.9

Characteristics	Study participants (n = 403)	
	No.	%
Education level of parent		
Below high school	47	11.7
High school	163	40.4
College/university and above	193	47.9
Education level of adolescents		
Primary school (Grade 1 to 5)	63	15.6
Middle school (Grade 6-9)	146	36.3
High school (Grade 10-12)	115	28.5
College/university and above	79	19.6
Parent's occupation		
Dependent	70	17.4
Manual worker	85	21.1
Non-manual worker	163	40.4
High-level professional	85	21.1
Work schedule		
<7hrs	223	55.3
≥7hrs	180	44.7
Living environment		
Urban	242	60.0
Rural	161	40.0
Social media use		
Yes	280	69.5
No	123	30.5
Search SRH information on social media		
Yes	195	69.6
No	85	30.4
School-based SRH information		
Yes	202	50.1
No	62	15.4
Don't know	139	34.5
School encouragement		
Yes	238	59.1
No	165	40.9
Confident discussion on SRH		
Yes	248	61.5
No	155	38.5
Extended family support		
Yes	259	64.3
No	144	35.7
Community influence		
Yes	187	46.4
No	216	53.6

In Figure 1, 62% reported open parent-adolescent communication. It also shows that 55.3% had good adolescent SRH knowledge, whereas 34.2% and 10.4% demonstrated moderate and poor knowledge, respectively.

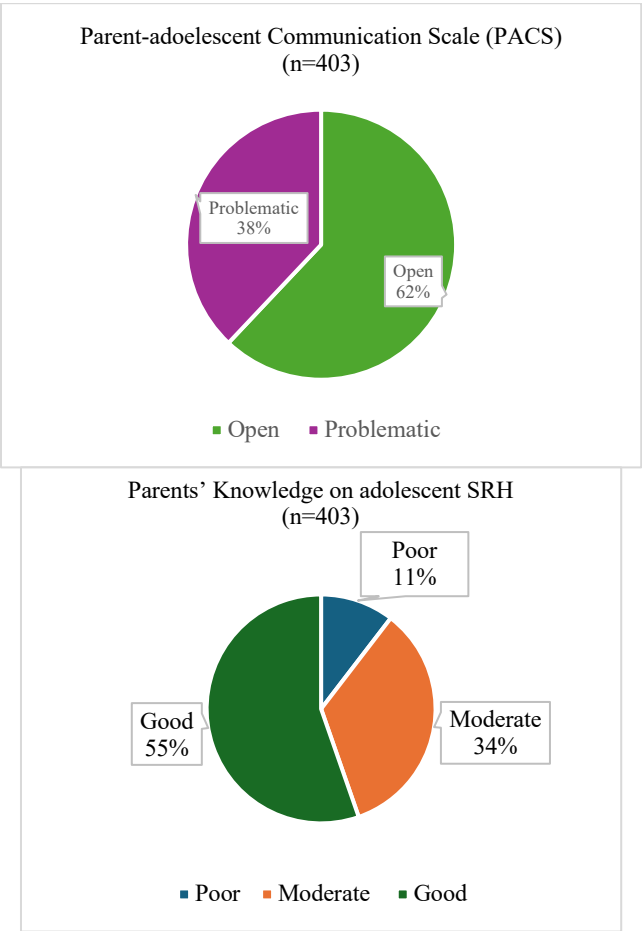

Figure 1 Parent-adolescent Communication Scale (PACS) and Parents' Knowledge on adolescent SRH

Bivariate analysis

Table 2 shows that parental knowledge was significantly associated with parents' education ($p = 0.015$), adolescents' education ($p = 0.005$), occupation ($p < 0.001$), work schedule ($p < 0.001$), and living environment ($p = 0.004$). A higher proportion of parents with college/ university and above demonstrated good knowledge (61.7%). Similarly, good knowledge was more prevalent among adolescents with college or university and above (62.0%). Participants working as high-level professionals showed the highest proportion of good knowledge (74.1%), while those working ≥7 hours per day were more likely to have good knowledge (83.3%). In addition, parents residing in ward areas demonstrated a higher proportion of good knowledge (61.2%).

Parental knowledge was significantly associated with social media use, school-based SRH education, school encouragement, confidence resulting from school support, extended family support, and community influence on SRH discussions (all $p < 0.05$). No significant association was found between PACS and parental knowledge of adolescent SRH ($\chi^2 = 0.233$, $p = 0.629$).

Table 2 Bivariate analysis between independent variables and parental knowledge on adolescent SRH

General characteristics	Study participants (n= 403)					
	Parent knowledge on adolescent SRH					
	Poor & Moderate		Good		χ2	p-value
	No.	(%)	No.	(%)		
Age of parents					6.397	0.041*
≤38	60	52.2	55	47.8		
39-45	73	38.2	118	61.8		
≥46	47	48.5	50	51.5		
Age of adolescents					0.809	0.368
10-14	92	42.6	124	57.4		
15-19	88	47.1	99	52.9		
Sex of parents					1.352	0.245
Father	88	41.9	122	58.1		
Mother	92	47.7	101	52.3		
Sex of adolescents						
Male	87	40.7	127	59.3	2.970	0.085
Female	93	49.2	96	50.8		
Parents' education level					8.466	0.015*
Below high school	19	40.4	28	59.6		
High school	87	53.4	76	46.6		
College/university and above	74	38.3	119	61.7		
Adolescents' education level					12.810	0.005*
Primary school	18	28.6	45	71.4		
Middle school	78	53.4	68	46.6		
High school	54	47.0	61	53.0		
College/university and above	30	38.0	49	62.0		
Occupation					30.079	<0.001**
Dependent	38	54.3	32	45.7		
Manual worker	55	64.7	30	35.3		
Non-manual worker	65	39.9	98	60.1		
High-level professional	22	25.9	63	74.1		
Work schedule					103.174	<0.001**
<7hr	150	67.3	73	32.7		
≥7hr	30	16.7	150	83.3		
Living environment					8.308	0.004*
Urban	94	38.8	148	61.2		
Rural	86	53.4	75	46.6		
Social media use					79.346	<0.001**
No	14	11.4	109	88.6		
Yes	166	59.3	114	40.7		
School provides SRH education					57.311	<0.001**
No, Don't know	52	25.9	149	74.1		
Yes	128	63.4	74	36.6		
School encouragement					75.697	<0.001**

General characteristics	Study participants (n= 403)					
	Parent knowledge on adolescent SRH					
	Poor & Moderate		Good		χ2	p-value
	No.	(%)	No.	(%)		
No	31	18.8	134	81.2		
Yes	149	62.6	89	37.4		
Confident discussion on SRH					107.027	<0.001**
No	19	12.3	136	87.7		
Yes	161	64.9	87	35.1		
Extended family					7.754	0.005*
No	51	35.4	93	64.6		
Yes	129	49.8	130	50.2		
Community influence					12.330	<0.001**
No	79	36.6	137	63.4		
Yes	101	54.0	86	46.0		
PACS					0.233	0.629
Open communication	114	45.6	136	54.4		
Problematic communication	66	43.1	87	56.9		

**p-value<0.001, *p-value<0.05

Multivariable Logistic Regression: Predictors of parental knowledge on adolescent SRH

Table 3 presents the results of the multiple logistic regression analysis of factors associated with parental knowledge of adolescent SRH. Among socio-demographic factors, the parents' high education (aOR=2.522, p=0.005), working ≥7 hours per day (aOR=7.227, p<0.001), and ward residence (aOR=2.298, p=0.014) were positively associated with good knowledge. Parents who used social media were 83.7% less likely to experience the outcome compared to those who did not use social media (aOR=0.163, p<0.001). Moreover, regarding school-level support, parents who reported feeling confident due to supportive materials from school had significantly lower odds of the outcome compared to those who did not receive such support (aOR=0.292, p=0.010). Other variables such as adolescents' education level, general school SRH provisions, and extended family and community support were not statistically significant.

Table 3 Multivariable analysis between associated independent variables and parental knowledge on adolescent SRH

Variables	aOR	95% C.I. for aOR		p-value
		Lower	Upper	
Age of parents				
≤38	Reference			
39-45	1.389	0.677	2.851	0.370
≥46	1.576	0.604	4.109	0.353
Sex of adolescents				
Male	Reference			
Female	0.919	0.520	1.625	0.771
Parents' education level				
High school and below	Reference			
College/university and above	2.522	1.329	4.785	0.005*

Variables	aOR	95% C.I. for aOR		p-value
		Lower	Upper	
Adolescents' education level				
Primary school, middle school	Reference			
High school	1.259	0.601	2.640	0.542
College/university and above	0.872	0.341	2.232	0.775
Occupation				
Dependent	Reference			
Manual worker	0.385	0.151	0.980	0.045*
Non-manual worker	0.559	0.238	1.313	0.182
High-level professional	1.468	0.616	3.500	0.387
Work schedule				
<7hr	Reference			
≥7hr	7.227	3.639	14.350	<0.001**
Living environment				
Village	Reference			
Ward	2.298	1.180	4.474	0.014*
Use social media				
No	Reference			
Yes	0.163	0.066	0.402	<0.001**
School provides SRH education				
No, Don't know	Reference			
Yes	1.202	0.557	2.591	0.639
School encouragement				
No	Reference			
Yes	0.653	0.249	1.711	0.386
Confident discussion on SRH				
No	Reference			
Yes	0.292	0.114	0.749	0.010*
Extended family				
No	Reference			
Yes	1.036	0.560	1.914	0.911
Community influence				
No	Reference			
Yes	0.751	0.414	1.363	0.347

**p-value<0.001, *p-value<0.05, aOR= Adjusted odds ratios

DISCUSSION

This study assessed parental SRH knowledge and its associated factors among parents of adolescents in Yangon. Fathers constituted a larger proportion of participants than mothers, contrasting with the previous studies conducted in Nepal (10) and Ethiopia (8), where mothers were more commonly represented. Most participants resided in wards, where access to mobile phones and internet services is greater. According to the Myanmar report (11), men are more likely than women to own mobile phones, which had increased fathers' opportunities to receive and complete the online questionnaire.

Most participants had attained a college/university education, consistent with studies from Nepal (10) and Southwest Ethiopia (8). Nearly 70% of parents reported using social media, and 69.6% of them searched for SRH

information, which is consistent with the East Kalimantan study suggesting that social media has become an important platform for disseminating evidence-based SRH information to parents (12).

Regarding family and school environment, over half of the parents reported receiving school support for adolescent SRH education, while over 60% described having open communication with their adolescents. These findings are consistent with previous studies showing that school-based materials increase parents' confidence in discussing SRH (7) and that open parent–adolescent communication promotes positive adolescent development (13).

Overall, 55.3% of parents depicted good SRH knowledge, comparable to findings from Ghana (14). The relatively high educational level of participants may partly explain this result, as higher education has been associated with better health literacy and greater use of evidence-based health information (15). However, the proportion of parents without good SRH knowledge highlights the need to strengthen accessible and reliable SRH education for parents of adolescents in Yangon.

Bivariate analysis demonstrated significant associations between parental SRH knowledge and parents' education, occupation, work schedule, and living environment, social media use, and school support. Parents with college/university education, those working in professional occupations, and those residing in wards demonstrated better SRH knowledge due to greater availability of health services and accessibility to accurate SRH information (15). Although professional occupations are generally associated with higher socioeconomic status, evidence from Asian countries has reported inconsistent associations between socioeconomic status and parental knowledge (15).

Unexpectedly, parents who did not use social media demonstrated better SRH knowledge than users. Although social media is an important health information source, the quality of its content varies considerably. An Australian study similarly found that highly educated parents were less likely to rely on social media because they were more confident obtaining information from healthcare professionals (16).

Similarly, parents who were not confident discussing SRH because of school support showed better SRH knowledge than those who were confident. This may indicate that knowledgeable parents obtain information from multiple sources rather than relying mainly on school-based materials (17). PACS was not significantly associated with parental knowledge, suggesting that communication may be influenced by factors beyond knowledge, including cultural norms, communication skills, and emotional comfort (9).

Parents with college/university and above had 2.5 times higher odds of having good knowledge than those with high school and below, consistent with previous studies showing that higher education improves health literacy and facilitates access to reliable and updated health information (18). Parents residing in wards had 2.3 times higher odds of good knowledge than those in villages, consistent with previous research (15) and reflecting better access to healthcare services, educational opportunities, internet connectivity, and health promotion activities (19). These findings suggest that SRH education should particularly target parents with lower educational attainment and those living in less-served areas to improve equitable access to reliable SRH information.

Parents with manual workers have lower odds of good SRH knowledge, which was not consistent with the Denmark study (20), which can limit opportunities to participate in health education campaigns and work-related fatigue. Interestingly, parents working longer hours demonstrated better SRH knowledge, possibly because of greater exposure to health information through workplace and other information channels (21). These findings suggest that SRH education could be delivered through multiple settings, including workplaces, to reach parents across different occupational groups.

Parents who used social media and felt confident because of school support had lower odds of having good SRH knowledge. This may indicate that knowledgeable parents rely more on authoritative online resources and healthcare professionals than on social media or school-based materials (17, 22). This finding suggests that social media and school-based SRH information should emphasize accurate, evidence-based content to ensure that access to these sources translates into improved parental knowledge. Several social and environmental factors lost statistical significance after adjustment, suggesting that their associations were confounded by parental education, occupation, and living environment.

CONCLUSION

Although more than half of parents had good adolescent SRH knowledge, important gaps remained. The findings suggest that parental SRH knowledge is shaped by socioeconomic, occupational, residential, and information-access inequalities. Parent-focused SRH education should prioritize parents with fewer educational and occupational resources, manual workers, and those in village areas. Interventions should strengthen access to accurate, culturally appropriate, and reliable SRH information through credible digital platforms and school-based initiatives. Future longitudinal and qualitative studies are recommended to explore the mechanisms underlying these associations.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (RECCU) (Ref. no: 150/69). Participation was voluntary, anonymous, and confidential, and participants could withdraw at any time without consequences. Participants were first assessed using a Participant Information Sheet, and electronic informed consent were applied.

LIMITATIONS

This study addresses an under-researched area in Myanmar and used multivariable logistic regression to adjust for potential confounders. It also included sociodemographic, behavioral, school-related, family-related, and community-level variables. However, causal relationships cannot be established due to the cross-sectional design. Online convenience sampling may have introduced selection bias by underrepresenting parents with limited internet access, lower digital literacy, or less online engagement. Self-reported data may be affected by recall and social desirability bias. In addition, the quality and frequency of SRH information obtained from social media and the depth of engagement with school-provided materials were not measured. Since the study was conducted in Yangon, the findings may not be generalizable to all parents in Myanmar.

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PREVALENCE OF HUMAN PAPILLOMAVIRUS VACCINE UPTAKE AND ASSOCIATED FACTORS AMONG MYANMAR WOMEN IN CENTRAL THAILAND: A CROSS-SECTIONAL STUDY

Nang Htwe Nu Aye[1], Unnop Jaisamrarn[1,2], Jiayu Li[1,*]
[1]School of Global Health, Faculty of Medicine, Chulalongkorn University, Bangkok, 10330, Thailand
[2]Department of Obstetrics and Gynecology, Faculty of Medicine, Chulalongkorn University, Bangkok, 10330, Thailand
****Corresponding author:** Jiayu Li,*
School of Global Health, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand. E-mail:Jiayu.l@chula.ac.th

ABSTRACT

Introduction: Human papillomavirus (HPV) vaccination is one of the most effective preventive interventions for reducing the burden of HPV-related diseases. Despite its proven effectiveness, HPV vaccine uptake remains suboptimal among migrant populations, who often face barriers related to health literacy, healthcare access, and affordability. Evidence regarding HPV vaccine uptake among Myanmar women living in Thailand remains scarce.

Objectives: The study aims to determine the prevalence of HPV vaccine uptake and identify factors associated with uptake among Myanmar women in Central Thailand.

Methodology: A cross-sectional study was conducted among Myanmar women aged 18 years and older residing in Central Thailand. Participants were recruited using a snowball sampling approach through migrant communities and social networks. Data were collected using a structured questionnaire that assessed participants' sociodemographic characteristics, self-reported HPV vaccination status, and potential factors associated with HPV vaccine uptake. Descriptive statistics were used to summarize participant characteristics and estimate the prevalence of HPV vaccine uptake. Factors associated with HPV vaccine uptake were examined using bivariable and multivariable logistic regression analyses following a purposeful variable selection strategy. Model fit, discrimination, and multicollinearity were assessed using the Hosmer–Lemeshow test, receiver operating characteristic curve, and variance inflation factors, respectively.

Results: Among the 276 participants, 266 with known HPV vaccination status were included in the analysis. Twenty-two women reported receiving at least one dose of the HPV vaccine, yielding an uptake prevalence of 8.3%. In the multivariable logistic regression analysis, women aged 30–49 years were more likely to have received HPV vaccination than those aged 18–29 years (Adjusted OR = 3.05, 95% CI: 1.12–8.32). Higher cervical cancer knowledge was independently associated with HPV vaccine uptake, with each one-point increase in knowledge score associated with a 26% increase in the odds of vaccination (Adjusted OR = 1.26, 95% CI: 1.02–1.55).

Conclusion: HPV vaccine uptake among Myanmar women living in Central Thailand was low. Older age and higher cervical cancer knowledge were independently associated with HPV vaccine uptake. These findings highlight the importance of strengthening culturally appropriate health education and improving access to HPV vaccination services to increase vaccine uptake among migrant women.

Keywords:
HPV vaccination, cervical cancer prevention, Myanmar migrant women, Thailand

INTRODUCTION

Human papillomavirus (HPV) vaccination is one of the most effective public health interventions for preventing HPV-related diseases, particularly cervical cancer, which remains a major cause of morbidity and mortality among women worldwide(1-5). Persistent infection with high-risk HPV types is responsible for nearly all cases of cervical cancer, and the World Health Organization (WHO) has identified HPV

vaccination as one of the three key pillars of the global strategy to eliminate cervical cancer as a public health problem(4, 6-8). Despite the proven effectiveness of HPV vaccination, vaccine uptake remains suboptimal in many countries, particularly among migrant and other underserved populations. Previous studies have shown that migrants often encounter multiple barriers to HPV vaccination, including limited health literacy, language barriers, financial constraints, lack of health insurance, and restricted access to preventive healthcare services(9-11). These barriers contribute to inequalities in vaccine access and may ultimately increase the risk of HPV-related diseases.

Thailand hosts a large migrant population from neighboring countries, with Myanmar nationals accounting for approximately 73% of all migrants(12,13). Myanmar migrant women constitute a substantial proportion of this population and may experience additional barriers to sexual and reproductive healthcare. Although Thailand has implemented a national HPV vaccination programme for school-aged girls and has made considerable progress in cervical cancer prevention(14-16), these programmes primarily target Thai citizens and may not adequately reach adult migrant women. Existing studies in Thailand have mainly examined HPV-related knowledge, attitudes, vaccine acceptability, or vaccine effectiveness among the general Thai population(17-19). However, evidence on actual HPV vaccine uptake and its associated factors among Myanmar migrant women in Thailand remains limited. Addressing this gap is essential for identifying barriers to vaccination and informing equitable public health interventions for this underserved population.

Therefore, this study aimed to determine the prevalence of HPV vaccine uptake and identify factors associated with HPV vaccine uptake among Myanmar women residing in Central Thailand.

METHODOLOGY

Study Design

A community-based cross-sectional study was conducted among Myanmar women residing in Central Thailand between March and April 2026 to determine the prevalence of HPV vaccine uptake and its associated factors.

Study Population and Study Setting

The study was conducted in Central Thailand, which hosts the largest concentration of Myanmar migrants in the country and provides relatively greater employment opportunities, healthcare services, and migrant support networks than many other regions of Thailand(12, 13). Eligible participants were Myanmar women aged 18 years or older who had resided in Central Thailand for at least six months, were able to communicate in the Myanmar language, and provided informed consent. Women who had undergone a total hysterectomy were excluded because HPV vaccination and cervical cancer prevention practices differ in this population.

Sample size and Sampling Technique

The sample size was calculated using Cochran's formula for estimating a population proportion(20). Based on a pilot survey of 30 Myanmar women that estimated an HPV vaccine uptake prevalence of 16%, and allowing for a 20% non-response rate, the minimum required sample size was 259 participants. A snowball sampling approach was used to recruit eligible participants(21). Initial seeds were selected to represent diverse socio-demographic backgrounds within the Myanmar community, including students, restaurant workers, factory workers, and educational institutions. Those participants were subsequently asked to identify other eligible Myanmar women from their social networks, and recruitment continued until the required sample size was achieved.

Study Instrument and Variables

A structured questionnaire was developed based on relevant literature and informed by the Knowledge, Attitudes, and Practices (KAP) framework. The questionnaire collected information on sociodemographic characteristics (age, ethnicity, marital status, education, language proficiency, health

insurance, and residence), health behaviors (smoking and drinking), cervical cancer and HPV vaccination knowledge, trust in HPV vaccine safety and effectiveness, history of gynecological check-up within the past three years, and self-reported HPV vaccine uptake, which served as the primary study outcome.

The questionnaire was initially developed in English and reviewed by three experts to assess content validity. Following revisions, it was translated into the Myanmar language using a forward–backward translation process to ensure culturally appropriate for the target population. The questionnaire was pilot tested among 30 Myanmar women prior to data collection to assess clarity and comprehensibility. Content validity was assessed using the item-level content validity index (I-CVI), while internal consistency was evaluated using Cronbach's alpha(22, 23). The questionnaire demonstrated acceptable validity and reliability. Three experts evaluated each item using a 5-point ordinal scale, and the I-CVI was calculated as the proportion of experts rating each item as 4 or 5. Six items initially had an I-CVI of 0.67 due to similarity in meaning; however, after the revision based on expert feedback, all items achieved an I-CVI of 1.0. Reliability analysis showed acceptable internal consistency for the knowledge domain (Cronbach's alpha=0.77). Moderate reliability for the practice domain (Cronbach's alpha=0.62), and lower internal consistency for the attitude domain (Cronbach's alpha=0.41). The attitude items were retained because they represented important constructs relevant to the study objectives, and lower alpha values may be observed in scales with a small number of items(24). The average completion time was approximately 10–20 minutes.

Data Collection

Data were collected using a structured questionnaire administered through REDCap, a secure web-based platform hosted by Chulalongkorn University. Participants were recruited through both online and onsite approaches. The online survey link was disseminated through Myanmar community networks and social media platforms, including Facebook and LINE, while onsite recruitment was conducted in community settings with permission from the relevant authorities. Completed questionnaires were reviewed for completeness and consistency before data analysis.

Statistical Analysis

A total of 276 participants completed the questionnaire. Among them, 10 reported being unsure of their HPV vaccination status and were excluded from the logistic regression analysis to avoid outcome misclassification, as the outcome variable (HPV vaccine uptake) could not be reliably classified for this group. Consequently, the final analytical sample consisted of 266 participants.

Descriptive statistics were used to summarize participant characteristics. Categorical variables were presented as frequencies and percentages. Continuous variables were assessed for normality using histograms and summarized as means with standard deviations (SDs) or medians with interquartile ranges (IQRs), as appropriate. Participant characteristics were compared according to HPV vaccine uptake status. Factors associated with HPV vaccine uptake were examined using bivariable and multivariable logistic regression analyses. Multivariable model building followed a purposeful variable selection strategy, in which variables with a p-value <0.20 in the bivariable analyses were considered for inclusion in the initial model, and the final model was determined by assessing statistical significance and potential confounding(24). Model calibration was assessed using the Hosmer–Lemeshow goodness-of-fit test, model discrimination using the area under the receiver operating characteristic (ROC) curve, and multicollinearity using variance inflation factors (VIFs). All statistical analyses were performed using Stata version 19 (StataCorp, College Station, TX, USA). Crude and adjusted ORs with 95% CIs were reported, and statistical significance was defined as a two-sided p-value <0.05.

RESULTS

Participant Characteristics

Among the 266 participants, 22 (8.3%) reported having received at least one dose of the HPV vaccine, while 91.7% reported never having received an HPV vaccine. Participant characteristics are summarized in **Table 1**. Most participants were aged 18–29 years (63.2%), identified as Burmese (60.9%), had secondary education or below (60.9%), and reported limited Thai language proficiency (65.0%). Approximately two-thirds had high English language proficiency (65.0%), 42.5% had health insurance, and 61.3% resided in Bangkok. Most participants had never smoked (89.9%) or consumed alcohol (62.0%).

Table 1 Participant characteristics by HPV vaccine uptake among Myanmar women in Central Thailand (N = 266)

Variables	Total n (%)	Unvaccinated n (%)	Vaccinated n(%)
Age			
18–29	168 (63.2)	160 (95.2)	8 (4.8)
30-49	98 (36.8)	84 (85.7)	14 (14.3)
Ethnicity			
Burmese	162 (60.9)	146 (90.1)	16 (9.9)
Karen	42 (15.8)	41 (97.6)	1 (2.4)
Others	62 (23.3)	57 (91.9)	5 (8.1)
Marital status (n=259)			
Single/Never married	163 (62.9)	152 (93.3)	11(96.8)
Ever married/cohabiting	96 (37.1)	86 (89.6)	10 (10.4)
Education			
Secondary education or below	162 (60.9)	157 (96.9)	5 (3.1)
College education or above	104 (39.1)	87 (83.7)	17 (16.4)
Thai language proficiency			
High	93 (35.0)	86 (92.5)	7 (7.5)
Limited	173 (65.0)	158 (91.3)	15 (8.7)
English language proficiency			
High	128 (48.0)	110 (85.9)	18 (14.1)
Limited	138 (52.0)	134 (97.1)	4 (2.9)
Health insurance			
No	121 (45.5)	108 (89.3)	13 (10.7)
Yes	113 (42.5)	107 (94.7)	6 (5.3)
Unknown	32 (12.0)	29 (90.6)	3 (9.4)
Place of residence			
Bangkok	163 (61.3)	145 (88.9)	18 (11.1)
Outside Bangkok	103 (38.7)	99 (96.1)	4 (3.9)
Smoking status			
Never smoker	239 (89.9)	219 (91.6)	20 (8.4)
Ever smoker	27 (10.1)	25 (92.6)	2 (7.4)
Drinking status			
Non-drinker	165 (62.0)	156 (94.5)	9 (5.5)
Drinker	101 (38.0)	88 (87.1)	13 (12.9)

Data are presented as n (%) unless otherwise indicated. Percentages were calculated within each category. Marital status was available for 259 participants because of missing data.

Knowledge, Trust, and Preventive Practices

Participants had a median cervical cancer knowledge score of 4 (IQR: 2–7), with scores ranging from 0 to 9 **(Table 2)**. Overall, 146 participants (54.9%) reported positive trust in the safety and effectiveness of HPV vaccination, whereas only 27 participants (10.1%) had undergone a gynecological check-up within the past three years.

Table 2 Knowledge regarding cervical cancer prevention and HPV vaccination among Myanmar women in Central Thailand (N = 266)

Knowledge item	Correct n (%)	Incorrect n (%)	Not sure n (%)
1. Cervical cancer is mainly caused by persistent HPV infection.	103 (38.7)	14 (5.3)	149 (56.0)
2. HPV is a sexually transmitted infection, and having multiple sexual partners increases the risk of HPV infection.	111 (41.7)	14 (5.3)	141 (53.0)
3. A person can carry HPV for many years without showing any symptoms.	99 (37.2)	29 (10.9)	138 (51.9)
4. The HPV vaccine can prevent most cases of cervical cancer.	141 (53.0)	5 (1.9)	120 (45.1)
5. HPV vaccination is recommended for both girls and boys aged 9–14 years.	51 (19.2)	60 (22.6)	155 (58.3)
6. Women who receive the HPV vaccine still need regular cervical cancer screening.	149 (56.0)	5 (1.9)	112 (42.1)
7. Cervical cancer screening should begin at age 25 and be repeated every 3–5 years.	111 (41.7)	19 (7.1)	136 (51.1)
8. Cervical cancer screening is important even if a woman has no symptoms.	199 (74.8)	3 (1.1)	64 (24.1)
9. Cervical cancer screening is available for non-Thai populations (foreigners) in Thailand.	152 (57.1)	4 (1.5)	110 (41.4)

Factors Associated with HPV Vaccine Uptake

In the bivariable logistic regression analyses, age group, education level, English language proficiency, place of residence, alcohol consumption, knowledge score, trust in HPV vaccine safety and effectiveness, and history of gynecological check-up within the past three years met the prespecified criterion ($p < 0.20$) and were entered into the initial multivariable logistic regression model. After applying the purposeful variable selection strategy, only age group and knowledge score remained independently associated with HPV vaccine uptake. Women aged 30–49 years had higher odds of HPV vaccine uptake than those aged 18–29 years (Adjusted OR = 3.05, 95% CI: 1.12–8.32, $p = 0.029$). In addition, each 1-point increase in knowledge score was associated with a 26% increase in the odds of HPV vaccine uptake (Adjusted OR = 1.26, 95% CI: 1.02–1.55, $p = 0.031$). Education level, English language proficiency, and history of gynecological check-up were not independently associated with HPV vaccine uptake after adjustment **(Table 3)**. The final model demonstrated good calibration (Hosmer–Lemeshow $\chi^2 = 8.63$, $p = 0.375$) and acceptable discrimination (AUC = 0.823). No evidence of multicollinearity was observed (mean VIF = 1.37).

Table 3 Bivariable and multivariable logistic regression analyses of factors associated with HPV vaccine uptake among Myanmar women in Central Thailand (N = 266)

Variables	Crude OR (95%CI)	*p*-value	Adjusted OR (95% CI)	*p*-value
Age				
18-29	Reference		Reference	
30-49	3.33 (1.34–8.26)	0.009	3.05 (1.12–8.32)	0.029
Education				
Secondary education or below	Reference		Reference	
College education or above	6.14 (2.19–17.20)	0.001	2.39 (0.54–10.50)	0.249
English language proficiency				
High	Reference		Reference	
Limited	0.18 (0.06–0.55)	0.003	0.47 (0.09–2.37)	0.363
Knowledge score				
(per 1-point increase)	1.47 (1.20–1.80)	< 0.001	1.26 (1.02–1.55)	0.031
Gynecological check-up within the past 3 years				
No	Reference		Reference	
Yes	2.97 (1.00–8.82)	< 0.001	2.35 (0.71–7.75)	0.159

Abbreviations: OR, odds ratio; CI, confidence interval. Crude ORs were estimated using bivariable logistic regression analyses. Adjusted ORs were estimated using multivariable logistic regression analyses. Reference categories are indicated as "Reference".

DISCUSSION

This study provides one of the first estimates of HPV vaccine uptake among Myanmar women living in Thailand. Overall, HPV vaccine uptake was low (8.3%), and participants demonstrated limited knowledge regarding cervical cancer prevention and HPV vaccination. After adjustment for potential confounders, older age and higher knowledge scores remained independently associated with HPV vaccine uptake.

The low HPV vaccine uptake observed in this study highlights a substantial gap in cervical cancer prevention among Myanmar migrant women in Thailand. Our finding is comparable to that reported among ethnic minority women living along the Thailand–Myanmar border, where HPV vaccination coverage was only 5%(25). However, it contrasts sharply with Thailand's national HPV vaccination programme, which achieved approximately 80% coverage among 15-year-old girls through the school-based National Immunization Program (NIP) in 2023(15, 26). This disparity is not unexpected because the NIP primarily targets Thai schoolgirls, whereas adult migrant women are generally not reached through routine vaccination programmes and may need to obtain HPV vaccination through individual healthcare-seeking, often requiring out-of-pocket payment. In addition, many Myanmar women may have had limited opportunities to access HPV vaccination before migration, as cervical cancer prevention programmes in Myanmar have faced considerable disruptions due to the COVID-19 pandemic and ongoing political instability(27). Together, these structural barriers may contribute to the persistently low HPV vaccine uptake observed among migrant women. In addition, practical barriers may further limit HPV vaccine uptake among migrant women. Because adult migrant women are generally required to

pay for HPV vaccination themselves, the cost of vaccination may be prohibitive for those with limited financial resources. Limited awareness of HPV vaccination and cervical cancer prevention, language barriers, and unfamiliarity with available healthcare services may also reduce opportunities to seek or receive vaccination(11).

Women aged 30–49 years were more likely to report HPV vaccination than those aged 18–29 years. One possible explanation is that older women may have greater engagement with healthcare services, providing more opportunities to receive health information and recommendations regarding HPV vaccination. Previous research among Myanmar migrants in Thailand has shown that healthcare utilization increases with age, particularly among women seeking reproductive and preventive health services(28). In contrast, studies from high-income settings, such as Switzerland, have reported lower HPV vaccine uptake among older adult women than younger women(11). These inconsistent findings likely reflect differences in vaccination policies, healthcare accessibility, and target populations. Unlike school-aged girls covered by Thailand's NIP, adult migrant women are generally not eligible for routine publicly funded HPV vaccination and may therefore face additional financial and access barriers to vaccination.

Higher knowledge regarding cervical cancer prevention and HPV vaccination was independently associated with HPV vaccine uptake, consistent with previous evidence identifying knowledge as an important determinant of vaccination behaviour. A systematic review reported that greater knowledge of HPV infection, cervical cancer, and preventive measures was associated with stronger intentions to receive HPV vaccination(29). Similarly, a meta-analysis found that inadequate HPV-related knowledge was consistently associated with lower HPV vaccine uptake across different populations(11). Knowledge may facilitate informed decision-making by improving awareness of HPV infection, cervical cancer risk, vaccine effectiveness, and the importance of preventive healthcare. Although education level and English language proficiency were associated with HPV vaccine uptake in the bivariable analyses, these associations did not remain significant after adjustment for other variables. This suggests that their apparent associations may have been explained by other correlated factors included in the multivariable model, particularly cervical cancer knowledge. Women with higher educational attainment or better English language proficiency may have greater opportunities to access health information, resulting in higher knowledge levels that may more directly influence HPV vaccination uptake. These findings support the integration of culturally appropriate HPV education into migrant health programmes to improve informed decision-making and increase vaccine uptake.

CONCLUSION

HPV vaccine uptake among Myanmar migrant women in Central Thailand was low. Older age and higher cervical cancer knowledge were independently associated with HPV vaccine uptake. These findings highlight the need to strengthen HPV vaccination among migrant populations through culturally appropriate and linguistically tailored health education, together with improved access to migrant-friendly vaccination services. Migrant health services should consider integrating HPV education into existing migrant health programmes and strengthening linkage between migrant communities and available vaccination services. Policymakers should support strategies that improve awareness and reduce barriers to HPV vaccination among migrant women in Thailand. Future research should evaluate strategies to increase HPV vaccine uptake and reduce cervical cancer disparities among migrant women in Thailand.

ETHICAL DECLARATION

Ethical approval was obtained from the Institutional Review Board, Faculty of Medicine, Chulalongkorn University (IRB No.0801/68). Data

collection commenced only after ethical approval had been granted. Electronic or written informed consent was obtained from all participants before enrolment. Participation was voluntary, and all data were collected anonymously and treated confidentially.

LIMITATIONS

This study provides one of the first estimates of HPV vaccine uptake and its associated factors among Myanmar migrant women in Thailand, an underserved population that is often underrepresented in public health research. The questionnaire was culturally adapted, translated into Myanmar using a forward–backward translation process, and pilot tested before data collection, which may have improved the validity and comprehensibility of participants' responses. The findings contribute to the limited evidence on HPV vaccination among migrant women and may help inform future cervical cancer prevention strategies in Thailand. Several limitations should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference between the identified factors and HPV vaccine uptake. Second, HPV vaccine uptake status and other study variables were self-reported and may be subject to recall and social desirability bias. Third, the use of a non-probability snowball sampling approach may have introduced selection bias, as participants were recruited through existing social networks and may therefore have shared similar socio-demographic characteristics or health-seeking behaviors. Finally, participants who were unsure of their HPV vaccine uptake were excluded from the regression analyses, which may have slightly influenced the estimated vaccination prevalence. Consequently, the findings limit the generalizability to all Myanmar migrant women in Thailand.

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