

The **16th**

**INTERNATIONAL
GRADUATE STUDENTS
CONFERENCE**

**POPULATION and
PUBLIC HEALTH SCIENCE**

IGSCPP: July 14, 2025



Chula
Chulalongkorn University



มหาวิทยาลัยมหิดล
Mahidol University

The College of Public Health Science,
Chulalongkorn University

ASEAN Institute for Health Development,
Mahidol University

Institute for Population and Social Research,
Mahidol University



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WELCOME MESSAGE



Prof. Chitlada Areesantichai, Ph.D.

Chairperson, Executive Committee, 16th IGSCPP

Dean

The College of Public Health Sciences, Chulalongkorn
University, Thailand

www.cphs.chula.ac.th

Dear Colleagues,

On behalf of the College of Public Health Sciences (CPHS) Chulalongkorn University, I would like to give a very warm welcome to all the participants at the 16th International Graduate Student Conference on Population and Public Health Sciences (IGSCPP), on July 14, 2025

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 16 years. Together, we have created an incredible and exciting international conference.

On behalf of the host, it is my great pleasure to witness the convergence of diverse participants—members and non-members alike, including local partners and international colleagues—united by a shared commitment to advancing global health and public advocacy. This conference serves as a meaningful platform for the exchange of ideas, addressing pressing challenges, and seeking innovative solutions in public health.

I would like to extend my heartfelt appreciation to our esteemed speakers for their invaluable presence and thought-provoking contributions. My sincere thanks also go to the dedicated program committee for their diligent efforts in ensuring a rigorous and thoughtful review process, resulting in the selection of high-quality presentations.

It is my genuine hope that each of you has gained valuable insights from the sessions and engaged in fruitful dialogue. May this conference mark the beginning of continued collaboration and impactful partnerships.

Thank you once again for being a part of this important gathering.

WELCOME MESSAGE



Assoc. Prof. Thunwadee Suksaroj, Dr.Sc.

Co-Chairperson, Executive Committee, 16th IGSCPP

Director of ASEAN Institute for Health Development

<https://aihd.mahidol.ac.th/>

Ladies and Gentlemen,

It is with great pleasure that I welcome you to the 16th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). This annual event is proudly co-organized by the College of Public Health Sciences (CPHS), Chulalongkorn University; the Institute for Population and Social Research (IPSR); and the ASEAN Institute for Health Development (AIHD), Mahidol University.

Over the years, this conference has become a meaningful platform for graduate students across the region and beyond to share knowledge, exchange ideas, and build lasting academic networks. As we gather once again, we celebrate not only your dedication to research but also your commitment to advancing population and public health sciences in a rapidly changing world.

Throughout this conference, I encourage you to engage fully—learn from one another, challenge existing perspectives, and explore innovative approaches to the pressing health and social challenges of our time. Let this be a space for rich dialogue, intellectual curiosity, and the formation of new collaborations.

May this 16th IGSCPP inspire you to continue your academic journey with purpose and passion, and may the insights gained here contribute to impactful, evidence-based solutions for a healthier and more equitable future.

Finally, I extend my heartfelt thanks to the organizing team for their dedication and hard work in bringing this important event to life.

Wishing you all a meaningful and enriching conference experience.

WELCOME MESSAGE



Assoc. Prof. Chalernpol Chamchan, Ph.D.

Co-Chairperson, Executive Committee, 16th IGSCPP

Director

Institute for Population and Social Research, Mahidol University

<http://ipsr.mahidol.ac.th/>

Dear colleagues and participants,

It is with great pleasure that I welcome you all to the 16th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). For over a decade and a half, this conference has served as a dynamic platform for graduate students and young scholars to present their research, build networks, and engage in academic dialogue across disciplines and borders.

This year's conference continues to be a collaborative effort among three key institutions: the College of Public Health Sciences (CPHS), Chulalongkorn University; the ASEAN Institute for Health Development (AIHD), Mahidol University; and the Institute for Population and Social Research (IPSR), Mahidol University. I am truly honored to witness this continuing partnership that reflects our shared commitment to promoting research and learning in the fields of population and public health.

On behalf of IPSR, I warmly welcome all participants joining us from diverse academic and cultural backgrounds. As you share your work and exchange ideas, I encourage you to explore the interdisciplinary connections—between population change, sustainable development, health equity, digital innovation, and beyond—that define the complexity of our world today.

I extend my sincere appreciation to Prof. Dr. Chitlada Areesantichai (CPHS), our chairperson, and Assoc. Prof. Dr. Thunwadee Suksaroj (AIHD), our co-chairperson, for their leadership in making this event a reality. Special thanks also go to the CPHS, AIHD and IPSR organizing team for their dedication and hard work.

Most importantly, thank you to all the students and researchers who are the heart of this conference. I hope the experience is enriching, inspiring, and opens doors for future collaborations.

Thank you very much.



**The 16th International Graduate Students Conference on Population
and Public Health Sciences (IGSCPP)**

July 14, 2025

Agenda

The College of Public Health Sciences, Chulalongkorn University

8.00-8.30	VDO Presentation & Welcome
8.30-9.00	<p>Conference Welcome Report</p> <p>Welcome keynote:</p> <p><i>Professor Chitlada Areesantichai, Ph.D. Dean, College of Public Health Sciences, Chulalongkorn University</i></p> <p><i>Associate Professor Thunwadee Suksaroj, Ph.D. Director of ASEAN Institute for Health Development, Mahidol University</i></p> <p><i>Associate Professor Chalernpol Chamchan, Ph.D. Director, Institute for Population and Social Research, Mahidol University</i></p> <p>Conference Opening Keynote</p> <p><i>Professor Wilert Puriwat, D.Phil. (Oxon) President of Chulalongkorn University</i></p> <p><i>MC: Asst. Prof. Anchalee Prasansuklab, Ph.D. / Asst. Prof. Anuchit Phanumartwiwath, Ph.D.</i></p> <p>Group Photo</p>

9.00-9.30	<p>Keynote Speech (ONLINE)</p> <p>Topic: <i>Community Resilience for Earthquake Disaster Management</i></p> <p><i>Associate Professor Toyoda Yusuke</i> <i>Ritsumeikan University Graduate School of Policy Science, Japan</i></p> <p>Zoom Link: https://chula.zoom.us/j/92317233065?pwd=ud78zCWNjiaxW9g6W2IPr2b03oSOfs.1 Meeting ID: 923 1723 3065/ Password: 936937</p>
9.30-12.00	<p>Oral Presentation</p>
Room 1	<p>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, Health Promotion, Health Behaviours</p> <p>Zoom Link: https://chula.zoom.us/j/92317233065?pwd=ud78zCWNjiaxW9g6W2IPr2b03oSOfs.1 Meeting ID: 923 1723 3065/ Password: 936937</p>
	<p>Chairperson & Co-Chairperson <i>Asst. Prof. Dusita Phuengsamran, Ph.D. / Assoc. Prof. Montakarn Chuemchit, Ph.D.</i></p> <p>Committee: <i>Akadet Chaichanavichakit, Ph.D.</i></p>
	<p>1) Factors Influencing Consumption Reduction of Sugar-Sweetened Beverages Under a Proposed Excise Tax in Indonesia (#47) by Zaldi Muchtar</p>
	<p>2) Prevalence and Factors Associated with Electronic Cigarette Use among Thai Undergraduate Students in Bangkok Metropolitan region, Thailand (#40) by Thanaporn Kuchaiyanont</p>
	<p>3) The Heterogeneity of Fertility Patterns in Vietnam: A Parity Progression Analysis (#44) by Nga Tran Thi Tuyet</p>
	<p>4) Psychological Resilience and its Associated Factors among Myanmar Migrants in Mae Sot, Tak Province of Thailand (#28) by Yan Myo Aung</p>
	<p>5) Exploring Wet Nursing Practices among Lactating Women During Emergencies in Rakhine State, Myanmar (#27) by Aung Thu Chai</p>
	<p>6) The Prevalence of Alcohol Use Disorder and Associated Factors among Adult Alcohol Consumers in Yangon City, Myanmar (#39) by Khin Yadanar Aung</p>
	<p>7) Enablers, Barriers, and Coping Strategies in Accessing Maternal Healthcare among Women in Conflict-Affected Rakhine State, Myanmar (#31) by Maung Aye Saw</p>

Room 2	<p>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, Health Promotion, Health Behaviours Track 6: One Health, Zoonoses and Antimicrobial Resistance</p> <p>Zoom Link: https://chula.zoom.us/j/96540689775?pwd=3wEFfe3I7vir7tR4boLDRL7enWY8Kc Meeting ID: 965 4068 9775 / Password: 163026</p>
	<p>Chairperson & Co-Chairperson: <i>Seema Vijay Medhe, Ph.D. / Asst. Prof. Tepanata Pumpaibool, Ph.D.</i></p> <p>Committee: <i>Asst. Prof. Pojjana Hunchangsith, Ph.D.</i></p>
	<p>1) Maternal Risk Factors for Neonatal Sepsis: A Time-To-Event Analysis (#48) <i>by Muqet Ullah Khan</i></p>
	<p>2) Health-Related Quality of Life Among Patients Living with HIV/AIDS in Vietnam: A Cross-Sectional Study (#46) <i>by Phi Hoang Nguyen</i></p>
	<p>3) Progress and Challenges of the HIV Prevention and Control Program in the National Capital Region, Philippines (2017–2022) (#02) <i>by Ma. Josephine Therese Emily G. Teves</i></p>
	<p>4) Antibiotic Self-Medication and Related Factors among Myanmar Migrants in Mae Sot, Thailand (#16) <i>by Khant Hmue San Lwin</i></p>
	<p>5) Exploring Preventive Measures Against Zoonotic Diseases among The Pet Owners in Nakhon Pathom, Thailand, in Association with Sociodemographic Factors and Psychosocial Factors (#55) <i>by May Thet Tun</i></p>
	<p>6) Factors Associated with Rabies-Related Behaviors among Myanmar Migrant Workers in Bangkok Metropolitan Area (#18) <i>by Amornsit Chavanayarn</i></p>
	<p>7) Unmet Needs for Mental Health Services among Sexual and Gender Diverse Individuals in Indonesia, The Philippines, and Singapore: A Quantitative Study (#32) <i>by Thiri Soe Win Loon</i></p>
Room 3	<p>Track 2: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience</p>
	<p>Chairperson & Co-Chairperson: <i>Christine Stanly, Ph.D. / Assoc. Prof. Marc Voelker, PhD.</i></p> <p>Committee: <i>Assoc. Prof. Wattasit Siriwong, PhD.</i></p>
	<p>1) Utilization of Telehealth Antenatal Care Services Among Pregnant Women in Rural Balochistan, Pakistan: A Cross-Sectional Study (#49) <i>by Yamna Ghaffar</i></p>

	2) Pandemic-Driven Spatial Redistribution of Gaming Addiction in Thailand: A LISA Analysis (#08) <i>by Tay Zar LIN</i>
	3) Prevalence and Risk Factors of Neck and Shoulder Pain among Thai High School Students: A Cross-Sectional Study (#15) <i>by Arthikom Laisin</i>
	4) Household Water Security among Myanmar Migrant Workers in Mae Sot District, Thailand: A Cross-sectional Study (#29) <i>by Kyaw Hla Win</i>
	5) Health Risk Assessment of Dermal Contact with Heavy Metals Contaminated Soil in Blood Cockle Farms, Thailand (#25) <i>by Nuttinan Jitsai</i>
	6) Managing Menstruation in Crisis: Challenges, Responses, and Humanitarian Solutions in Displaced Camps, Southern Shan State, Myanmar (#50) <i>by Su Su Htet</i>
	7) Effects of Health-Related Factors, Neighborhood Environment, and Socio-Economic Challenges on Subjective Well-Being among Myanmar Migrant Workers in Tak Province, Thailand (#38) <i>by Hein Latt Kyaw</i>
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	Chairperson & Co-Chairperson: <i>Assoc. Prof. Khemika Yamarat, Ph.D. / Assoc. Prof. Suchada Thaweessit, Ph.D.</i> Committee: <i>Chanida Lertpitakpong, Ph.D.</i>
	1) Perceived Accuracy of Online Health Misinformation among Thai Adults Aged 50-75 Years in Bangkok, Thailand: A Pilot Study (#51) <i>by Jintapat Kuwijitsuwan</i>
	2) Socio-Demographic Determinants of Oral Health Knowledge Among People with Type II Diabetes Mellitus in Mandalay, Myanmar: A Cross-Sectional Study (#52) <i>by Zwe Pyae Zaw</i>
	3) Predictor of Cognitive Function Among Older People in Nursing Homes in North Sumatra: Cross-Sectional Study (#07) <i>by Siska Evi Martina</i>
	4) Barriers and Motivators of Male Involvement in Maternal Healthcare among Karen Ethnic Group in Kayin State, Myanmar (#34) <i>by Tin Yadanar Swe</i>

	5) Undergraduate Crash-Care Preparedness in New Delhi: Linking knowledge to Attitude in A Cross-Sectional Study(#01) <i>by Manvi Sharma</i>
	6) Determinants of Utilization of Institutional Delivery in Bangladesh (#11) <i>by Thet Wai Thwe</i>
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	Poster committees: <i>Prof. Emeritus Ratana Somrongthong, Ph.D. / Nanta Auamkul, M.D, M.P.H.</i> <i>Asst. Prof. Pokkate Wongsasuluk, Ph.D./ Kriangkrai Lerdthusnee, Ph.D.</i> <i>Assoc. Prof. Chaweewon Boonshuyar/ Sompong Chaiopanont, M.D.</i> <i>Nipunporn Voramongkol, M.D., MPH. / Napaphan Viriyautsahakul, M.D., M.Sc.</i>
	(P01) Survey of knowledge, attitude and practice of traditional ice cream manufacturers and vendors in Hamadan city regarding ice cream hygiene <i>by Reihaneh Reyahi-Khoram</i>
	(P2) Factors Associated with Poor Self-Rated Health in Older Adults Receiving Outpatient NCD Care in Hpa-an District, Kayin State, Myanmar <i>by Min Thant Htoo</i>
	(P03) Sleep Hygiene Practices and Sleep Quality among Older Adults in Nonthaburi Province, Thailand <i>by Suparat Siripan</i>
	(P04) Abortion Knowledge and Attitudes Among Undergraduate Students in Bangkok, Thailand, Post-Legislative Reform <i>by Thanapond Sukonthachart</i>
	(P05) Factors Related to Spiritual Health Among Older People in Thailand: A Cross-Sectional Study <i>by Chitose Shimizu</i>
	(P06) Association of Sociodemographic and Family Environmental Factors with Knowledge related to Sexual and Reproductive Health Among Older Adolescent Girls in Mpigi District, Uganda: A Cross-Sectional Study <i>by Kyoko Hoshino</i>
	(P07) Knowledge and Attitude Towards Sexually Transmitted Infections among Male Myanmar Migrant Workers in Samut Prakan, Thailand <i>by Khant Htet Aung</i>
	(P08) Prevalence and Determinants of Insomnia among Employees in Internet-Based Companies in Hangzhou: A Cross-sectional study <i>by Yunwen Zheng</i>
	(P09) Digital Technology Use for Social Cohesion among Older Adults in Rural Myanmar Amidst the Crisis: Barriers and Coping Strategies (A Case Study in Hpa-An, Kayin State) <i>by Ruth Hkawn Awng</i>

	(P10) Knowledge of Infection Prevention and Control (IPC) Measures and Associated Factors Among Private-Sector Dentists in Yangon, Myanmar: A Cross-Sectional Study <i>by Kyaw Tun Win</i>
	(P11) Socio-Demographic and Empowerment Predictors of Safer-Sex Negotiation among Married Women in Bangladesh: Findings from the 2017–2018 BDHS <i>by Maliha Nawrin</i>
	(P12) Determinants of Heat-Related Illness among Myanmar Migrant Workers in Mae Sot District, Thailand <i>by Thae Su Win</i>
	(P13) Developing the Thai version of “Social Connectivity of Mothers with People in the Community Scale” <i>by Hikaru Honda</i>
	(P14) From Signal to Support: Understanding Telemental Health Acceptance in Yangon, Myanmar <i>by Jeslyn</i>
	(P15) Digital Health Literacy of Middle-Aged Women in Urban Yangon, Myanmar: Bridging the Gap Between Access and Action <i>by Thant Hae Thi</i>
	(P16) Understanding Determinants of Air Pollution Awareness among International Students in Thailand: A Cross-Sectional Study <i>by Honey Cho Nwet Oo</i>
	(P17) Food Environment and Related Factors Influencing Junk Food Consumption Behavior among Secondary School Students in Biratnagar, Nepal <i>by Abhilasa Pradhan</i>
13.30-15.30	Oral Presentation
Room 1	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, Health Promotion, Health Behaviours Zoom Link: https://chula.zoom.us/j/92317233065?pwd=ud78zCWNjiaxW9g6W2IPr2b03oSOfs.1 Meeting ID: 923 1723 3065/ Password: 936937
	Chairperson & Co-Chairperson: <i>Syarifah Aqilah, Ph.D. / Lect. Nara Khamkhom, Ph.D.</i> Committee: <i>May Chan O, Ph.D.</i>
	8) Assessing Vulnerabilities in Online Sexual Abuse and Exploitation of Children: Development and Reliability Testing of the OSAEC Vulnerability Assessment Tool in the Philippines (#03) <i>by Ma. Josephine Therese Emily G. Teves</i>

	9) Trends in Pneumonia-Related Hospitalizations, Outpatient Visits and Mortality in Thailand Post-COVID-19: A Study From 2022 to 2024 (#14) <i>by Peerawich Armatrmtree</i>
	10) Oral Health Status and Salivary Changes in Older Adults with Uncontrolled Type 2 Diabetes Mellitus (#53) <i>by Edwins Kurniawan</i>
	11) Street Food Consumption and its Determinants among Undergraduate Students in Qingdao, China (#17) <i>by Kaiqi Xu</i>
	12) Lived Experiences and Understandings: A Qualitative Inquiry into Displaced Myanmar Youth's Knowledge and Attitudes on Sexually Transmitted Infections (#54) <i>by Naw Hla Hla San</i>
	13) Prevalence of Electronic Cigarette Use and Its Associated Factors among Suburban Dwellers in Yangon, Myanmar (#23) <i>by Hein Htet Aung</i>
	14) Malaria Knowledge, Attitude and Health-Seeking Behavior of Migrant Population in a Thai Border District: A Cross-Sectional Study (#09) <i>by Myo Min Thein</i>
	15) Reproductive Health Problems and Factors Associated with Services Used among Japanese Female Expatriates in Bangkok (#45) <i>by Ayaka Nakashima</i>
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	<p>Chairperson & Co-Chairperson: <i>Asst. Prof. Dyah Anantalia Widyastari, Ph.D. / Assist. Prof. Duongsamorn Manowan, Ph.D.</i></p> <p>Committee: <i>Nuchanad Hounnaklang, Ph.D.</i></p>
	8) Flood Preparedness among Myanmar Migrants in Mae Sai District, Chiang Rai Province, Thailand (#41) <i>by Myo Thant Naing</i>
	9) White Coats in War Zones: The Unseen Battle of Karenni Healthcare Heroes (#05) <i>by Si Thu Aung</i>
	10) Association between Influencing Factors and Stress among Myanmar Migrants in Thailand during Multiple Crises in their Home Country (#21) <i>by Khin Aye Myat Nyein</i>

	11) Household Food Insecurity and Related Factors on Undernutrition among Under 5 Children in Migrant Populations Along the Thailand-Myanmar Border (#36) <i>by Saw Min Than</i>
	12) Unseen and Unheard: Depression and Student Challenges among Myanmar university students in Bangkok (#43) <i>by Su Pyae Myo Thwet</i>
	13) Promoting Early Learning Among Myanmar Migrant Children in Tak Province, Thailand: Psychosocial Determinants of Caregivers' Engagement (#30) <i>by Hsu Nandar Aung</i>
	14) Anxiety in the Aftermath: Assessing the Population's Mental Health following 2021 Political Crisis in Myanmar (#35) <i>by Su Myat Mon</i>
Room 3	Track 2: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience
	Chairperson & Co-Chairperson: <i>Narumol Bhummapha, Ph.D, / Tarinee Buadit, Ph.D.</i> Committee: <i>Asst. Prof. Nucharapon Liangruenrom, Ph.D.</i>
	8) Occupational Stress, Coping Strategies, and Associated Factors Among Healthcare Workers at Health Centers in Ho Chi Minh City, Vietnam: A Cross-Sectional study (#42) <i>by Phi Hoang Nguyen</i>
	9) Demographic Determinants of Workforce Participation among the Elderly in Indonesia (#24) <i>by Arif Rosyidi</i>
	10) Environmental and Behavioral Determinants of Respiratory Symptoms in Children Aged 2 to 5: A Case Study of Childcare Center with Clean Air Rooms in The Northern Region Thailand (#19) <i>by Nuttapon Sirilar</i>
	11) The level of Perceptions, Awareness, and Practices toward the PM2.5 During the Air Pollution Episode among Chinese Students in Bangkok and vicinity, Thailand: A Cross-Sectional Study (#33) <i>by Jiali Chen</i>
	12) Sedentary Behavior and Screen Time Associated to Office Syndrome among Desk Jobs Workers in Singapore (#37) <i>by Htet Myat Htun</i>
	13) Digital Healthcare Literacy Related to Telemedicine Perception among Young Adults in Myanmar (#22) <i>by Yin Nyein Aye</i>
	14) Health Care Utilization and Out-Of-Pocket Costs among the Elderly Patients with Hypertension and Diabetes (#04) <i>by Quynh Anh Mai</i>

	15) The Factors Related to the PRK Implant Clinical Outcomes: A 2-year Retrospective study (#56) <i>by Kyaw Zin Thein</i>
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	Chairperson & Co-Chairperson: <i>Truc Ngoc Hoang Dang, Ph.D. / Ms. Alina Pant</i> Committee: <i>Onuma Zongram, Ph.D.</i>
	7) Exploring Utilization Patterns of Thailand's Three Main Public Health Insurance Scheme Beneficiaries (#12) <i>by Pakhun Angsupan</i>
	8) Determinants of Long-Term Residence Intention among the Floating Population in Bangkok Metropolitan Region (BMR): The Moderating Role of Spatial Context (#26) <i>by Nuntanujch Limgamoltipaya</i>
	9) Key Determinants of Under-Five Mortality for Policy Focus: Economic Status, Healthcare Access, or Maternal Education? (#10) <i>by Wai Yan Htun</i>
	10) Mental Well-Being and its Associated Factors in High School Students in Nakhon Ratchasima Province, Thailand (#06) <i>by Nuchanat Chittaku</i>
	11) Walking Without Sight: A Cross-Sectional Analysis of Walkway Accessibility Among Visually Impaired Individuals in Thailand (#20) <i>by Namtip Ruchatachat</i>
	12) When "He Has to Be at Work" Becomes a Barrier to Male Involvement in Family Planning in Peri-urban Yangon, Myanmar (#13) <i>by Su Pwint Phyu</i>
	Wrap Up & Evaluation <i>MC: Asst. Prof. Anchalee Prasansuklab, Ph.D. / Asst. Prof. Anuchit Phanumartwiwath, Ph.D.</i>
15.30-16.00	Outstanding Award and Closing <i>Prof. Chitlada Areesantichai, Ph.D.</i> <i>Dean, College of Public Health Sciences, Chulalongkorn University</i> <i>MC: Asst. Prof. Anchalee Prasansuklab, Ph.D. / Asst. Prof. Anuchit Phanumartwiwath, Ph.D.</i>

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SESSION 1: 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, Health Promotion, Health Behaviours

PREVALENCE AND FACTORS ASSOCIATED WITH ELECTRONIC CIGARETTE USE AMONG THAI UNDERGRADUATE STUDENTS IN BANGKOK METROPOLITAN REGION, THAILAND

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ABSTRACT

Introduction: The prevalence of electronic cigarettes (e-cigarettes) has risen significantly in recent years, particularly among young adults. Their use has been linked to a higher likelihood of initiating traditional cigarette smoking, posing serious public health concerns. The Bangkok Metropolitan Region, as Thailand's most urbanized area with dense university populations, represents a key demographic for such behavior.

Objective: This cross-sectional study aimed to determine the prevalence of e-cigarette use and identify associated factors among Thai undergraduate students in the Bangkok Metropolitan Region.

Methodology: A cross-sectional study was conducted at six universities in the region. A total of 482 students participated via convenience sampling through an online survey. A self-administered questionnaire was used to collect data on perceived stress, social influence, attitudes toward e-cigarettes, and usage patterns. Chi-square tests and multiple logistic regression were applied to examine associations between independent variables and e-cigarette use, with statistical significance set at $p < 0.05$.

Results: Among 482 participants, the majority were female and aged between 18–26 years. The current use prevalence of e-cigarettes was 8.5%. E-cigarette use was significantly associated with positive attitudes toward e-cigarettes and social influences from siblings, friends, colleagues, and romantic partners. Logistic regression analysis identified positive attitudes toward e-cigarettes as the strongest predictor (aOR = 49.86, $p < 0.001$), followed by having a romantic partner who uses e-cigarettes (aOR = 8.88, $p = 0.002$) and friends who use e-cigarettes (aOR = 6.05, $p < 0.001$).

Conclusion: Among Thai undergraduate students, a positive attitude toward e-cigarettes is the most influential predictor of use, increasing the odds nearly 50-fold. Having a romantic partner or friends who use e-cigarettes also significantly increases the likelihood of use. Interventions should target social networks and focus on shifting perceptions to reduce uptake.

Keywords: attitude, Bangkok, e-cigarette use, young adults, social influence, prevalence

INTRODUCTION

In recent years, the popularity of electronic cigarettes (e-cigarettes) has grown rapidly, sparking ongoing debate about their implications for public health. Marketed as a safer alternative to conventional cigarettes, e-cigarettes have appealed both to smokers seeking cessation aids and to younger individuals attracted by their modern designs and diverse flavors. However, growing evidence indicates

that e-cigarettes carry significant health risks, including nicotine addiction and the potential to initiate combustible cigarette use, particularly among adolescents and young adults(1).

The National Institute of Health defines e-cigarettes as devices resembling cigarettes, cigars, or pens that do not contain tobacco but operate via batteries and vaporize a solution containing nicotine, flavorings, and other chemicals potentially harmful to users. The core

public health concern revolves around their social impact on teenagers and young adults. The World Health Organization (WHO) has warned of a significant increase in tobacco smoking initiation linked to e-cigarette use (2). A systematic review study conducted by Soneji S, 2017 (1) reported that among adolescents and young adults aged 14 to 30 years old, the probability of initiating cigarette smoking was 23.2% among ever e-cigarette users compared to 7.2% among never users. Similarly, Leventhal, 2015 (3) found that e-cigarette ever users were more likely than never users to begin using combustible tobacco at both 6 months (30.7% vs. 8.1%) and 12 months (25.2% vs. 9.3%).

Globally, the prevalence of e-cigarette use among younger individuals is 16.8% for ever-use and 4.8% for current use, with males generally having higher usage rates(4). National trends vary significantly. In Thailand, despite laws prohibiting the sale, importation, and distribution of e-cigarettes, usage continues to rise. According to the National Statistical Office, the prevalence of e-cigarette uses among Thais aged 15 and older dropped from 0.10% in 2014 to 0.02% in 2017 after a ministerial ban. However, by 2021, it had surged to 0.14%, representing a seven-fold increase(5).

Age has consistently emerged as a significant factor, with those aged between 18 to 24 years old exhibiting the highest rates of e-cigarette use globally(6). Gender associations are less consistent and vary by region. Family and peer smoking behaviors are more robustly linked to e-cigarette initiation among adolescents and young adults. Those with friends or family members who use e-cigarettes are significantly more likely to do so themselves(7).

Advertising also plays a role. A systematic review of 29 studies found that exposure to tobacco-related content on social media is significantly associated with increased lifetime tobacco use and susceptibility, a trend that likely extends to e-cigarettes(8). Stress level was also found as the significant associated factors influencing the likelihood of e-cigarette use among adolescents. Studies have found that higher levels of perceived stress associated with increased e-cigarette use. In addition, attitudes toward e-cigarettes are another critical factor. A

cross-sectional study found that dual users perceived e-cigarettes as less harmful than non-users did. Compared to non-users, all user groups reported significantly lower perceived addictiveness of e-cigarettes. Interestingly, these trends extended to perceptions of conventional cigarettes, although findings were more variable for e-cigarette-only users(9).

While international studies have explored these associations, research on the factors influencing e-cigarette use in the Thai context, especially among university students in Bangkok, is limited. Therefore, the aim of this study is to determine the prevalence of e-cigarette use and its association with perceived stress, social influence (family, peers, partners, social media), and personal attitudes among Thai undergraduates in the Bangkok Metropolitan Region.

METHODOLOGY

Research study design

This study employed a cross-sectional design using a self-administered online questionnaire distributed via Google Forms. The instrument measured three categories of independent variables, including psychological factors (e.g., perceived stress), social influences (e.g., peer and familial exposure), and attitudes and perceptions toward e-cigarette use. The dependent variable was categorized as e-cigarette use.

Research study population

Given the scope of this study, it was neither feasible nor necessary to include all 18 autonomous universities in the Bangkok Metropolitan Region. Therefore, the study employed predetermined selection criteria to ensure diversity in student backgrounds, accessibility for data collection, and institutional support for research activities. The six selected universities were Chulalongkorn University, Kasetsart University, King Mongkut's University of Technology Thonburi, Mahidol University, Srinakharinwirot University, and Thammasat University. This area is identified as the most densely populated region in the country, with individuals aged 18 to 24 years, the target population is within this

age range and representing about 1.32% of the total population, amounting to 878,344 people. Participants who met the following criteria: (1) currently enrolled as a Thai undergraduate student at one of the six universities; (2) aged 18 years or older; (3) able to access the internet and complete an online questionnaire; and (4) willing to provide informed consent; were recruited into the study.

Data collection

The questionnaire link was disseminated using a snowball sampling method through social and academic networks, including friends and peers. Data collection was conducted within a 2-month timeframe. After reading the consent form, students were asked to provide their email address and university name. Personal identifications were not collected to maintain anonymity. Email addresses were used solely to prevent duplicate submissions.

Data Analysis

Data were analyzed using SPSS version 29, licensed to Chulalongkorn University. Descriptive statistics (frequencies and percentages) were used for categorical variables. For continuous data, the Kolmogorov–Smirnov test was applied to assess normality. Means and standard deviations were reported for normally distributed variables, while medians and interquartile ranges (IQRs) were reported for non-normal distributions. For the

dependent variable (current e-cigarette use), participants were categorized as “Yes” if they were current users and “No” otherwise. The 10-item Perceived Stress Scale (PSS-10) was used to assess stress levels in the past month. To assess the perceived influence of family, peers, and social media on e-cigarette use, the participants were asked about past/current e-cigarette using status by people in their social circle and the frequency of social media exposure to e-cigarette content. For Attitude, 5 Likert- scales were employed and classified into two groups using median and IQR (since the data were not normally distributed). Variables showing a p-value < 0.05 were included in the multiple logistic regression model. Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were reported, with significance set at p < 0.05.

RESULTS

The prevalence of current e-cigarette use among Thai undergraduate students in the Bangkok Metropolitan Region was 8.5% (Table 1), indicating that nearly one in ten students currently used e-cigarettes. The majority (91.5%) were non-current users. The majority of students demonstrated as female (63.1%), Moderate Stress (64.3%), never exposed to e-cigarette content on their social media platforms (45.4%), and had Negative Attitude toward E-cigarette use (53.7%). Moreover, most of participants reported had no e-cigarette users within their family and friends (Table 2).

Table 1 E-cigarette Use Status of the Study Participants (n = 482)

E-cigarette status	Frequency (n=482)	Percent (%)
Non-Use	441	91.5%
Current User	41	8.5%
Total	482	100.0%

Table 2 Descriptive finding of Gender, Psychological Influences, Social Influences, and Attitude and Perception Toward E-cigarette use (n = 482)

Factors	Frequency (n)	Percentage (%)
Gender		
Male	141	29.3
Female	304	63.1
LGBTQIAN+	37	7.7
Perceived Stress		

Factors	Frequency (n)	Percentage (%)
Low Stress	134	27.8
Moderate Stress	310	64.3
High Perceived stress	38	7.9
Mean (SD)	17.38 (6.505)	
Range (min-max)	0-36	
Father E-cigarette Use		
Non-Use	466	96.7
Current Use	16	3.3
Mother E-cigarette Use		
Non-Use	479	99.4
Current Use	3	0.6
Sibling E-cigarette Use		
Non-Use	442	91.7
Current Use	40	8.3
Friends E-cigarette Use		
Non-Use	365	75.7
Current Use	117	24.3
Colleagues E-cigarette Use		
Non-Use	228	47.3
Current Use	254	52.7
Romantic Partner E-cigarette Use		
Non-Use	178	36.9
Current Use	21	4.4
No Partner	283	58.7
Social Media related Content Exposure		
Never	219	45.4
Rarely	156	32.4
Sometimes	75	15.6
Often	23	4.8
Very Often	9	1.9
Attitude and Perception		
Negative Attitude (≤ 18)	259	53.7
Positive attitudes (> 18)	223	46.3
Median (Q1 and Q3)	18 (13-25)	
Range (min-max)	11-53	

The results of Chi-square analyses (Table 3) revealed several significant associations. The association was found between e-cigarette use and positive attitudes toward e-cigarettes ($p < 0.001$). Social influences also showed strong associations such as students who had siblings ($p < 0.001$), friends ($p < 0.001$), colleagues ($p = 0.002$), or romantic partners ($p < 0.001$) who used e-cigarettes were significantly more likely to be users themselves.

On the other hand, gender, stress level, parental smoking status, and frequency of social media exposure, were not significantly associated with e-cigarette use. Although stress level was initially hypothesized to be a contributing factor, Figure 1 shows no meaningful difference in stress scores between users and non-users, further supporting the non-significance of stress in the bivariate analysis.

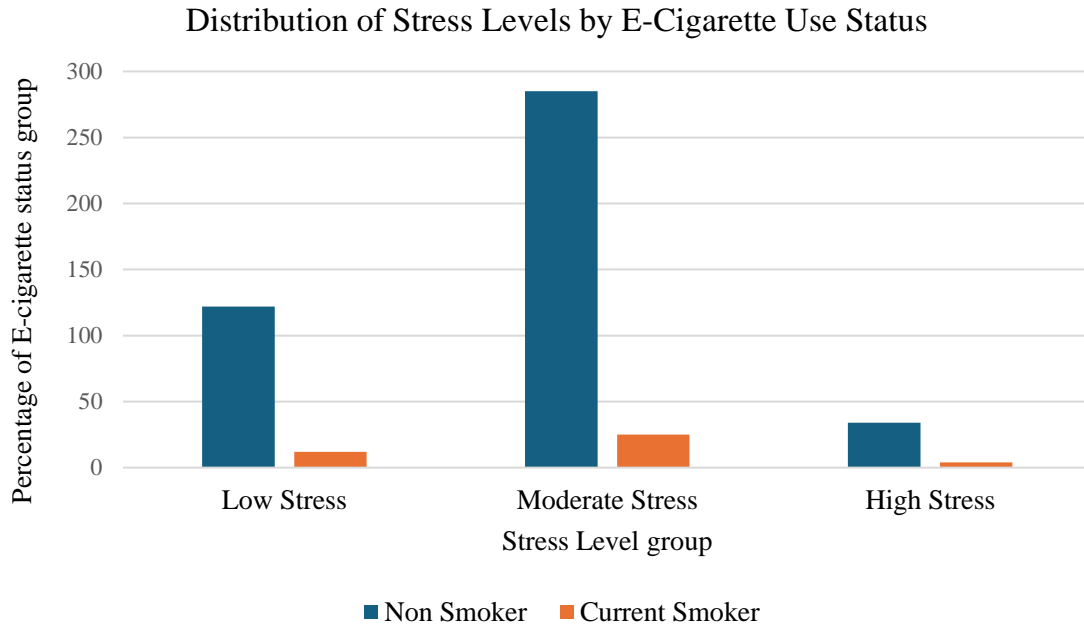
Table 3 Association between Gender, Psychological Influences, Social Influences, Attitude and Perception Toward E-cigarette use, and E-cigarette use (N=482)

General Characteristics	E-cigarette smoking status (n = 482)		Chi-square	p-value
	Current Smokers (n, %)	Non-current Smokers (n, %)		
Gender				
Male	17 (3.50%)	124 (25.7%)	3.987	0.136
Female	20 (4.10%)	284 (8.9%)		
LGBTQIAN+	4 (0.80%)	33 (6.8%)		
Stress Level				
Low Stress	12 (2.5%)	122 (25.3%)	0.312	0.856
Moderate Stress	25 (5.2%)	285 (59.1%)		
High Perceived Stress	4 (0.8%)	34 (7.1%)		
Father				
Nonsmoker	40 (8.3%)	426 (88.4%)	0.108	0.742
Current smoker	1 (0.2%)	15 (3.1%)		
Mother				
Nonsmoker	40 (8.3%)	439 (91.1%)	2.391	0.122
Current smoker	1 (0.2%)	2 (0.5%)		
Sibling				
Nonsmoker	31 (6.4%)	411 (85.3%)	15.247	< 0.001***
Current smoker	10 (2.1%)	30 (6.2%)		
Friends				
Nonsmoker	10 (2.1%)	355 (73.7%)	64.247	< 0.001***
Current smoker	31 (6.4%)	86 (17.8%)		
Colleagues				
Nonsmoker	10 (2.1%)	218 (45.2%)	9.438	0.002**
Current smoker	31 (6.4%)	223 (46.3%)		
Romantic Partner				
Nonsmoker	10 (2.1%)	168 (34.9%)	54.603	< 0.001***
Current smoker	11 (2.3%)	10 (2.1%)		
Do not have partner	20 (4.1%)	263 (54.6%)		
Social Media Approach				
Never	13 (2.7%)	206 (42.7%)	5.323	0.256
Rarely	16 (3.3%)	140 (9.0%)		
Sometimes	7 (1.55)	68 (14.1%)		
Often	3 (0.6%)	20 (4.1%)		
Very Often	2 (0.4%)	7 (1.5%)		
Attitude and Perception Toward E-cigarette use ^a				
Negative Attitude	1 (0.2%)	258 (53.5%)	47.33	< 0.001***
Positive Attitude	40 (8.3%)	183 (38.0%)		

a= Attitude and Perception Toward E-cigarette use categorized using median score (median = 18.00)

*= p-value < 0.05, **= p-value < 0.01, ***=p-value < 0.001

Figure 1 Comparison of Stress Levels Between Non-Smokers and E-Cigarette Users



The multiple logistic regression analysis (Table 4) revealed several significant predictors of e-cigarette use among participants. The most influential factor was a positive attitude toward e-cigarettes, which increased the odds of use by nearly 50 times (aOR = 49.864, $p < 0.001$). Social influences also played a substantial role such as participants with friends who used e-cigarettes were more than six times as likely to be users

themselves (aOR = 6.046, $p < 0.001$). While those with romantic partners who used e-cigarettes were nearly nine times more likely to engage in use (aOR = 8.88, $p = 0.002$). In contrast, factors such as perceived stress, frequency of social media exposure, and smoking behaviors of family members or colleagues were not statistically significant in predicting e-cigarette use.

Table 4 Logistic Regression Analysis of Factors Associated with E-Cigarette Use, Showing Adjusted Odds Ratios (aOR), 95% Confidence Intervals (CI), and Significance Levels

Variables	E-cigarette smoking status			
	p-value	aOR	95% CI	
			Lower	Upper
Social Influences				
Sibling				
Nonsmoker	Ref			
Current smoker	0.255	1.768	0.663	4.716
Friends				
Nonsmoker	Ref			
Current smoker	<.001***	6.264	2.549	15.398
Colleagues				
Nonsmoker	Ref			
Current smoker	0.919	0.951	0.364	2.485
Romantic Partner				

Nonsmoker	Ref			
Current smoker	<.001***	8.296	2.39	28.795
Do not have partner	0.248	1.662	0.702	3.938
Attitude and Perception Toward E-cigarette use				
Negative Attitude	Ref			
Positive Attitude	<.001***	30.066	3.988	226.639

*= p-value < 0.05, **= p-value < 0.01, ***=p-value < 0.001

DISCUSSION

The findings of this study revealed that 8.5% of the participating university students were current e-cigarette users. Although this prevalence appears lower than in some previous Thai studies, it still reflects a noteworthy public health concern, particularly given Thailand's legal ban on e-cigarette sales and possession. For example, a 2021 study among college students in Bangkok reported a higher current use rate of 22.2% (10), and national youth surveys have shown increasing trends in e-cigarette experimentation. This underscores the need for continued surveillance and the development of university-level interventions that address both behavior and perception.

Students who reported having friends who currently use e-cigarettes were more than six times more likely to be current users themselves (aOR = 6.264, 95% CI: 2.549–15.398, $p < 0.001$). This aligns with findings from prior studies suggesting that peer influence plays a dominant role in shaping smoking behavior among adolescents and young adults (11). Peers often act as behavior models and sources of e-cigarette access, thus normalizing use and diminishing perceived risks.

Students with romantic partners who currently smoked e-cigarettes were significantly more likely to use themselves (aOR = 8.296, 95% CI: 2.390–28.795, $p < 0.001$). This observation reflects the intimate influence of close relationships, where attitudes and behaviors, including substance use, are often shared or reciprocated (12)

Most notably, students with positive attitudes toward e-cigarettes were found to be 30 times more likely to use them compared to those with negative attitudes (aOR = 30.066, 95% CI: 3.988–226.639, $p < 0.001$). This extremely high adjusted odds ratio underscores the critical role of perception in health behavior.

Positive attitudes may stem from beliefs that e-cigarettes are less harmful than traditional tobacco products, as well as from perceptions of e-cigarettes as trendy or socially acceptable (13). As attitudes are potentially modifiable, these findings emphasize the need for health communication strategies that reshape beliefs around the risks and social implications of vaping.

CONCLUSION

This study assessed the prevalence and predictors of e-cigarette use among undergraduate students in the Bangkok Metropolitan Region. While the overall prevalence remains relatively modest at 8.5%, the analysis identified two key predictors which are positive attitudes toward e-cigarettes and social influence, particularly from friends and romantic partners.

These findings emphasize that interpersonal dynamics and personal beliefs have a greater impact on e-cigarette use than individual stress levels or social media exposure. To address this issue effectively, public health strategies should focus on peer-oriented interventions, campaigns that shift attitudes, and education that challenges the normalization of vaping behaviors in social settings.

Future research should explore longitudinal trends in usage and evaluate how factors such as policy shifts, digital environments, and public health messaging influence behavior. Such insights will be essential to strengthening the evidence base for effective prevention and control of e-cigarette use in Thailand.

RECOMMENDATION

Based on the findings, it is recommended that public health authorities and educational institutions implement targeted interventions aimed at reducing e-cigarette use among young adults. Programs should focus on correcting positive misconceptions about e-cigarettes

through health education and awareness campaigns. Since peer and partner relationships strongly influence usage, peer-led initiatives and group-based discussions may be especially effective. Furthermore, incorporating e-cigarette education into university health curriculums can help young people develop critical thinking about tobacco-related behaviors. Lastly, ongoing monitoring and research should be encouraged to track trends and evaluate the effectiveness of intervention strategies over time.

ETHICAL DECLARATION

In this study, primary data were utilized from google form research survey, the questionnaire were approved by the Research Ethics Review Committee for Research involving Human Research Participants, Group 1, Chulalongkorn University. While this research was translated into Thai. Additionally, the research was adhered to established ethical guidelines.

LIMITATIONS

This study has several limitations. First, its cross-sectional design prevents conclusions about causality; associations found do not confirm whether certain factors, like positive attitudes, cause or result from e-cigarette use. Second, the findings may not generalize to all Thai youth, as the sample focused only on undergraduate students in six Bangkok-based universities, excluding rural, vocational, and graduate populations. Lastly, reliance on self-reported online data introduces potential biases such as recall and social desirability bias. Despite these issues, the study offers important insights for future research and policy.

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PSYCHOLOGICAL RESILIENCE AND ITS ASSOCIATED FACTORS AMONG MYANMAR MIGRANTS IN MAE SOT, TAK PROVINCE OF THAILAND

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ABSTRACT

Introduction: Myanmar migrants in Mae Sot, Thailand, face stressors related to migration, acculturation, and socioeconomic challenges, making them vulnerable to mental health problems. Although studies have conducted about mental health conditions of Myanmar migrants, preventive mental health such as psychological resilience and its associated factors in Mae Sot remains limited.

Objectives: To assess levels of psychological resilience and examine associated factors among Myanmar migrants in Mae Sot, Thailand.

Methodology: A cross-sectional study was conducted among Myanmar migrants aged 18 and above, who had lived in Mae Sot for at least six months. Data was collected through face-to-face interviews using Brief Resilience Scale (BRS) which is a structured questionnaire that had been developed from validated tools. Descriptive analysis, chi-square test and binary logistic regression were performed using IBM® SPSS® version 25.

Results: Of the 241 participants surveyed, 55.6% reported low psychological resilience. Preliminary analysis using chi-square tests revealed statistically significant associations ($p < 0.05$) between psychological resilience and the participants' sex, acculturative stress, perceived stress, psychological distress, and social support. Binary logistic regression analysis revealed these associations. Male participants were significantly less likely to experience low psychological resilience compared to females (COR = 1.482; 95% CI: 1.046–2.096). Participants with low psychological distress were significantly less likely to report low resilience compared to those with high distress (COR = 3.714; 95% CI: 1.887–7.549). Similarly, those with low acculturative stress had significantly lower odds of low resilience compared to those with high acculturative stress (COR = 0.366; 95% CI: 0.142–0.943). Migrants with low perceived stress were also significantly less likely to report low resilience (COR = 3.968; 95% CI: 1.299–12.195) compared to those with high perceived stress. In addition, participants with low social support were nearly twice as likely to report low resilience compared to those with high social support (COR = 1.976; 95% CI: 1.160–3.366).

Conclusion: Over half of the Myanmar migrants surveyed reported low psychological resilience. These findings highlight the need for tailored mental health strategies, such as culturally sensitive counseling services, peer support groups, stress management programs, and interventions to enhance social support networks to strengthen resilience and improve psychological well-being and mental health in this vulnerable population.

Keywords: Psychological Resilience, Acculturative Stress, Perceived Stress, Preventive Mental Health, Social Support, Myanmar Migrants

INTRODUCTION

Human migration is the movement of people from one place to another in search of

better living conditions, including improved social and economic opportunities (1). Global

migration significantly influences public health, with migrants often encountering unique health challenges. Migration is often accompanied by traumatic experiences that can occur before departure, during the journey, or after resettlement (2). Their unique stressors, such as difficult migration journeys and socioeconomic adversity, can increase their risk of mental disorders like depression, anxiety, post-traumatic stress disorder, bipolar disorder, and schizophrenia (11).

Migrants face unique challenges such as undocumented status, labor exploitation, poor living conditions, and acculturation stressors, which significantly impact their mental health and resilience (3). Migrants are particularly vulnerable to anxiety, depression and post-traumatic stress disorder (PTSD) due to their exposure to multiple risk factors, including violence, war, and political persecution (4). These challenges exacerbate these difficulties for social integration of host country highlighting the need to address both pre- and post-migration factors when supporting the mental health of migrant populations (2).

In 2023, 1.3 million Myanmar people crossed the border, and in the first half of 2024, over 640,000 entries were reported, most of them came for work and safety (5). Therefore, Myanmar migrants in Mae Sot face legal insecurity, exploitative work conditions, and rising health needs. Exposure to adverse experiences has been shown to have negative consequences on health and wellbeing, though research on resilience offers a way to anticipate the appearance of maladaptive responses by strengthening protective mechanisms (6).

Generally, overall well-being of migrants can be significantly affected by a lack of resilience (7). Migrants with lower resilience are at a higher risk of developing mental health disorders, such as depression, anxiety, and post-traumatic stress disorder (PTSD), particularly evident among forced migrants who face traumatic experiences (8). Lack of resilience can hinder migrants' ability to adapt to new social environments, making difficulties in integrating into host communities leading to social isolation and a lack of support networks (7).

Psychological resilience is the capacity to absorb disturbances and use resources efficiently and it can contribute to positive functioning and well-being (9). Migrants with lower resilience are more likely to experience depression, anxiety, and post-traumatic stress disorder (PTSD) due to stressors such as acculturation challenges, social isolation, and trauma exposure (5, 10).

There is limited research focusing specifically on psychological resilience and its interaction with stressors in Mae Sot which creates a critical gap in understanding the protective factors that could mitigate mental health risks.

This study directly addresses this gap by examining the relationship between sociodemographic, socioeconomic, migration, health-related stressors and protective factors with psychological resilience among Myanmar migrants in Mae Sot.

Ethical approval was obtained from the Mahidol University Central Institutional Review Board (MUCIRB) prior to data collection. Local community leaders and civil society organizations in Mae Sot were contacted and informed about the research. A researcher and two research assistants were recruited and received one-day training, which covered research objectives, ethical considerations, data confidentiality, and interviewing techniques to ensure data quality. Data were collected through face-to-face interviews using a Myanmar-language structured questionnaire administered via Kobo Toolbox, which included validation checks and skip logic to enhance accuracy and completeness. Questions were clarified using simple terms under the supervision of the principal investigator, and responses were recorded anonymously to ensure confidentiality. The collected data were reviewed daily for quality control, and research assistants were contacted when clarification or verification was needed. All interview data were securely stored for one year following data analysis and were then permanently deleted.

METHODOLOGY

This cross-sectional study investigated the association between sociodemographic, socioeconomic, migration- and health-related

factors, stressors, protective factors, and psychological resilience among Myanmar migrants in Mae Sot, Tak Province. Mae Sot District is purposively selected due to its large migrant population. Three migrant communities were randomly chosen, and participants are selected using probability-proportional-to-size sampling. Voluntary response sampling is used during data collection, coordinated with community leaders.

Standardized and validated tools were used to assess psychological resilience and related psychosocial factors. The Brief Resilience Scale (BRS) was used to measure the ability to recover from stress, consisting of 6 items rated on a 5-point Likert scale. The BRS has demonstrated good internal consistency, with Cronbach's alpha ranging from 0.80 to 0.91 across various samples including migrants (12). It has also shown strong construct validity and good internal consistency in previous study of Myanmar migrants (13). The Interpersonal Support Evaluation List-12 (ISEL-12) assessed perceived social support across three dimensions: tangible, appraisal, and belonging support. The internal consistency of the social support scale was previously evaluated in a study among early middle-aged Myanmar migrant workers, showing a Cronbach's alpha exceeding 0.80, indicating good reliability (13). Acculturative stress was measured using the Acculturative Stress Scale (ASS-24), which includes 24 items addressing difficulties migrants face while adapting to a new cultural environment. It has demonstrated good internal consistency showing Cronbach's alpha of 0.89 and construct validity in previous study of Myanmar migrant populations (14).

Perceived stress levels were assessed using the 10-item Perceived Stress Scale (PSS-10), a widely used instrument for evaluating the degree to which individuals appraise situations in their lives as stressful. The previous study sample for Myanmar migrants has shown content validity and its Cronbach's alpha is 0.85 (14). All instruments were administered in the Myanmar language using face-to-face interviews, and

culturally adapted translations were reviewed for clarity and relevance in the local migrant context.

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics version 25. Descriptive statistics was used to summarize sociodemographic, socioeconomic, migration-related, and psychosocial variables. Categorical variables were presented as frequencies and percentages, while continuous variables were described using means and standard deviations. Binary logistic regression analysis was employed to examine the association between independent variables (such as demographic, socioeconomic, and psychosocial factors) and psychological resilience. Psychological resilience was treated as a binary outcome variable based on established cutoff scores. Crude odds ratios (COR) with 95% confidence intervals (CI) and p-values were calculated to identify significant predictors. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 presented the characteristics of the respondents ($n = 241$). The sample consisted of slightly more females than males. The majority of the participants were aged 30 years and below. The educational background was nearly equally divided, with 50.2% having education up to high school level and 49.8% having university-level or higher education. Most respondents had stayed in Mae Sot for more than one year, and were employed. Regarding marital status, 81.3% were single, divorced, separated, or widowed, while only 18.7% were married. A large proportion (76.3%) did not have health insurance, and 64.7% lacked legal documentation.

In terms of psychosocial characteristics, 51.9% of respondents reported low social support. The majority (80.5%) experienced high levels of psychological distress. Acculturative stress was reported as low by 52.3% of participants and high by 47.7%. For perceived stress, 54.4% of respondents had low levels while 45.6% reported high levels.

Table 1 Characteristics of respondents (N= 241)

Categories		Number	Percent (%)
Sex			
	Female	130	53.9
	Male	111	46.1
Age (years)			
	30 and below	194	80.5
	31 and above	47	19.5
Education level			
	Did not attend school to high school level	121	50.2
	University level and higher	120	49.8
Length of stay			
	6 months up to 1 year	39	16.2
	more than 1 year up to 3 years	88	36.5
	more than 3 years	114	47.3
Employment status			
	Employed	147	61
	Unemployed	94	39
Marital Status			
	Single/ Divorced/ Separated/ Widowed	196	81.3
	Married	45	18.7
Health Insurance			
	Yes	57	23.7
	No	184	76.3
Documentation status			
	Yes	85	35.3
	No	156	64.7
Social Support			
	Low	125	51.9
	High	116	48.1
Level of psychological distress			
	Low	47	19.5
	High	194	80.5
Level of acculturative stress			
	Low	126	52.3
	High	115	47.7
Level of perceived stress			
	Low	131	54.4
	High	110	45.6

Table 2 showed the association between independent variables and psychological resilience levels using chi-square tests. Several factors were found to be statistically significantly associated with psychological resilience. Sex was significantly associated with resilience, with a higher proportion of females (59.2%) reporting

low resilience compared to males (50.5%). Acculturative stress was significantly related to resilience ($p = 0.033$); respondents with high acculturative stress had a higher proportion of low resilience (67.0%) compared to those with low acculturative stress (44.4%). Social support was also significantly associated; individuals

with low social support had a greater proportion of low resilience (66.4%) compared to those with high support (43.1%). Psychological distress showed a strong association; among those with high psychological distress, 61.9% had low resilience, whereas only 29.8% of those with low distress had low resilience. Perceived stress was status, were not significantly associated with resilience levels in this analysis.

significantly associated with respondents of high perceived stress were more likely to report low resilience (64.5%) compared to those with low perceived stress (47.3%).

Other variables including age, education level, length of stay, employment status, marital status, health insurance, and documentation

Table 2 Association between independent variables and level of psychological resilience using Chi-square tests (N= 241)

Variables	Number	Level of psychological resilience (n, %)		P-value
		Low	High	
Sex				<i>0.034*</i>
Female	130	77 (59.2)	53 (40.8)	
Male	111	56 (50.5)	55 (49.5)	
Age				<i>0.795</i>
≤ 30 years old	194	110 (56.7)	84 (43.3)	
≥ 31 years old	47	24 (51.1)	23 (48.9)	
Education level				<i>0.171</i>
Did not attend school to high school level	121	70 (57.9)	51 (42.1)	
University level and lower	120	64 (53.3)	56 (46.7)	
Length of stay				<i>0.231</i>
6 months up to 1 year	39	22 (56.4)	17 (43.6)	
more than 1 year up to 3 years	88	55 (62.5)	33 (37.5)	
more than 3 years	114	57 (50)	57 (50)	
Employment status				<i>0.837</i>
Unemployed	94	55 (58.5)	39 (41.5)	
Employed	147	78 (53)	69 (47)	
Marital Status				<i>0.088</i>
Single/ Widowed/ Separated	196	115 (58.7)	81 (41.3)	
Married	45	19 (2.2)	26 (57.8)	
Health insurance				<i>0.068</i>
Yes	57	24 (42.1)	33 (57.9)	
No	184	110 (59.8)	74 (40.2)	
Documentation status				<i>0.764</i>
Yes	85	46 (54.1)	39 (45.9)	
No	156	88 (56.4)	68 (43.6)	
Level of acculturative stress				<i>0.033*</i>
Low	125	56 (44.4)	70 (55.6)	
High	116	77 (67)	38 (33)	
Social support				<i>0.036*</i>
Low	125	83 (66.4)	42 (33.6)	
High	116	50 (43.1)	66 (56.9)	

Variables	Number	Level of psychological resilience (n, %)		P-value
		Low	High	
Level of psychological distress				<i>0.000*</i>
Low	47	14 (29.8)	33 (70.2)	
High	194	120 (61.9)	74 (38.1)	
Level of perceived stress				<i>0.020*</i>
Low	131	62 (47.3)	69 (52.7)	
High	110	71 (64.5)	39 (35.5)	

Table 3 presents the results of binary logistic regression analysis examining factors associated with low psychological resilience. Several variables were found to be significantly associated with low resilience. Males were less likely to have low resilience compared to females (COR = 1.482, $p = 0.029$), suggesting females were more likely to report low resilience. Participants with lower education levels (high school or below) were significantly more likely to have low resilience than those with university-level education or higher (COR = 3.215, $p = 0.021$). Those with high acculturative stress had significantly greater odds of low resilience compared to those with low stress (COR = 2.731,

$p = 0.037$). Respondents with low perceived stress were less likely to have low resilience compared to those with high perceived stress (COR = 3.968, $p = 0.048$), indicating a protective effect. Individuals with low social support were nearly twice as likely to report low resilience compared to those with high support (COR = 1.976, $p = 0.012$). Participants with low psychological distress were significantly less likely to report low resilience than those with high distress (COR = 3.714, $p < 0.001$), showing a strong protective effect. Other variables, such as age and marital status, were not significantly associated with low resilience in this analysis.

Table 3 Binary logistic regression analysis of some variables associated with low psychological resilience

Predictor variable	Category	Level of psychological resilience		COR (95% CI)	p-value
		Low (%)	High (%)		
Age	≥30 years (Ref)	24 (51.1)	23 (48.9)	1.255	0.486
	≤31 years	110 (56.7)	84 (43.3)	(0.663-2.377)	
Sex	Female (Ref)	77 (59.2)	53 (40.8)	1.482	0.029*
	Male	56 (50.5)	55 (49.5)	(1.046–2.096)	
Marital Status	Single/ Other (Ref)	115 (58.7)	81 (41.3)	1.629	0.127
	Married	18 (40.0)	27 (60.0)	(0.871-3.046)	
Level of education	University level and above (Ref)	64 (53.3)	56 (46.7)	3.215	0.021*
	≤ High school level	70 (57.9)	51 (42.1)	(1.190- 8.696)	
Level of acculturative stress	Low (Ref)	56 (44.4)	70 (55.6)	2.731	0.037*
	High	77 (67.0)	38(33.3)	(1.061- 7.033)	
Level of perceived stress	High (Ref)	71 (64.5)	39 (35.5)	3.968	0.048*
	Low	62 (47.3)	69 (52.7)	(1.299- 12.195)	
Level of social support	High (Ref)	50 (43.1)	66 (56.9)	1.976	0.012*
	Low	83 (66.4)	42 (33.6)	(1.160- 3.366)	
	High (Ref)	119 (61.3)	75 (38.7)	3.714	

Predictor variable	Category	Level of psychological resilience		COR (95% CI)	p-value
		Low (%)	High (%)		
Level of psychological distress	Low	14 (29.8)	33 (70.2)	(1.887- 7.549)	

Table 4 presents the distribution of responses to the six items of the Brief Resilience Scale (BRS), which measures the ability to recover from stress. Items 2, 4, and 6 are negatively worded and reverse coding was used to interpret accurately. Overall, the findings reveal a mixed level of self-perceived resilience among respondents. Among 241 participants surveyed, 55.6% reported low psychological resilience, for positively worded statements such as “I tend to bounce back quickly after hard times” and “It does not take me long to recover from a stressful event”, a large proportion of respondents selected “neutral” (54% and 38%, respectively). This suggests that many individuals may be uncertain about their ability to recover from difficult experiences. However, item 5 (“I usually come through difficult times

with little trouble”) received the highest agreement (42% combined strongly agree and agree), indicating that some respondents do view themselves as relatively resilient.

For the negatively worded items, the majority of participants disagreed. For example, 58% disagreed or strongly disagreed with “I have a hard time making it through stressful events”, and 51% disagreed with “It is hard for me to snap back when something bad happens”. These responses reflect a tendency to deny vulnerability and indicate more resilience. In summary, while a portion of respondents demonstrate traits of resilience, the overall pattern reflects moderate psychological resilience, with many participants unsure about their capacity to recover from adversity.

Table 4 Percentages of respondents according to items of Brief Resilience Scale (BRS)

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I tend to bounce back quickly after hard times.	7%	26%	54%	10%	3%
*2. I have a hard time making it through stressful events.	0%	6%	36%	49%	9%
3. It does not take me long to recover from a stressful event.	5%	20%	38%	32%	6%
*4. It is hard for me to snap back when something bad happens.	2%	11%	36%	43%	8%
5. I usually come through difficult times with little trouble.	5%	37%	44%	12%	3%
*6. I tend to take a long time to get over setbacks in my life.	1%	18%	40%	35%	7%

*Negatively worded items with reverse coding for analysis

DISCUSSION

This study examined the sociodemographic and psychosocial characteristics associated with psychological

resilience among migrant respondents in Mae Sot. The findings revealed that a substantial proportion of participants experienced low

resilience, particularly among females, individuals with lower educational attainment, those with high acculturative and perceived stress, low social support, and high psychological distress. Statistically significant associations were observed between resilience and these key psychosocial factors. In contrast, variables such as age, marital status, employment, length of stay, health insurance, and documentation status did not show significant associations with resilience levels.

Binary logistic regression analysis further confirmed that low educational level, high acculturative stress, low social support, and high psychological distress were significant predictors of low psychological resilience. Importantly, perceived stress and psychological distress emerged as strong influencing factors, highlighting the impact of mental health burdens on resilience capacity.

RECOMMENDATIONS

Over half of the Myanmar migrants surveyed reported low psychological resilience. These findings highlight the need for tailored mental health strategies, such as culturally sensitive counseling services, peer support groups, stress management programs, and interventions to enhance social support networks to strengthen resilience and improve psychological well-being and mental health in this vulnerable population.

To address the factors associated with low psychological resilience among Myanmar migrants, several key recommendations are proposed. First, community support mechanisms should be strengthened by developing culturally appropriate programs such as migrant peer groups, community spaces, and psychosocial activities that foster emotional connections and reduce social isolation. Second, access to mental health services should be enhanced through the implementation of mobile or community-based interventions in migrants' native language, which can more effectively address stress, trauma, and acculturation challenges. Third, promoting educational and skill-building opportunities, including non-formal education, vocational training, and legal documentation can improve migrants' adaptability, self-efficacy, and social

integration. Moreover, further research using longitudinal or mixed-methods designs is recommended to explore causal relationships between stressors, coping mechanisms, and resilience, and to validate the use of resilience-related scales in migrant populations.

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EXPLORING WET NURSING PRACTICES AMONG LACTATING WOMEN DURING EMERGENCIES IN RAKHINE STATE, MYANMAR

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ABSTRACT

Introduction: The practice of breastfeeding non-biological children, commonly referred to as “wet nursing”, has a long-standing history across various cultures. Although extensively discussed in Western literature, wet nursing is underexplored in Southeast Asian settings, particularly in Myanmar. In emergency contexts, where maternal breastfeeding may be disrupted, wet nursing may serve as an important practice to ensure infant nutrition. However, there is limited research documenting this phenomenon in Rakhine State of Myanmar.

Objective: This study aimed to explore wet nursing situations among lactating women residing in Rakhine State, Myanmar during emergencies.

Methodology: A qualitative approach was adopted using semi-structured interviews with fifteen lactating women conducted in Sittwe, Capital of Rakhine in June 2025. Exploring three key themes covering awareness, perceived benefits and cultural acceptability (support) of wet nursing, all interviews were audio-recorded, transcribed and analysed thematically using MAXQDA software.

Results: Fifteen lactating women were interviewed, with nine having breastfed non-biological children. Four key themes emerged. “Compassion and Nurturing” revealed mothers breastfed other babies to ensure adequate feeding, believing their breast milk would protect infants from diseases and diarrhoea. Many expressed joy and satisfaction from nurturing other babies. “Rare but Time-honoured” highlighted while wet nursing existed in society through family traditions, mothers described it was uncommon but utilized during maternal death or breastfeeding difficulties. “Nameless” showed most participants reported no specific cultural term for wet nursing. Despite support from lactating women and husbands, limited broader community support was a shared concern revealed as “Unrecognised and Unsupported”.

Conclusion: Wet nursing remains a compassionate and functional practice among women in Rakhine State, particularly during emergencies. Yet it exists in a quiet space, acknowledged privately but lacking societal support or formal visibility. These findings suggest an opportunity for the Myanmar Nutrition Cluster and related partners to formally promote wet nursing as a life-saving practice during emergencies, using culturally sensitive community engagement strategies.

Keywords: Breastfeeding, Emergency, Rakhine, Wet Nursing

INTRODUCTION

Breastfeeding is recognized as a life-saving intervention that supports optimal growth and development in children. Initiating breastfeeding within the first hour of birth, practicing exclusive breastfeeding for the first six months, and continuing up to two years or beyond can prevent over 820,000 child deaths annually worldwide (1). However, not all mothers are able to breastfeed due to medical conditions such as chemotherapy, the use of contraindicated medications, or maternal death.

In some cases, adoptive families may lack access to a lactating mother (2, 3).

To address these gaps, the World Health Organization (WHO) recommends a hierarchy of infant feeding options. These include expressed breast milk from the infant’s own mother, breast milk from a healthy wet nurse, re-lactation, donor milk from human milk banks, and, when necessary, formula feeding using a cup (4). In emergency settings, where infants face heightened risks of malnutrition, illness, and death, breastfeeding remains the most effective intervention, and

wet nursing is one of the primary alternatives to ensure survival (5).

Wet nursing, the act of breastfeeding a non-biological child, is an ancient practice shaped by social and cultural traditions (6). Historically, it was employed in cases of maternal death, illness, or lactation failure, and even for social reasons such as preserving fertility or strengthening familial bonds. However, its prevalence declined in the 19th century due to rising use of formula, declining maternal mortality, and its marginalization within medical practice (7, 8). Nonetheless, contemporary studies have documented its continued, albeit rare, practice, especially during emergencies when infants are separated from their mothers or maternal breastfeeding is not feasible (9–11).

Myanmar has faced escalating conflict since the military coup on February 1, 2021 (12). As of recent reports, over 3.5 million people are internally displaced, with the highest proportions in Sagaing (35.74%), Rakhine (15.02%), and Magway (7.24%) regions (13). Rakhine State alone accounts for over 520,000 displaced individuals, the second highest in the country (13). Political instability has severely restricted humanitarian access, leading to widespread malnutrition among mothers and limiting access to clinics and nutritional support (14). In many cases, mothers were unable to produce breast milk, forcing infants to rely on diluted powdered milk (15). UNICEF also reported a rise in infant orphans, with many depending entirely on infant formula due to the sociocultural limitations around wet nursing in Rakhine and Shan states (16). Therefore, a comprehensive understanding of wet nursing is critical to developing culturally sensitive guidelines that help save infants' lives in emergencies.

Despite its historical and practical relevance, wet nursing remains underexplored in global and regional research, particularly within emergency settings. To the best of our knowledge, no study has specifically examined wet nursing practices in Rakhine State. This study seeks to fill that gap by exploring the realities of wet nursing among lactating women during emergencies in Rakhine, Myanmar.

METHODOLOGY

Study Design

This study employed a cross-sectional qualitative design using in-depth interviews.

Study Setting and Period

This study was conducted in Sittwe, the capital of Rakhine State, Myanmar, in June 2025. Sittwe is a coastal area that has been significantly affected by protracted conflict and displacement.

Sampling and Participant Recruitment

This study used the purposive sampling technique to recruit fifteen lactating women for an in-depth interview. Trainings for research assistants covered explanation of interview questions, interview techniques and practical sessions. Door to door method was used to recruit participants who were currently lactating, 18 years and above, and resided in Rakhine at least 6 months.

In-depth Interviews

In-depth interview questions were composed of six items covering the topic of awareness regarding wet nursing, local term of wet nursing, perceived benefits as well as cultural acceptability. To ensure validity, the questionnaire was reviewed by three academic experts. The back-to-back translation (English to Burmese) was confirmed by two experts to heighten linguistic correctness and cultural adequacy.

With voluntary participation, trained research assistants conducted face-to-face in-depth interviews in private settings, such as participants' homes, to ensure comfort and confidentiality. A semi-structured interview guide was used to facilitate the discussion. Each interview lasted approximately 10 to 15 minutes and was audio-recorded with participants' consent to ensure accurate data capture.

Data Analysis

The principal researcher transcribed the audio records and familiarized the data following Braun and Clarke's six-step framework. Thematic analysis was applied to identify recurrent themes, analyze, and report patterns using six phases (17). The data was imported into the MAXQDA Analytics Pro software (Version 24.5.1), recommended by

Creswell (18) for analysis inductively. After the data familiarization process, the highlighted key concepts and identified segments on written memos were assigned as codes. The research team reviewed initial codes derived the narratives, along with memos and assigned segments, and finalized the coding framework including codes, sub-themes and main themes. After compiling and checking the data situation, the principal researcher conducted a peer review with the team to ensure the result's credibility.

RESULT

The thematic analysis found that four themes, “Compassion and Nurturing”, “Rare but

Time-Honored”, “Nameless: Culturally Present, Linguistically Absent”, and “Unrecognized and Unsupported” were rooted among the lactating mothers. The descriptive analysis reports the demographic characteristics of the participants.

Demographic Characteristics

The median age of participants was 30 years (range: 20–40), and the median household size was 6 members (range: 4–10). As shown in Table 1, most participants (80%) lived in nuclear family settings, and 93% were married. The predominant religions represented were Buddhism (46.7%) and Islam (40%), reflecting the religious diversity within the study setting.

Table 1 Demographic characteristics of the participant (n=15)

Demographic Characteristics	Number	Percentage
Age (years)		
18-29	7	46.7
30-40	8	53.3
Household Member		
< 5	3	20.0
≥ 5	12	80.0
Family Type		
Nuclear	12	80.0
Extended	3	20.0
Marital Status		
Married	14	93.3
Divorced	1	6.7
Religion		
Buddhist	7	46.7
Islam	6	40.0
Hindu	2	13.3

Results from Thematic Analysis

Theme 1: Compassion and Nurturing

Mothers mentioned wet nursing not as a normal act, but as a deeply compassionate and communal act. It was often initiated to protect the lives of infants whose mothers had died or were unable to breastfeed. The codes “Feel satisfied” could support this theme.

“I feel satisfied with the support to breastfeed other babies” (ID-13)

“There is no harm in doing it (wet nursing) and the mother feels satisfied” (ID-3)

Mothers expressed their “Nurturing essence” for letting the baby feel full and stop agitation due to hunger. Some acknowledged the immunoenhancing and disease-preventive effects of breastmilk on life-threatening diarrhea, pneumonia, and malnutrition. The infant’s distress signals, such as crying, is a powerful stimulus for triggering their lactating kinship and wet nurse. “Be full”, “Free from frequent diseases”, and “Heartbroken” are the codes supporting the Compassionate and Nurturing care regarding the wet nursing.

“Baby’s stomach will be full due to breastfeeding from a wet nurse. It is good to get breastmilk from a wet nurse” (ID-3).

“Even though a baby’s mother cannot produce breastmilk, it is important to get breastfed from a wet nurse So that babies will be free from frequent diseases such as diarrhea and malnutrition” (ID-10,5)

“I breastfed that mother’s baby who was hungry, as I felt heartbroken and could not bear to see the baby crying” (ID-15)

Theme 2: Rare but Time-honored

Only a few mothers had seen wet nursing practiced, with the majority noting it was not a common practice in their community. Neighboring lactating mothers only served as wet-nurses in cases of maternal death, breastfeeding difficulties, and absence due to urgency. They believed that biological mothers, formula feeding, and awareness of wet-nurse-induced diseases were causing this practice to be seldom in the community.

“I think people in the community rarely use it. Mother should support breastfeeding other babies, especially in emergency conditions, such as baby mothers leave for work and the baby cries with hunger. Some mothers on behalf of their babies breastfed babies, but others gave bottle feeding” (ID-6)

“Other people practice wet nursing while some people don’t, as they fear transmission to their babies from the wet nurse..... I breastfeed other babies who are in need. I do not think that babies will get infections from a wet nurse through breastfeeding” (ID-9)

“When a mother cannot produce breastmilk, other should support mothers and babies to breastfeed.” (ID-2).

Despite a rare practice, many women acknowledged wet nursing as a time-honoured one. The practice has existed since the respondents’ adolescence, with many first learning about it through family members. In addition, several women experienced wet nursing firsthand by breastfeeding other babies, often within their extended families. The codes “since I was an adolescent”, “Old”, and “Breastfeed other babies... from strangers or relatives” developed the theme: “Time-honoured”.

“I heard it. To my understanding, families ask lactating mothers to breastfeed other babies who might be strangers or relatives, without fees or for no fees. I have heard about it since I was an adolescent, but not widely” (ID-6)

“But breastfeeding other babies is an old practice” (ID-3,4,6,7,8,12 and 13)

Theme 3: Nameless: Culturally Present, Linguistically Absent

During discussions about local terms for wet nursing, some mothers shared commonly used

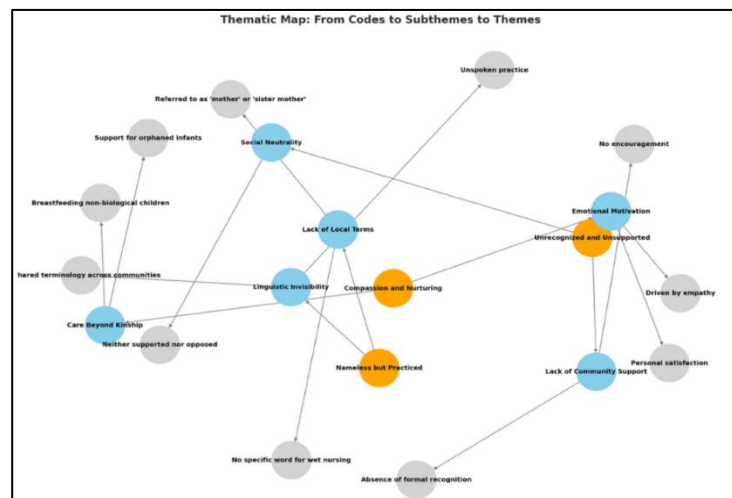


Figure 1 Thematic Map: From Codes to Subthemes to Themes: A visual representation of the thematic analysis process. Grey nodes represent participant-derived codes; blue nodes represent analytical subthemes; and orange nodes represent the final themes.

expressions such as “May May Chay” (Mother’s younger sister), “Du Du Mar” (Lactating Mother), or simply referred to the mother” or a “hired mother.” How

ever, most respondents emphasized that there was no specific linguistic term for wet nursing in any of the three communities, Rakhine, Muslim, or Hindu. Despite the absence of formal terminology, mothers still described and recognized the practice of wet nursing in their own words, as illustrated below:

“There is no word to describe this in our local terms in the Muslim Community. They ask for my help by saying, “Mother, can you breastfeed this child as the baby’s mother is busy with work”, and I breastfed them. (ID-1)

“I think there is no specific term for wet nursing. Just saying that, “here she comes, a mother who is going to breastfeed my baby”. (ID-4)

“I think there is no specific term for wet nursing” (ID 2,3,7,9,10,11,12, and 15)

Theme 4: Unrecognized and Unsupported

Mothers who engaged in wet nursing often did it without support or recognition. The community neither encouraged nor discouraged the practice, leaving it emotionally motivated but socially unacknowledged.

“Neither people support nor against breastfeeding to non-biological children. There is no one who is against or dislikes wet nursing” (ID-1)

“There is no support regarding wet nursing practice in the community” (ID-13)

“I have no idea with others, but I get no support by doing wet nursing. All mothers in here have pure hearts and motherly instincts” (ID-15).

DISCUSSION

This study aimed to explore wet nursing practices among lactating women during emergencies in Rakhine State, Myanmar. The narratives revealed that wet nursing was primarily driven by maternal compassion and empathy, often in response to maternal death, breastfeeding difficulties, or the physical absence of the infant’s mother. These findings align with previous literature documenting the resurgence of wet nursing during crises where maternal breastfeeding is

woman as “mother.” A few participants described the wet nurse as an “adopted

disrupted (8, 10). However, concerns about disease transmission, particularly through breast milk, emerged as a barrier to broader acceptance. A few participants expressed hesitation toward wet nursing, fearing it could harm infants. Such fears may contribute to the limited practice observed in some communities. Nevertheless, a recent systematic review identified fear of HIV transmission as a key reason for rejecting wet nursing, even recommending prioritization of trusted relatives as wet nurses in such contexts (8).

An unexpected finding was the linguistic absence of a specific term for wet nursing across the three major religious communities represented in the study. Although multiple terms exist globally, such as “allomaternal nursing,” “cross-nursing,” “shared breastfeeding,” and “non-maternal nursing”; none were recognized by participants. Instead, requests were made informally, such as “Mother, could you breastfeed my baby?” This highlights the cultural and semantic invisibility of the practice. Human behaviors are embedded within symbolic systems, where language plays a critical role in giving meaning to cultural practices (19). The absence of a clearly defined term for wet nursing may render it culturally ambiguous or socially undervalued, limiting both recognition and institutional support. This lack of cultural acknowledgment could explain why mothers in the study felt unsupported when engaging in wet nursing, despite expressing willingness to help. Recent literature emphasizes the importance of community and cultural support to sustain wet nursing and protect both the nursing mother and the non-biological child (8).

Given these findings, tailored interventions are needed to promote safe, culturally sensitive wet nursing as a life-saving practice during emergencies. Interventions should include community education to reduce stigma, guidelines for safe implementation, and support structures to normalize and protect wet nurses, ensuring that infants without access to their mother’s milk still receive the nutritional and immunological benefits of breastfeeding.

Strengths and Limitations of the study

This was the first study regarding wet nursing practices in Myanmar especially for Rakhine during emergencies. Qualitative research of wet nursing is scarce, but this study used an inductive qualitative methodology. Study used real-time data collection which could be considered a strength of the study. However, social-desirability bias may have occurred due to the nature of face-to-face interview. Therefore, the interview was conducted in a private area with trained research assistants.

CONCLUSION

This study highlights the current state of wet nursing practices among lactating women from diverse religious and cultural backgrounds in the emergency context of Rakhine, Myanmar. The findings show that wet nursing as an act of compassionate care and a time-honored tradition passed down through generations. In situations where maternal breastfeeding is not possible, wet nursing emerges as a feasible, safe, and contextually appropriate alternative for infants. To ensure its continued relevance and acceptance, awareness must be raised among lactating mothers and within the broader community to help normalize and destigmatize the practice. Additionally, supportive systems should be established to formally recognize and protect wet nurses. Without a distinct cultural terminology or symbolic framing, wet nursing risks being overlooked, despite its potential to save lives during crises.

RECOMMENDATIONS

Similar studies should be replicated in the comparable conflict settings such as Sagaing and Magway Regions, (13) and Shan State where infants had to rely on formula (16). For generalizability, quantitative research with randomly selected samples should be implemented. An ethnographic study could enhance insight into how wet nurses interact within sociocultural contexts. Myanmar Nutrition Cluster and its members should promote alternative infant feeding methods in emergencies, and the importance and benefits of wet nursing. Key message should emphasize the immediate benefits; wet nursing could save baby's life, it will fill baby's stomach and stop

baby from crying. Messages should also include such as wet nursing will bring satisfaction to wet nurses through this mutual support and it will also stimulate and maintain wet nurse breastmilk production. Well-designed wet nursing programs should be initiated including support system for wet nurses while normalization of the practice through community mobilization. Before programming in Muslim community, the awareness of milk kinship should be studied (9, 20).

ETHICAL CONSIDERATION

Ethical approval was obtained from the Research Ethics Review Committee for Research involving Human Research Participant, Group 1, Chulalongkorn University (COA. No. 152/68).

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THE PREVALENCE OF ALCOHOL USE DISORDER AND ASSOCIATED FACTORS AMONG ADULT ALCOHOL CONSUMERS IN YANGON CITY, MYANMAR

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ABSTRACT

Introduction: Alcohol Use Disorder (AUD) is a significant public health concern, particularly in rapidly urbanizing settings. Urban lifestyles, characterized by social pressures and pervasive advertising, contribute to increased alcohol consumption. In Myanmar, especially in Yangon City, evidence on the extent and determinants of AUD remains limited.

Objectives: This study aimed to (1) determine the prevalence of AUD and (2) identify associated factors among alcohol consumers in Yangon City, Myanmar.

Methodology: A cross-sectional analytical study was conducted among 334 alcohol consumers aged 25–64 years in Yangon using a self-administered online questionnaire. Snowball sampling was employed due to the hidden nature of the target population. The Alcohol Use Disorder Identification Test (AUDIT) was used to assess AUD, with a score of ≥ 8 indicating high-risk AUD. Descriptive statistics were used to determine prevalence, and binary logistic regression was used to analyze associated factors.

Results: The average age of participants was 39.9 years, and 44.9% were found to have high-risk AUD. Key reasons for alcohol use included emotional distress (38.9%), work-related drinking (94.9%), ease of access (57.2%), exposure to online advertisements (41.9%), and social influence (75.7%). Four significant predictors of AUD were identified: being male (AOR = 5.101; 95% CI: 1.958–13.288), social drinking (AOR = 4.077; 95% CI: 1.106–15.030), experiencing negative consequences from alcohol (AOR = 3.766; 95% CI: 1.633–8.683), and frequent alcohol consumption (AOR = 12.560; 95% CI: 2.412–65.416).

Conclusion: The study reveals a substantial prevalence of AUD among adults in Yangon and identifies key sociodemographic and behavioral factors. This underscores the urgent need for targeted public health strategies, including regulation of alcohol marketing, community education, and gender-sensitive interventions aimed at reducing harmful drinking behaviors in urban Myanmar.

Keywords: Alcohol use disorder, alcohol consumers, social drinking, alcohol inducement, Myanmar

INTRODUCTION

Today, social alcohol drinking continues to be associated with networking and elevated social status, while abstaining from alcohol often leads to social exclusion, highlighting the complex relationship between alcohol use and societal dynamics (1). Globally, alcohol consumption is significant, drunk by more than half of the population, and alcohol usage has surged globally over the last 30 years and is predicted to rise further (1). Myanmar reflects this trend, with 73% of individuals aged 15 and above consuming alcohol in 2016, driven by

increased availability and affordability (2). Alcohol Use Disorder (AUD), a medical condition characterized by an impaired ability to stop or control alcohol use despite adverse social, occupational, or health consequences (3), is a significant global health issue, encompassing a spectrum of conditions, including hazardous drinking, dependence, and addiction. These conditions lead to severe health consequences, including liver disease, heart and blood vessel disorders, mental health issues, and an increased risk of premature mortality (4). In poorer

countries, the morbidity and mortality risks are higher per liter of pure alcohol consumed than in higher-income countries (5).

Chen et al., 2024 mentioned the global AUD prevalence with a rate of 1326.3 (per 100,000) (6), causing an estimated 17 million life years lost in 2019 (7). In Southeast Asia, the rising prevalence of AUD is linked to urbanization and shifts in cultural attitudes toward alcohol consumption. According to 2019 data from the World Health Organization, the prevalence of AUD in Myanmar ranges from 2.7% to 6.2% (8).

Alcohol Use Disorder (AUD) has become a pressing concern in Myanmar nowadays, particularly in urban areas such as Yangon, where exposure to modern social and environmental influences drives higher alcohol intake. In Myanmar, alcohol consumption has been gradually growing since 2000. Men continuously consumed more alcohol than women, with male consumption peaking in the late 2010s before declining somewhat in 2020 (9). Women consumed significantly less alcohol, but their drinking habits steadily rose over time, indicating a shift in cultural and societal dynamics. These findings demonstrate the impact of gender roles and shifting societal attitudes on alcohol use (9). Therefore, a steady increase in alcohol-related health problems due to various factors can be seen for years, especially among the adult population, including young adults.

Despite this growing concern, the dynamics of AUD in urban centers, such as Yangon, remain poorly understood. Existing research has predominantly focused on rural populations or national trends, thereby neglecting the unique sociocultural and environmental factors prevalent in urban settings. Furthermore, the 2021 coup and subsequent decline in Myanmar's healthcare infrastructure have significantly hindered data collection and the publication of updated research. This gap in urban-specific data severely limits the development of targeted and effective public health interventions. This study, therefore, aims to directly address these critical knowledge gaps by investigating the prevalence of AUD and identifying associated factors among alcohol consumers in Yangon City. The findings will provide crucial evidence for developing targeted

public health strategies, informing policy development, and designing culturally relevant interventions to mitigate alcohol-related harm in Yangon.

METHODOLOGY

Study Area

The research design is a cross-sectional study, selecting 33 townships in Yangon City as the study area, which is the heart of the alcoholic beverage sector, and because of its high population density, fueled by widespread rural-to-urban migration and fast urbanization (10), making it an ideal location for researching alcohol use trends and their relationship to AUD.

Study Population

The study targeted adult alcohol consumers aged 25 to 64 years who had resided in any of the 33 townships of Yangon City for more than six months. Eligibility was determined by self-reported consumption of any alcoholic beverage at least once per month during the past twelve months.

Sampling Technique and Measurement Tools

Snowball sampling was employed to reach this hidden population of alcohol consumers, who may not be easily accessible through traditional sampling frames. The initial "seeds"—participants who met the inclusion criteria—were invited through personal networks and online communication platforms. These individuals were then asked to recruit others in their circles.

To broaden outreach, a bilingual recruitment flyer was disseminated in English and Burmese, including a study overview, eligibility criteria, and a QR code linking to the self-administered Google Form questionnaire. Partnerships were also established with local liquor retailers, bars, and clubs to promote the survey among their patrons.

The questionnaire comprised six sections: screening questions, sociodemographic characteristics, societal influences, accessibility, alcohol consumption patterns, and the AUDIT tool. While the AUDIT (Alcohol Use Disorder Identification

Test) is a standardized and validated tool developed by WHO, the remaining parts of the questionnaire were newly designed based on the Social-Ecological Model. All items were translated into Burmese and back-translated to ensure linguistic and conceptual accuracy.

A pilot test was conducted among 30 individuals in Mandalay City, which shares demographic similarities with Yangon. Content validity was assessed by three experts, achieving an IOC score > 0.8. Based on pilot feedback, minor revisions were made to enhance clarity and cultural relevance, including simplification of terms, reordering of questions, and removal of ambiguous language.

A total of 369 responses were initially collected. After excluding 35 responses for incompleteness or failure to meet inclusion criteria, 334 responses were included in the final analysis.

Variables

Independent variables included four domains: (1) Sociodemographic characteristics (age, gender, religion, education, income, and occupation), (2) Society factors (social behavior, personal beliefs, social influence, and family influence), (3) Accessibility factors (physical access, advertisement exposure, and discounts), and (4) Consumption factors (duration, frequency, type, brand, and amount of alcohol consumed).

The dependent variable was Alcohol Use Disorder (AUD), measured using the WHO-developed Alcohol Use Disorder Identification Test (AUDIT). The AUDIT consists of 10 items that assess recent alcohol consumption, drinking behavior, and alcohol-related problems. An AUDIT score of 8 or above was considered indicative of high-risk or hazardous drinking, consistent with international and WHO guidelines (11). Participants scoring below 8 were categorized

as low-risk consumers, while those scoring 8 or above were considered high-risk drinkers with potential AUD.

Statistical Analysis

Data were initially entered into Google Sheets and verified by the principal investigator to ensure completeness and consistency. Responses were cleaned, coded, and exported into Microsoft Excel before being imported into SPSS version 29.0.2.0 (licensed to Chulalongkorn University) for final analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the sociodemographic characteristics, drinking patterns, and AUD prevalence. Bivariate analysis was conducted using binary logistic regression to examine the association between each independent variable and the outcome variable (high-risk AUD). Variables with p-values less than 0.05 in bivariate analysis were subsequently included in the multivariable logistic regression model to identify independent predictors of AUD. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported for each factor. Missing data were addressed through listwise deletion. All statistical tests were two-tailed, with a significance level set at $p < 0.05$.

RESULTS

Sociodemographic profile

Among the 334 participants, the mean age was 39.9 years. Most respondents (71.6%) were male, while 28.4% were female. Notably, a greater proportion of males had lower educational attainment (80.9% of those with basic education were male), whereas a higher proportion of females (41.1%) had completed higher education. In terms of income, 73.6% of males were in the lowest income category, whereas females were more represented in higher income brackets. **Table 1** presents the detailed breakdown.

Table 1 Sociodemographic profile of the participants

Characteristics	Total (N = 334)	Male	Female
	n (%)	n (%)	n (%)
Age			

Characteristics	Total (N = 334)	Male	Female
	n (%)	n (%)	n (%)
< 38 years	155 (46.4%)	99 (63.9%)	56 (36.1%)
≥ 38 years	179 (53.6%)	138 (77.1%)	41 (22.9%)
Gender			
Male	237 (71.6%)		
Female	97 (28.4%)		
Others	0		
Religions			
Buddhist	309 (92.5%)	216 (69.9%)	93 (30.1%)
Islam	11 (3.3%)	11 (100%)	0
Christian	10 (3%)	7 (70%)	3 (30%)
Hindu	4 (1.2%)	3 (75%)	1 (25%)
Education			
Basic education (Lower than primary school – High school)	183 (54.8%)	148 (80.9%)	35 (19.1%)
Higher education (University level – Bachelor’s degree and above)	151 (45.2%)	89 (58.9%)	62 (41.1%)
Monthly income			
299,999 MMK and below	121 (36.2%)	89 (73.6%)	32 (26.4%)
300,000 MMK – 599,999 MMK	108 (32.3%)	78 (72.2%)	30 (27.8%)
600,000 MMK – 899,999 MMK	61 (18.3%)	37 (60.7%)	24 (39.3%)
900,000 MMK and above	44 (13.2%)	33 (75%)	11 (25%)
Occupation			
Government officers	23 (6.9%)	17 (73.9%)	6 (26.1%)
Private employees	124 (37.1%)	84 (67.7%)	40 (32.2%)
Self-employed	180 (53.9%)	131 (72.8%)	49 (27.2%)
Student	1 (0.3%)	1 (100%)	0
Unemployed	6 (1.8%)	4 (66.7%)	2 (33.3%)

Prevalence of Alcohol Use Disorder and Drinking Behaviors

AUD prevalence among the sample was 44.9%, based on AUDIT scores ≥ 8 . Drinking frequency showed gender disparity: 39.7% of males drank four or more times weekly compared

to only 10.3% of females. Similarly, males were more likely to consume larger quantities per occasion and report binge drinking (six or more drinks). The frequency of alcohol-related problems, such as failure to stop drinking or drinking-related interference with

responsibilities, was also significantly higher based results. among males. Table 2 summarizes the AUDIT-

Table 2 Alcohol Use Disorder Identification Test Results of the participants

Characteristics	Total (N = 334) n (%)	Male (n = 237) n (%)	Female (n = 97) n (%)
Frequency of drinking alcohol			
(0) Never	0	0	0
(1) Monthly or less	77 (23.1%)	32 (13.5%)	45 (46.4%)
(2) 2 to 4 times a month	75 (22.5%)	48 (20.3%)	27 (27.8%)
(3) 2 to 3 times a week	78 (21.9%)	63 (26.6%)	15 (15.5%)
(4) 4 or more times a week	104 (31.1%)	94 (39.7%)	10 (10.3%)
Amount of alcohol drunk in a typical day			
(0) 1 drink or 2 drinks	111 (33.2%)	53 (22.4%)	71 (45.5%)
(1) 3 drinks or 4 drinks	160 (47.9%)	127 (53.6%)	22 (16.3%)
(2) 5 drinks or 6 drinks	47 (14.1%)	42 (17.7%)	1 (3%)
(3) 7, 8, or 9 drinks	14 (4.2%)	13 (5.5%)	0
(4) 10 or more drinks	2 (0.6%)	2 (0.8%)	1 (20%)
Frequency of having six or more drinks on one occasion			
(0) Never	210 (62.9%)	130 (54.9%)	80 (82.5%)
(1) Less than monthly	84 (25.1%)	69 (29.1%)	15 (15.5%)
(2) Monthly	19 (5.7%)	18 (7.6%)	1 (1%)
(3) Weekly	10 (3%)	10 (4.2%)	0
(4) Daily or almost daily	11 (3.3%)	10 (4.2%)	1 (1%)
Frequency of finding themselves unable to cease drinking once begun in the past year			
(0) Never	264 (79%)	170 (71.7%)	94 (96.9%)
(1) Less than monthly	52 (15.6%)	49 (20.7%)	3 (3.1%)
(2) Monthly	6 (1.8%)	6 (2.5%)	0
(3) Weekly	8 (2.4%)	8 (3.4%)	0
(4) Daily or almost daily	4 (1.2%)	4 (1.7%)	0
Frequency of drinking preventing from fulfilling responsibilities			
(0) Never	266 (79.6%)	176 (74.3%)	90 (33.5%)
(1) Less than monthly	55 (16.5%)	49 (20.7%)	4 (7.7%)

(2) Monthly	8 (2.4%)	8 (3.4%)	0
(3) Weekly	4 (1.2%)	3 (1.3%)	1 (25%)
(4) Daily or almost daily	1 (0.3%)	1 (0.4%)	0

Frequency of drinking in the morning after heavy drinking in the past year

(0) Never	268 (80.2%)	179 (75.5%)	89 (91.8%)
(1) Less than monthly	55 (16.5%)	47 (19.8%)	8 (8.2%)
(2) Monthly	7 (2.1%)	7 (3%)	0
(3) Weekly	4 (1.2%)	4 (1.7%)	0
(4) Daily or almost daily	0	0	0

Frequency of feeling guilty or remorseful after drinking in the past year

(0) Never	261 (78.1%)	171 (72.2%)	90 (92.8%)
(1) Less than monthly	52 (15.6%)	46 (19.4%)	6 (6.2%)
(2) Monthly	12 (3.6%)	12 (5.1%)	0
(3) Weekly	4 (1.2%)	4 (1.7%)	0
(4) Daily or almost daily	5 (1.5%)	4 (1.7%)	1 (1%)

Frequency of experiencing challenges recalling events from the previous night due to alcohol consumption in the past year

(0) Never	278 (83.2%)	192 (81%)	86(30.5%)
(1) Less than monthly	47 (14.1%)	37 15.6%)	8 (18.6%)
(2) Monthly	7 (2.1%)	7 (3%)	0
(3) Weekly	2 (0.6%)	1 (0.4%)	1 (50%)
(4) Daily or almost daily	0	0	0

You or someone else been injured as a result of your drinking.

(0) No	300 (89.8%)	205 (86.5%)	95 (97.9%)
(2) Yes, but not in the last	24 (7.2%)	22 (9.3%)	2 (2.1%)

year

(4) Yes, during the last year	10 (3%)	10 (4.2%)	0
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Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut it down?

(0) No	174 (52.1%)	101 (42.6%)	73 (75.3%)
(2) Yes, but not in the last	24 (7.2%)	21 (8.9%)	3 (3.1%)

year

(4) Yes, during the last year	136 (40.7%)	115 (48.5%)	21 (21.6%)
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Prevalence of Alcohol Use Disorder

Low risk (scores of < 8)	184 (55.1%)	100 (42.2%)	84 (86.6%)
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High risk (scores of ≥ 8)	150 (44.9%)	137 (57.8%)	13 (13.4%)
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Factors Associated with High-Risk AUD

Bivariate logistic regression analysis identified several significant associations with high-risk AUD. These included male gender, lower education, higher frequency and quantity of drinking, social drinking behavior, negative consequences of alcohol use, and ease of accessibility to alcohol.

Multivariable logistic regression confirmed

four key independent predictors: male gender (AOR = 5.101; 95% CI: 1.958–13.288), social drinking (AOR = 4.077; 95% CI: 1.106–15.030), experience of negative consequences (AOR = 3.766; 95% CI: 1.633–8.683), and frequent alcohol consumption (AOR = 12.560; 95% CI: 2.412–65.416). Full regression results are presented in Table 3.

Table 3 Significant associations with Alcohol Use Disorder

Characteristics	B	AOR (95% CI)	P -value
Gender			
Male	1.629	5.101 (1.958-13.288)	<0.001**
Female		reference	
Presence of social drinking			
Yes	1.405	4.077 (1.106-15.030)	0.035*
No		reference	
Having negative consequences of alcohol drinking			
Yes	1.326	3.766 (1.633-8.683)	0.002**
No		reference	
Frequency of alcohol consumption			
3-4 days a week	1.696	5.451 (1.113-26.686)	0.036*
5-6 days a week	2.310	10.075 (1.720-59.026)	0.010*
Everyday	2.531	12.560 (2.412-65.416)	0.003**
Once a month		reference	

**p value < 0.01 = Highly significant, *p value < 0.05 = Significant, AOR = Adjusted odd ratio

DISCUSSION

The study includes 334 participants and focuses on Alcohol Use Disorder among adult alcohol consumers aged between 25 and 64 years in Yangon City. Most of the respondents are above 38 years old, which reflects the cumulative effects of prolonged alcohol consumption habits in this demographic group, and predominantly

males, with 237 participants. This pattern is consistent with prior research conducted across Southeast Asia, where male dominance in alcohol use has been attributed to sociocultural norms, gender roles, and greater social permissiveness toward male drinking behaviors (2). Higher educational attainment becomes a protective factor against AUD. The higher the education

level, the more likely to exhibit healthy drinking behavior. More than half of the participants have completed only basic education (up to high school), and most of this population with basic education is more likely to develop AUD. This is consistent with existing literature, which strongly suggests that education level not only affects alcohol drinking behavior but also mediates the health consequences. A study done in the United States found that those with lower educational attainments were nearly 50% more likely to have alcohol dependence than those with higher education (12).

People with low incomes are more prone to the health consequences of alcohol consumption than those with high incomes. It is commonplace in this locality for cheap native liquors or unrecorded "country" alcohol to be sold from roadside stalls and local stores in recycled containers or small sachets. Their price is only a fraction of that of brand-name products, as they are generally exempt from tax. However, as their quality varies and their labels are often incorrect or non-existent, these drinks may contain added toxic impurities—all factors that can significantly increase the danger to buyers' lives (13). When people are financially hard-up, that does not stop them from drinking alcohol, pushing them towards the lower-quality, stronger stuff, or sharing of bottles between friends, both of these patterns have close links with binge sessions and dependence (13).

The age of first alcohol consumption plays a crucial role in AUD development. 87% of the Lebanese adolescents had started drinking alcohol before the age of 14, and the ease of access to alcohol explained it (14). A study done in a rural community of Central Thailand identified that the average age at initiation of alcohol consumption was 13.9 years, and nearly 60% of drinkers started alcohol use at the age of less than 15 years (15).

In this study, almost half of the population had taken their first drink by age 22, and males reported starting as early as nine and females at the age of 16. This pattern is consistent with prior research showing that earlier initiation, drinking before ages 13–15, is linked to more frequent and problematic alcohol use and a higher risk of Alcohol Use Disorder, across adolescence and adulthood (16). A study found that the

younger the age at which people started to drink, the greater their likelihood of developing alcohol dependence within 10 years of drinking onset and before age 25 years (17).

The alcohol experience is the result of an interaction between the alcohol, the user, and their environment (18). Individual drinking habits are heavily influenced by those with whom they spend most of their time: family and peers (19). A study discovered that those who got support from close friends were more than twice as likely to develop problematic alcohol usage (20). The majority of the population in this study are social drinkers, which is significantly associated with the high risk of AUD, with four times higher odds than non-social drinkers.

Some of the most serious negative consequences of alcohol use are explicitly linked to social consumption (21). More than half of the participants acknowledge experiencing negative consequences, leading to AUD. This finding is consistent with the studies. Individual-level studies show that people with AUD are at increased risk of suicidal ideation (1.86 times), self-harm (3.13 times), and completed suicide (2.59 times). Studies show that heavy drinking in the event increases suicide risk among drivers with alcohol use disorder; road crash risk is at least twice that of non-dependent drivers (22).

The literature on community influences on alcohol use generally examines environmental factors, including neighborhood features and alcohol availability (19). The findings of this study highlight the significant role that alcohol accessibility plays in the risk of developing Alcohol Use Disorder (AUD). Notably, participants who have easy access to purchasing alcohol from nearby shops are more likely to report high-risk AUD. The findings in this study are consistent with a study showing that people living in places with higher alcohol outlets did not increase their drinking days, but increased their drinking amount up to 21% per week (23). The source through which participants became aware of alcohol promotions influences AUD risk. Information obtained through shop advertisements and word of mouth was associated with high-risk AUD.

Longer duration of alcohol consumption

is linked to higher AUD risk. Participants who have been drinking for more than 10 years are more likely to develop high-risk AUD. Respondents who prefer local brands are at a higher risk of AUD; however, the association was not statistically significant. Participants who reported purchasing alcohol three to four days per week, five to six days per week, or daily exhibited significantly higher odds of high-risk AUD, aligning with existing literature indicating that increased frequency of alcohol acquisition is a reliable indicator of problematic alcohol use.

The prevalence of AUD among the Myanmar migrant workers living in Mae Sot was 12.3% (24). According to the World Health Organization (2024b), the prevalence of AUD in Myanmar among those 15 years and above in 2019 was approximately 6.2%. The prevalence of AUD in 33 townships in Yangon City, Myanmar, is 44.9% in 2025. Unlike the previous situation, the current study was done in a small region of Myanmar. Therefore, compared to other values, the prevalence of AUD in this sample is considerably high, underscoring the need for gender-sensitive strategies in alcohol harm reduction and targeted prevention programs, particularly focusing on male populations.

CONCLUSION

This study found that nearly half (44.9%) of adult alcohol consumers in Yangon are at high risk of Alcohol Use Disorder (AUD). The most significant factors associated with high-risk AUD were male gender, social drinking behavior, frequent alcohol use, and experiencing negative consequences from drinking. These findings highlight the substantial burden of harmful alcohol use in Myanmar's largest urban area, underscoring the need for urgent public health attention. The study contributes important evidence on the urban-specific drivers of AUD in Yangon, a city where cultural norms, accessibility, and commercial influences reinforce risky drinking patterns. This research fills a gap in the existing literature by offering a city-level analysis in a country with limited alcohol-related data.

LIMITATION

This study has several limitations. The cross-sectional design restricts the ability to infer

causal relationships between risk factors and AUD outcomes. Snowball sampling, while practical for reaching hidden populations, may introduce selection bias and limit the generalizability of findings to the broader population of Yangon. Additionally, all data were self-reported, which could lead to recall bias or social desirability bias—particularly in reporting alcohol-related behaviors that may be considered sensitive or stigmatized. Despite these constraints, the study provides valuable insights into alcohol use patterns in an underrepresented urban context.

RECOMMENDATION

At the national level, strengthening policy enforcement and creating urban-specific alcohol control measures are urgently needed. These should include restrictions on alcohol marketing, particularly visual and online advertisements, and the implementation of taxation or pricing strategies to deter excessive consumption. At the community level, local authorities and public health sectors should expand health education programs to raise awareness of the dangers of heavy drinking. Collaboration with non-governmental organizations can help deliver peer-led prevention and support initiatives. At the individual level, early identification of at-risk drinkers using tools such as the AUDIT questionnaire should be promoted in clinical settings, workplaces, and community outreach programs. Counseling and rehabilitation services must also be made accessible to support recovery.

FUTURE RESEARCH

Future research should focus on longitudinal studies to track the progression and outcomes of AUD in urban populations. Including younger age groups (aged 15 and older) is crucial given the increasing trend of alcohol consumption among adolescents. Moreover, mixed-method studies can help uncover the psychological, social, and environmental mechanisms that drive harmful drinking in urban Myanmar. These efforts will be vital to inform culturally appropriate and evidence-based interventions that reduce the impact of alcohol-related harm across different levels of society.

ETHICAL DECLARATION

This study was reviewed and approved by the Human Research Ethics Review Committee, Set 1, Chulalongkorn University (Ref No. 169/68), and the Ethics Review Committee of the Ministry of Health, National Unity Government, Myanmar (Ethics/NUG-MOH/2025/05). Informed consent was obtained from all participants before their participation.

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ENABLERS, BARRIERS AND COPING STRATEGIES IN ACCESSING MATERNAL HEALTHCARE AMONG WOMEN IN CONFLICT-AFFECTED RAKHINE STATE, MYANMAR: A QUALITATIVE STUDY

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ABSTRACT

Introduction: Maternal health is a critical global public health concern. Access to quality services—including antenatal care (ANC), skilled birth attendance, and postnatal care (PNC)—is essential for ensuring positive outcomes. In Myanmar, particularly in Rakhine State, maternal health service coverage is significantly lower than the national average and has worsened due to armed conflict since November 2023. While existing research points to service decline in conflict settings, it offers limited understanding of women's personal experiences and coping strategies. Moreover, there is a lack of studies in Rakhine State on maternal healthcare under conflict. This study addresses a critical evidence gap and also contributes to SDG 3 and SDG 5 by exploring this intersection in a conflict-affected setting.

Objectives: This study explores the enablers and barriers to maternal healthcare access during conflict in Rakhine State and examines the coping strategies women use to navigate these challenges.

Methodology: A qualitative design using in-depth, semi-structured interviews was conducted with 12 women and 3 healthcare providers in Kyauktaw Township. Participants were recruited through purposive and snowball sampling. The Social Ecological Model (SEM) was used to examine multi-level influences on maternal healthcare access, while the Transactional Theory of Stress and Coping (TTSC) guided the analysis of women's coping strategies. The study employed the Social Ecological Model and the Transactional Theory of Stress and Coping to analyse multi-level influences. Thematic analysis guided the identification of key themes.

Results: Findings reveal multi-level barriers to maternal healthcare access. At the individual level, financial hardship, limited health knowledge, and psychological stress hindered ANC, delivery, and PNC. Interpersonal barriers included male migration, restricted decision-making, and lack of support. Community-level obstacles involved insecurity, blocked transport, displacement, and traditional beliefs. Organizational challenges included hospital closures, staff shortages, supply disruptions, and referral delays due to military blockades. Discrimination based on financial status was reported. At the policy level, disrupted governance and movement restrictions limited service continuity. Enablers included prior health knowledge, family support, community solidarity, NGO assistance, and health worker improvisation. Women employed diverse coping strategies, from problem-focused actions like improvising transport and seeking alternative providers to strong reliance on emotion-focused strategies such as acceptance, spiritual beliefs, and self-talk to manage uncontrollable stressors. Providers adapted under resource and security constraints.

Conclusion: Conflict in Rakhine State imposes complex, multi-level barriers to maternal healthcare, forcing women to rely on resilience and informal support networks to cope with unsafe and under-resourced systems. These insights underscore the urgent need for multi-level and integrated interventions, including strengthened health governance, protection of health facilities, supply preparedness, financial protection mechanisms, and the involvement of local actors in culturally competent service delivery.

Keywords: Conflict-affected communities, Coping strategies of women, Maternal healthcare, Myanmar, Rakhine State

INTRODUCTION

Maternal health remains a critical global public health concern, encompassing the well-being of women throughout pregnancy, childbirth, and the postpartum period (1). Access to quality maternal healthcare services, including antenatal care (ANC), skilled birth attendance (SBA), and postnatal care (PNC), is fundamental for ensuring positive maternal and neonatal outcomes. Despite global efforts to achieve the Sustainable Development Goal (SDG) of reducing maternal mortality, significant challenges persist, particularly in low- and middle-income countries (LMICs) where health systems are often under-resourced and fragile (2-5). Myanmar, for instance, faces substantial maternal health hurdles, evidenced by its high maternal mortality ratio (MMR) of 179 deaths per 100,000 live births in 2020, positioning it as the second highest in the Southeast Asia Region (6).

Within Myanmar, access to maternal health services is not uniform, with Rakhine State experiencing considerably lower coverage and utilization compared to the national average. In 2019, about 78 percent of women in Rakhine State received at least one ANC visit, but this dropped to 55 percent by the fourth visit (7). Fewer than 40 percent of women gave birth in a health facility, and PNC coverage was around 64 percent, which was lower than in many other states (7). The situation has been exacerbated by the armed conflict in Rakhine State, which intensified in November 2023. This ongoing violence has led to severe humanitarian challenges, including restrictions on access to care, mass displacement, shortages of supplies, and increased protection risks, significantly hindering pregnant women's ability to access essential services (8).

Existing research on maternal healthcare in conflict-affected settings, such as Syria and several African countries, often points to a decline in the use of services like ANC, skilled delivery, and PNC (9-11). However, these studies offer limited understanding of the personal experiences and coping strategies of women living in such contexts. In Rakhine State, there are

very few studies exploring the factors that influence the use of maternal health services such as ANC, childbirth, and postnatal care. No research has specifically examined how women access these services during periods of conflict. To address this important gap, the present study aimed to explore the experiences of women in conflict-affected areas of Rakhine State, focusing on their access to antenatal care, institutional delivery, and postnatal care.

Specifically, the study aimed to analyse the enablers and barriers to accessing these services and to explore the diverse coping strategies women employ to overcome these disadvantages. The study employs two theoretical frameworks: the Social Ecological Model (SEM) to understand multi-level influences on health behaviour (12), and the Transactional Theory of Stress and Coping (TTSC) to conceptualize individual responses to the profound stressors encountered (13), ensuring that findings are directly connected to practical and actionable solutions. By rooting its findings in real-world challenges, this research aims to generate valuable evidence to inform policy and intervention design for improving maternal health outcomes in Rakhine State and similar conflict-affected contexts. In doing so, it seeks to guide both national policymakers and humanitarian actors in developing conflict-sensitive, community-based strategies that can protect and promote maternal health in fragile environments.

METHODOLOGY

Study Design

This study adopted a qualitative research design, and it was conducted by in-depth, semi-structured interviews to explore the experiences of women and healthcare providers regarding maternal healthcare access in conflict-affected Rakhine State, Myanmar. The methodological approach was fundamentally guided by the SEM, which provided a structured framework for identifying multi-level enablers and barriers to care. Alongside this, the TTSC was applied to

systematically analyse the diverse strategies women utilized to manage the profound stress and challenges associated with accessing healthcare during conflict. The semi-structured interview guide was systematically developed based on the SEM and the TTSC, aiming to explore individual, interpersonal, community, organizational, and policy-level influences on maternal healthcare access, as well as coping strategies. The guide included questions designed to explore experiences related to enablers, barriers, and coping mechanisms at each of these levels.

Participation recruitment

The study's target population included two distinct but interconnected groups: women who had given birth within the past 18 months, and healthcare providers directly involved in maternal health service delivery. A total of 15 participants were included in the study, comprising twelve women and three healthcare providers. This sample size was determined based on the principle of data saturation, ensuring that no new themes or insights emerged from further data collection. The sample size was determined according to the principle of data saturation, which was assessed continuously during the process of data collection and analysis. Interviews were conducted until no new themes or insights emerged, confirming that the data had comprehensively captured the key aspects of the phenomena under investigation. In addition, given the conflict-affected context of the region and the complex local conditions, such as limited internet accessibility in certain areas, and occasional airstrikes despite the absence of ground fighting, it was difficult to recruit more participants beyond this number. Women participants, all aged over 18, were strategically selected to achieve ethnic, socio-economic, and geographic diversity, thereby providing a comprehensive understanding of varied experiences across different subgroups. The study selected women who had given birth within the past 18 months to ensure their pregnancies and childbirths took place during the peak period of conflict in Rakhine State, allowing them to provide accurate recall of their lived experiences. The women participants included four from the Rakhine ethnic community, four from the Muslim

community, and four from other ethnic minority groups.

The healthcare provider group consisted of one medical doctor, one midwife, and one nurse, each over 18 years of age and possessing at least two years of experience in maternal healthcare service delivery within Kyauktaw Township, Rakhine State. Their varied professional backgrounds were crucial for gaining diverse insights into the systemic challenges and enablers within the local health system. Participant recruitment was conducted through a combination of purposive and snowball sampling methods. The principal investigator contacted eligible healthcare providers through established medical professional networks, inviting those who met the inclusion criteria to participate. Interviews were arranged at times and locations convenient for the participants. Recruitment of women participants was facilitated by a trained research assistant who played a key role in community engagement and trust-building. Initial participants were identified through a local medical clinic, from which four women were recruited. An additional four participants were identified with the help of key community informants. To ensure inclusion of women from geographically remote or conflict-affected areas, snowball sampling was then used to recruit four more participants. This combined approach allowed for the inclusion of women with varied ethnic, socio-economic, and residential backgrounds.

Data Collection and analysis

Data collection was carried out through online video interviews. These interviews were primarily conducted via Zoom and Viber video calls, using a designated location with available internet access to overcome connectivity challenges. All interviews were audio-recorded with clear consent from participants. The recordings were carefully transcribed in the Myanmar language and then translated into English to support thorough analysis. Thematic analysis was used to examine the data, with transcripts systematically coded into key themes and subthemes related to maternal healthcare access and coping strategies. This process was guided by the principles of the SEM and the TTSC, helping to organize the findings across

different levels of influence and individual responses.

Research ethics

Ethical approval for the study was granted by the Institutional Review Board (IRB) of the Institute for Population and Social Research, Mahidol University. Written informed consent was obtained from all participants, and strong measures were taken to protect confidentiality, including the anonymization of personal information and secure storage of all data.

RESULTS

The findings of this study provide a comprehensive exploration of the multifaceted

barriers, crucial enablers, and diverse coping strategies employed by women in conflict-affected Rakhine State to access maternal healthcare. These results are systematically presented through the lens of the SEM, followed by an analysis of women’s problem-focused and emotion-focused coping mechanisms. Thematic development was undertaken as an iterative process, in which initial codes derived from the transcribed interviews were grouped into emergent subthemes. These subthemes were subsequently integrated into broader themes and categories alignment with the SEM and the TTSC conceptual frameworks.

To contextualize the findings, the demographic and professional characteristics of the study participants are summarized below.

Table 1 Demographic characteristics of women participants

ID	Age	Race	Education	Marital Status	Place of Living	Occupation
1	34	Rakhine	Tertiary or higher	Married	Urban	Office Clerk
2	29	Rakhine	Primary or lower	Married	Rural	Small retailer
3	24	Rakhine	Middle school	Married	Rural	Dependent
4	42	Rakhine	High school	Married	Rural	Dependent
5	35	Mro (Ethnic Minority)	High school	Married	Rural	Dependent
6	40	Mro (Ethnic Minority)	Primary or lower	Married	Rural	Daily wage laborer
7	30	Mro (Ethnic Minority)	Tertiary or higher	Married	Urban	Primary school teacher
8	38	Mro (Ethnic Minority)	Middle school	Married	Rural	Daily wage laborer
9	30	Muslim	Primary or lower	Married	Rural	Dependent
10	19	Muslim	Middle school	Married	Rural	Dependent
11	23	Muslim	Middle school	Married	Rural	Small retailer
12	19	Muslim	Middle school	Married (husband abroad)	Rural	Dependent

Table 2 Professional characteristics of healthcare provider participants

ID	Position	Experiences in the area (years)
13	Medical Officer	3
14	Midwife	5
15	Nurse	8

Enablers and barriers in maternal health care among Rakhine women
Individual level

Financial constraints emerged as a pervasive barrier, with many women reporting an inability to afford essential healthcare services, necessary medications, or transportation, particularly exacerbated by the conflict-induced inflation of costs and loss of income. This economic hardship sometimes compelled expectant mothers to undertake physically demanding daily wage labour during pregnancy.

“I received no pregnancy vaccinations. I knew I should get vaccinated, but I didn’t have money... I needed to buy them from other villages. I couldn’t afford it.” _ID2, Rakhine woman aged 29, primary education, small retailer, rural.

Furthermore, limited knowledge and awareness regarding the importance and recommended frequency of ANC, PNC, and potential pregnancy complications were prevalent, often leading to delayed or skipped essential visits, especially among those with lower educational attainment.

“I’m not sure how many ANC visits I should take—maybe three times. I don’t know exactly.” _ID11, Muslim woman aged 23, middle school education, small retailer, rural

The pervasive conflict environment significantly impacted women’s emotional and psychological well-being, leading to heightened stress, fear, and helplessness, which interfered with their ability to prioritize health-seeking behaviours.

“Three days of obstructed labour and no medical help. I suffered so much. I truly thought I was dying—and that my child was dying too.”

_ID10, Muslim woman aged 19, middle school education, dependent, rural)

Conversely, prior health knowledge, proactive planning (e.g., purchasing supplements in advance), and exercising personal autonomy in decision-making served as crucial individual enablers, allowing some women to navigate disrupted systems more effectively. Women with previous complex pregnancies also demonstrated a heightened motivation to seek more frequent antenatal care.

“Fortunately, I had purchased two bottles of folic acid before the conflict started. Although they weren’t enough for the entire pregnancy, I took them anyway.” _ID1, Rakhine woman aged 34, tertiary education, former office clerk, urban

Interpersonal level

Collective financial hardship within family networks, often compounded by male partners’ unemployment or migration, constituted a major barrier to accessing maternal care.

“My husband was in another country. He didn’t send money for delivery, and I had no one else to ask.” _ID12, Muslim woman aged 19, middle school education, dependent, rural

Limitations in women’s autonomy and decision-making power within the family, where decisions regarding delivery location or ANC timing were frequently determined by husbands or older relatives due to patriarchal norms, also impeded timely access to skilled care.

“My husband told me to give birth at my mother-in-law’s home before he left for another country to work... I had to follow his decision,

even though I didn't agree.” _ID12, Muslim woman aged 19, middle school education, dependent, rural

Moreover, the absence of crucial social support, resulting from conflict-induced family separation or travel restrictions, left many women isolated and without emotional or practical assistance during pregnancy and childbirth. Despite these barriers, interpersonal relationships also proved to be powerful enablers. Financial and material support from spouses, siblings, and parents played a critical role in covering transport, clinical fees, and nutritional needs, often filling gaps left by weakened public health systems.

“My parents and husband helped me with money. My husband even borrowed from his relatives when we needed more.” _ID3, Rakhine woman aged 24, middle school education, dependent, rural

Emotional support from loved ones provided significant strength and comfort amidst insecurity, helping women cope with childbirth-related anxieties.

“My mother and husband were with me during childbirth. Their presence comforted me.” _ID10, Muslim woman aged 19, middle school education, dependent, rural

Practical assistance with household chores, childcare, and transportation by family members was also vital, alleviating physical and logistical burdens. Furthermore, some families engaged in shared or supportive decision-making, actively involving women in healthcare planning, which facilitated access to care.

Community level

Geographical remoteness and conflict-related transportation difficulties, including blocked routes and inflated costs, significantly limited women's ability to reach health facilities.

“The transportation cost to get to the hospital was more than five times higher than usual due to the risks. We couldn't use road transportation by car or ambulance... So, we used

a river route, renting a small boat.” _ID1, Rakhine woman aged 34, tertiary education, former office clerk, urban

Pervasive security risks, such as constant threats of airstrikes and shelling, instilled fear, discouraging travel for non-emergency visits and sometimes leading to complete avoidance of institutional services.

“Once, there was fighting between two military groups, and both artillery shelling and airstrikes occurred. One artillery shell landed near our compound. I lost consciousness for three hours due to shock.” _ID10, Muslim woman aged 19, middle school education, dependent, rural

Displacement and residential instability due to conflict disrupted the continuity of maternal care, as women lost access to trusted providers and familiar facilities upon relocation to temporary shelters. Harmful community beliefs and traditional practices, such as reliance on Traditional Birth Attendants (TBAs) and adherence to restrictive postpartum rituals, often superseded medical advice.

“Most women do not prefer to give birth at hospitals; they prefer to deliver in the village with traditional birth attendants. They only want to go to the hospital in case of an emergency.” _ID13, medical doctor

Additionally, low community awareness regarding maternal health needs contributed to the underutilization of essential services. Community-wide financial hardship, stemming from the economic crisis, further impeded access to affordable care. Conversely, community solidarity and mutual aid, where neighbours and villagers collectively shared resources and provided support during displacement, served as a crucial informal safety net.

“Villagers from both my village and the village where the hospital was located supported one another in such difficult times. We shared clothes, food, and utensils with warm hearts. Everyone helped each other because we were all

in trouble.” _ID1, Rakhine woman aged 34, tertiary education, former office clerk, urban

Support, though sometimes modest, from Civil Society Organizations (CSOs) and community leaders also helped bridge service gaps.

Organizational level

Significant barriers included blocked hospital referrals due to military blockades, hindering timely transfers for emergency obstetric care.

“The doctor said the baby should be referred to the state hospital, but at that time, the Myanmar military blocked all transportation routes from Kyauktaw to Sittwe General Hospital—even for emergency medical referrals.” _ID4, Rakhine woman aged 42, high school education, dependent, rural

Inconsistent and often unsustainable support from non-governmental organizations (NGOs), which frequently ceased contact due to communication disruptions, also created service gaps. Widespread hospital closures or forced relocation to makeshift, undedicated facilities due to insecurity severely compromised care quality and safety. Critical shortages of specialized medical personnel (e.g., radiologists, paediatricians) and essential medical supplies, exacerbated by import restrictions and rising costs, significantly limited-service provision.

“Even important medicines like oxytocin were out of stock. I had to use supplies sparingly—even bandages, betadine, and syringes.” _ID14, Midwife

Pregnancy and child vaccination programs were also disrupted or completely halted. Rare instances of discrimination by hospital staff based on financial hardship were also reported. Despite these challenges, local healthcare workers played a crucial enabling role by providing essential referral advice, even when formal systems failed. Hospitals adapted by relocating operations to safer buildings and improvising diagnostic services (e.g., medical

doctors performing ultrasounds) to ensure continuity of care.

“We had to relocate hospital operations to non-targeted buildings, as actual hospital sites were often targeted by military forces.” _ID13, Medical Doctor

Following peak conflict, services gradually resumed with proactive community outreach. Internal staff training, conducting emergency deliveries under highly adverse conditions (e.g., using a phone flashlight during an air attack), and informal collaboration among providers were vital enablers.

“A woman was giving birth with me at night during an air attack. We were in a temporary building without electricity, and I delivered her baby using only one phone’s flashlight.” _ID14, Midwife

The strategic deployment of mobile clinics and pre-packed clean delivery kits also ensured continued maternal care in remote areas.

Policy/institutional level

The ongoing conflict severely disrupted healthcare infrastructure and transportation networks, a direct consequence of martial law and movement restrictions. The absence or weakness of formal health governance led to widespread confusion and a lack of strategic direction for healthcare providers.

“There are still no strategies or policies for maternal health since the start of the conflict. Health authorities are planning, but nothing is functioning yet.” _ID14, Midwife

Gaps in healthcare coverage resulted from fragmented political control and inconsistent humanitarian assistance, leading to variations in service availability based on governing authority. Furthermore, maternal health services were not always free, and out-of-pocket expenses for medications and transport remained a significant barrier. Nevertheless, institutional adaptations, such as relocating hospital operations to safer buildings and deploying mobile clinics, demonstrated

flexibility in maintaining services. Resourcefulness and improvisation by healthcare providers, coupled with crucial external support and coordination from non-state actors (e.g., ULA/AA government, CSOs, NGOs, INGOs), also enabled partial continuity of services. The importance of preparedness and early coordination among stakeholders for future resilience was also highlighted.

“The ULA government has been helping to provide some hospital facilities and to plan for relocating hospital locations. CSOs, NGOs, and INGOs provided medicine to hospitals during the conflict.” _ID13, Medical Doctor

Coping strategies of Rakhine women

Women in Rakhine State employed diverse coping strategies to navigate these challenges.

Problem-focused coping strategies

Problem-focused coping strategies involved concrete, direct actions taken to overcome practical challenges. To navigate pervasive financial constraints, women undertook strenuous daily wage work during pregnancy to generate income, and when direct payment was impossible, they borrowed money from relatives and in-laws.

“So, I had to do random daily wage work, like cropping the paddy fields during pregnancy.” _ID2, Rakhine woman aged 29, primary education, married, small retailer, rural

Women also adapted to disrupted healthcare access by improvising transportation methods, such as perilous river routes, to reach medical facilities.

“We couldn’t use road transportation by car or ambulance... So, we used a river route, renting a small boat.” _ID2, Rakhine woman aged 29, primary education, married, small retailer, rural

When professional care was inaccessible, they often sought alternative, unqualified providers (e.g., "quacks") or self-medicated from village pharmacies due to affordability and convenience.

“During the AN period, when I was sick and couldn’t afford to visit proper healthcare providers, I even went to a non-medical person (quack) who was cheaper but not professional.” _ID9, Muslim woman aged 30, primary education, married, dependent, rural

Proactive planning, such as purchasing essential nutritional supplements in advance, and strategic relocation to safer areas specifically for childbirth, also served as crucial coping mechanisms.

Emotion-focused coping strategies

Emotion-focused coping strategies were also prevalent, particularly for managing uncontrollable stressors. Acceptance and fatalism were common, especially when direct action was not possible, providing a sense of mental preparedness for adverse outcomes.

“I told myself I wouldn’t be that unlucky. If bad things happened, like bomb droppings from air attacks, just let me die.” _ID7, Mro woman aged 30, tertiary education, government schoolteacher, urban

A profound reliance on spiritual beliefs and prayer emerged as a central coping mechanism, offering comfort and hope amidst uncertainty and fear.

“I just prayed to Allah.” _ID10, Muslim woman aged 19, middle school education, married, dependent, rural

Positive self-talk and self-encouragement were frequently employed to maintain mental resilience, involving reframing situations, focusing on small positives, and affirming inner strength.

“I told myself, ‘I can do it. I can overcome these difficulties.’” _ID1, Rakhine woman aged 34, tertiary education, married, office clerk, urban

The strong emotional bond with their unborn or newborn child often served as a powerful source of strength and purpose, motivating endurance despite hardship. In situations where active problem-solving was impossible, some women resorted to passive endurance, quietly suffering through pain or uncertainty. Lastly, some women demonstrated strong personal agency by making their own decisions about pregnancy and care, asserting their convictions despite external judgment or familial pressure.

“I responded, ‘I chose this pregnancy. I don’t care about the country’s situation. I don’t care. I just want this child. And this is my family’s business, not yours.’” ID5, Mro woman aged 35, high school education, married, dependent, rural

DISCUSSION AND RECOMMENDATION

This study’s findings provide a comprehensive illustration of how enablers and barriers to maternal healthcare access in conflict-affected Rakhine State are deeply interconnected across individual, interpersonal, community, organizational, and policy/institutional levels, consistent with the SEM. By integrating the SEM with the TTSC and drawing on the in-depth lived experiences of women and healthcare providers in the under-researched context of Rakhine State, this study provides a unique, multi-dimensional understanding of maternal health challenges and the ways women navigate them in conflict zones, going beyond the service decline observed in other similar settings.

At the individual level, economic precarity, limited health literacy, and psychological distress are not merely personal limitations but rather reflections of broader structural disadvantages exacerbated by the conflict. This finding is consistent with prior research showing that poverty, low education, and psychological strain often intersect to restrict women’s ability to seek and access maternal healthcare in fragile settings (3, 5, 14-16).

Interpersonally, collective financial hardship and limitations on women’s autonomy, often dictated by patriarchal norms, significantly impede access to skilled care, mirroring findings from other low-income and conflict-affected settings. This observation is supported by

previous studies which found that household poverty, male-dominated decision-making, and disrupted family structures commonly restrict women’s maternal health access in fragile contexts (3, 15-18).

Community-level barriers, including geographical inaccessibility, pervasive security risks, forced displacement, and adherence to harmful traditional beliefs, contribute to multi-layered vulnerability. Low community awareness and weakened health promotion structures further sustain these issues. These findings reflect broader patterns observed in similar conflict-affected and under-resourced contexts, where limited infrastructure, community-level insecurity, displacement, and deeply rooted sociocultural norms collectively shape maternal health behaviours and access to care (4, 14, 15, 18-21).

Organizationally, critical failures such as disrupted referral systems, hospital closures, and severe shortages of personnel and supplies profoundly undermine care access. The inconsistent support from non-governmental organizations and rare instances of discrimination by healthcare staff also compound existing service gaps, reflecting broader challenges faced by humanitarian actors in conflict settings. These organizational challenges reflect patterns widely reported in fragile health systems during conflict, where disrupted referrals, staff shortages, and service gaps severely limit maternal care access (19, 21, 22). At the policy/institutional level, fragmented health governance, militarized restrictions, and inconsistent humanitarian coordination directly disrupt health service delivery, demonstrating how political instability influences the structural determinants of health. This aligns with prior studies showing that conflict-related political instability and weak governance directly hinder maternal health service delivery (5, 23).

Despite these formidable obstacles, the study also identified significant enablers that highlight women’s resilience and adaptive capacities. Individual factors, including prior health knowledge, personal autonomy, and past pregnancy experiences, facilitate care-seeking. This aligns with studies showing that prior pregnancy experience and personal health knowledge improve care-seeking in fragile

settings (15, 16). Supportive interpersonal dynamics, such as financial, emotional, and practical assistance from family members, are crucial in filling gaps left by weakened health systems. Similar findings highlight that family financial and emotional support can bridge service gaps during crises (3, 24). Community-level resilience, manifested through mutual aid and support from civil society organizations and local leaders, provides essential informal safety nets. Community-driven support and mutual aid have similarly been documented as important enablers of maternal healthcare access in conflict-affected settings, particularly where formal systems are weakened (18, 25). Organizationally, midwives and other healthcare providers exhibit remarkable innovation and perseverance by relocating services, improvising diagnostics, conducting internal training, and deploying mobile clinics, aligning with evidence of adaptation in crisis settings. Evidence from Myanmar and other fragile contexts shows that healthcare workers often adapt creatively to sustain maternal services amid conflict (19, 20, 22). Policy/institutional enablers, including strategic service adaptations and crucial external support, underscore the role of flexibility and localized governance in sustaining healthcare access. Research from conflict zones supports the role of localized governance and cross-sector coordination in maintaining essential care (18, 23, 25).

Women's coping strategies, analysed through the Transactional Theory of Stress and Coping, encompass both problem-focused (e.g., seeking alternative providers, proactive planning, borrowing money) and emotion-focused approaches (e.g., acceptance, spiritual reliance, positive self-talk, maternal bond). The greater prevalence of emotion-focused coping highlights the uncontrollability of many conflict-related stressors, leading women to rely on internal and spiritual resources to manage profound distress. These findings are consistent with previous studies on coping mechanisms in conflict-affected and low-resource settings (11, 14, 15, 21, 25).

Based on these findings, multi-level and integrated interventions are urgently needed. Policy interventions must strengthen formal health governance, ensure the protection of health

facilities from military targeting, and implement proactive preparedness for essential supplies. For humanitarian actors and local stakeholders, close coordination with the de facto government and local communities is essential to ensure that aid reaches those most in need. Key priorities include deploying mobile clinics to serve remote areas, securing essential supplies through advance planning, and providing targeted financial assistance to improve equitable maternal healthcare access in conflict-affected Rakhine State. Community-level investments are crucial for reinforcing existing solidarity networks and delivering culturally appropriate health promotion strategies to address persistent knowledge gaps. Supporting healthcare providers through ongoing training, fostering interprofessional collaboration, and actively addressing discriminatory practices within healthcare settings are vital to rebuild trust and ensure equitable access. Furthermore, economic constraints must be comprehensively addressed by introducing appropriate healthcare payment systems or financial protection mechanisms to reduce the unsustainable burden of out-of-pocket expenditures on impoverished households. The de facto government should prioritize restoring and improving maternal health services in post-conflict settings.

Despite these important insights, this study has several limitations. The region's control by the Arakan Army restricted access to recent literature, reports, and news, limiting the availability of up-to-date information on the healthcare system and workforce. Security risks, including intermittent airstrikes, constrained recruitment to 12 women and 3 healthcare providers and prevented coverage of all geographic areas. Internet access was only available in designated locations, making scheduling interviews challenging and sometimes requiring rescheduling. Despite these constraints, efforts were made to gather rich and detailed information from all participants

CONCLUSION

This study presents a comprehensive analysis of the layered barriers, enabling factors, and coping strategies shaping women's access to maternal healthcare in conflict-affected Rakhine

State, Myanmar. By integrating the SEM and the TTSC, the study demonstrates that women's healthcare experiences are profoundly shaped by the intricate interplay of individual, interpersonal, community, organizational, and policy/institutional factors. The findings highlight that maternal healthcare inequities are systemic, stemming from financial insecurity, limited autonomy, geographical isolation, strained organizational capacities, and fragmented governance. Despite these significant challenges, women demonstrate strength and adaptability through a range of problem-focused and emotion-focused coping strategies, relying on personal initiative, family support, community solidarity, and spiritual beliefs to navigate difficult circumstances. This dual-framework approach not only enriches academic understanding but also provides actionable insights for context-sensitive and equity-oriented interventions. Given the persistence of conflict-related barriers, there is an urgent need for conflict-sensitive, community-based maternal care policies that prioritize safety, cultural appropriateness, and equitable access. Ultimately, ensuring safe and accessible maternal healthcare in Rakhine State requires holistic efforts that encompass health system strengthening, infrastructure rehabilitation, and culturally competent care models, crucially involving local actors in all stages of program design and decision-making.

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TRENDS IN PNEUMONIA-RELATED HOSPITALIZATIONS, OUTPATIENT VISITS, AND MORTALITY IN THAILAND POST-COVID-19: A STUDY FROM 2022 TO 2024

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ABSTRACT

Introduction: Thailand continues to face a high burden of pneumonia-related hospitalizations and in-hospital mortality. During the COVID-19 pandemic, attention shifted toward SARS-CoV-2, potentially obscuring the surveillance and burden of other respiratory infections, including pneumonia. As protective measures ease, concerns have emerged about changing pneumonia trends in the post-COVID-19 era. Therefore, this study aimed to examine nationwide trends in pneumonia-related hospitalizations, outpatient visits, and mortality to inform future prevention and control strategies in Thailand.

Methodology: A longitudinal secondary analysis was conducted using national pneumonia surveillance data from 2015–2024, obtained from Thailand’s Ministry of Public Health. Cases classified under ICD-10 pneumonia codes with complete demographic and temporal data were included. Spatial distributions were visualized using yearly heat maps stratified by province, health zone, age group, and occupation. Linear Mixed Effects models were used to assess significant changes over time and across climate zones, with model fit confirmed via Akaike’s Information Criterion. Intraclass Correlation Coefficients quantified regional clustering, and p-values < 0.05 indicated significance.

Results: From 2022 to 2024, pneumonia-related hospitalizations increased by 50%, while mortality more than tripled (rising from 284 to 865 deaths). Outpatient visits also saw a 41% increase over the same period. Older adults (≥65 years) consistently represented over 60% of annual deaths, whereas agricultural workers and students experienced marked increases in hospitalizations and mortality. Regional trends in hospitalizations and outpatient visits varied significantly by province (p < .001), with regional variation accounting for 33.5% of hospitalization differences (ICC = 0.335). Mortality showed a significant increase over time (p = .011), but geographic variation was less pronounced.

Conclusion: Pneumonia remains a major health concern in Thailand, particularly among older adults, inpatients, and agricultural workers in the post-COVID era. These findings support targeted interventions in high-burden provinces and among vulnerable populations.

Keywords: Hospitalization Trends, Mortality Trends, Pneumonia, Thailand, Post COVID-19

INTRODUCTION

Pneumonia remains a major global health concern, causing approximately 2.5 million deaths annually, including 672,000 deaths among children under five and 1.2 million deaths among adults over 69 years in 2019 (1, 2). It contributes to an estimated 97 million Disability-Adjusted

Life Years (DALYs), disproportionately affecting the very young and elderly (2, 3).

In Thailand, pneumonia ranked third in morbidity and first in mortality among nationally surveilled diseases in 2022, with 234,196 reported cases and 284 deaths, emphasizing its ongoing public health impact (4). From 2013 to 2022, morbidity rates fluctuated with peaking in

2018, declining during the COVID-19 pandemic, and then rising again in 2022. Although case fatality rates (CFR) declined between 2013 and 2016 and stabilized thereafter, provincial disparities persist, with Ubon Ratchathani, Saraburi, and Yasothon provinces reporting the highest morbidity in 2022 (4-6).

Following the easing of COVID-19 restrictions, the resurgence of respiratory infections, including influenza and respiratory syncytial virus (RSV), has placed renewed strain on healthcare systems. The pandemic's broad interventions, such as masking and distancing, not only suppressed respiratory disease transmission but also disrupted pneumonia surveillance, obscuring true disease trends (7-11). As Thailand transitions into the post-COVID-19 era, renewed concerns have emerged regarding shifting pneumonia patterns and growing health disparities.

Pneumonia remains a major public health concern in Thailand, consistently contributing to substantial morbidity and mortality. During the COVID-19 pandemic, widespread public health interventions, including masking, social distancing, and reduced mobility, significantly altered the transmission dynamics of respiratory infections. These measures not only suppressed the spread of COVID-19 but also obscured the true burden and epidemiological trends of other respiratory diseases, such as pneumonia. As Thailand transitions into the post-COVID-19 era, the relaxation of these protective measures has raised critical concerns about potential resurgence, shifts in disease patterns, and emerging health disparities related to pneumonia.

Despite available national surveillance data through the Ministry of Public Health's 506 reporting system, there is limited analysis of pneumonia trends in the post-pandemic context. Existing research largely focuses on the early pandemic phase, with little attention to regional and demographic shifts in the current landscape. To address these gaps, this study analyzes pneumonia-related hospitalization and mortality trends in Thailand from 2022 to 2024, representing the post-COVID period, using ICD-10-coded surveillance data. The findings aim to inform data-driven public health strategies and guide the allocation of healthcare resources for pneumonia

prevention and control in a changing epidemiological environment.

METHOD

Study Design, Setting, and Population

This study employed a retrospective longitudinal analysis using national pneumonia surveillance data collected between 2022 and 2024 by Thailand's Ministry of Public Health. Data were drawn from the 506-disease reporting system, which compiles pneumonia case records from all 77 provinces nationwide. Rather than sampling, the analysis included all reported pneumonia cases during the study period. Eligible cases were identified based on ICD-10-CM codes J12–J18 and included only those with complete demographic and geographic information. Where applicable, validated procedures were used to address and impute missing data to ensure consistency in the dataset.

Data Management Process

The principal researcher formally requested pneumonia surveillance data from the Ministry of Public Health (MOPH), specifying the inclusion criteria based on ICD-10 codes (J12–J18), the time period (2022–2024), and national geographic coverage. Age-stratified population estimates were obtained from the National Statistical Office for rate standardization. To address missing data, a validated rule-based approach was applied. For categorical variables such as province or health zone, missing values were imputed based on hospital location codes or administrative mappings, ensuring alignment with existing administrative structures. For continuous variables like age, mean or median imputation was performed within each province-year stratum when the proportion of missing data was less than 5%. Any records with missing key diagnostic fields, such as pneumonia severity, were excluded to maintain data integrity and avoid bias.

Following data cleaning, five preprocessing steps were implemented to ensure consistency and harmonization across the dataset. The first step involved format standardization, where variable names, coding structures, and data types were aligned across multiple datasets. For

example, province names were standardized to a uniform naming convention to eliminate inconsistencies across sources. Temporal alignment was the second step, where monthly pneumonia case and death counts were aggregated into annual totals (January to December) for each province. This process allowed for consistent yearly comparisons across regions, ensuring that each data point represented a full year. The third step, geographic harmonization, addressed inconsistencies in administrative unit naming and boundary definitions. This was achieved by mapping local or regional data to national standards and grouping provinces into 13 health zones and 6 climate regions for spatial analysis, which accounted for regional and environmental variations in pneumonia trends. The fourth step involved age-standardization, where crude counts of pneumonia cases and deaths were transformed into age-standardized rates per 100,000 population using direct standardization. This method adjusted for differences in age structure between provinces by utilizing the national age distribution for each year. Finally, data verification was conducted to ensure the processed figures were accurate and consistent. This step involved cross-checking the data against official MOPH annual surveillance reports, and any anomalies (such as outliers, duplicates, or invalid entries) were identified and corrected prior to statistical modeling to ensure a reliable final dataset.

Variables and Measures

Annual Pneumonia cases included total cases per month summed for 12 consecutive months, including Inpatient (Hospitalization) and outpatient visits. The data were disaggregated by province, health administrative zone, climate zone, age groups, and occupation. The mortality rate was pneumonia-related deaths per 100,000 population for each year.

Data Analysis

Microsoft Power BI (2023) was used to visualize provincial distributions of pneumonia-related hospitalizations (IPD), outpatient visits (OPD), and mortality from 2022 to 2024 using heat maps to illustrate spatial and temporal trends. Descriptive statistics, including frequencies and percentages, were used to summarize hospitalization and mortality by age group and occupation.

To examine annual and provincial trends, linear mixed-effects models were applied to log-transformed values of hospitalization, outpatient visits, and mortality. Model fit was assessed using Akaike's Information Criterion (AIC). Results were reported with F-values and significance levels. Marginal and conditional R² values were used to evaluate variance explained by fixed and full models, while the intraclass correlation coefficient (ICC) quantified variance attributable to random effects from climate zones.

RESULTS

1. Provincial Disparities in Pneumonia-related Hospitalization and Outpatient Visits in Thailand (2022-2024)

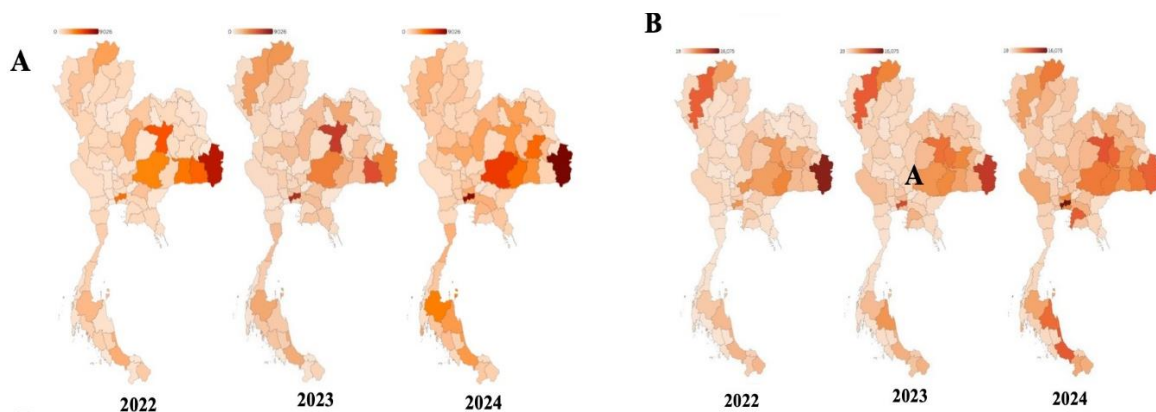


Figure 1 Spatial Distribution of Pneumonia-related Cases (A) Annual Number of Inpatient hospitalizations in each province (B) Annual Number of Outpatient Visits in each province (2022-2024)

Hospitalization (In-patients) Spatial Trends

From 2022 to 2024, pneumonia-related hospitalizations (IPD) showed increasing geographic concentration in eastern and southern Thailand, as illustrated in Figure 1A. Initially centered in the central and eastern regions (e.g., Bangkok, Chachoengsao), the burden shifted by 2023 to northeastern provinces such as Nakhon Ratchasima and Buriram. In 2024, Chanthaburi and Surat Thani recorded the highest hospitalization rates. Overall, a growing spatial concentration was observed in the East and South, possibly reflecting environmental risk factors, regional outbreaks, or improved surveillance systems.

Outpatient Spatial Trends

Outpatient pneumonia cases were consistently high in eastern provinces, with Chanthaburi leading across all years. Northern areas like Chiang Mai and Chiang Rai showed high OPD volumes in 2022, followed by increases in southern coastal provinces (e.g., Songkhla, Phuket) in 2024 (Figure 1B). The spread into southern Thailand may reflect rising incidence, increased health-seeking behavior, or better surveillance post-COVID. These findings support the need for tailored prevention, improved outpatient capacity, and region-specific public health responses.

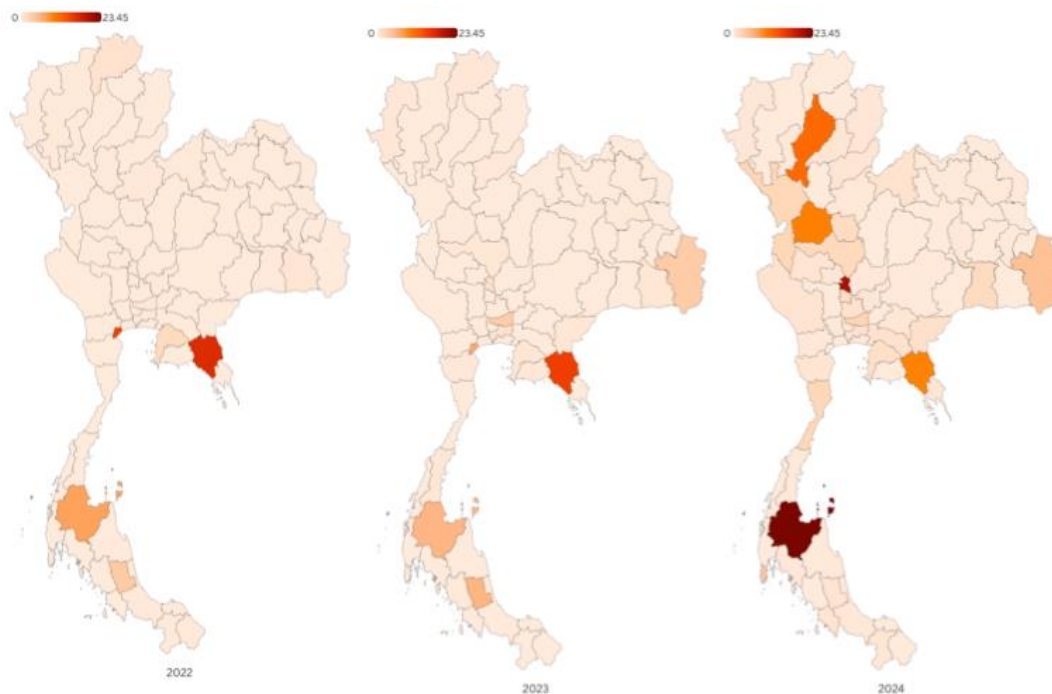


Figure 2 Spatial Distribution: Annual Mortalities in each province (2022-2024)

2. Provincial Disparities in Pneumonia-related Mortality in Thailand (2022-2024)

Figure 2 displays the annual spatial distribution of pneumonia-related deaths across Thailand from 2022 to 2024. In 2022, higher mortality counts were concentrated in Bangkok and selected southern provinces, including Phuket, Surat Thani, and Songkhla. By 2023, this pattern remained with slight intensification,

particularly in Phuket and Narathiwat. In 2024, the highest mortality shifted to southern provinces such as Songkhla and Narathiwat, while new clusters emerged in northeastern provinces, including Kalasin, Nakhon Phanom, and Chaiyaphum. The number of affected provinces increased over the three years, indicating a broader geographic spread of pneumonia-related deaths.

3. Pneumonia Hospitalization and Mortality Stratified by Age Group and Occupation

Age- and occupation-specific data from 2022 to 2024 show variations in pneumonia-related hospitalizations and mortality. The number of cases and deaths differed across age groups and occupational categories each year. Table 1 presents the annual figures for pneumonia hospitalizations and deaths, disaggregated by age group and occupation from 2022 to 2024.

Pneumonia-related mortality increased across older age groups between 2022 and 2024. Among individuals aged 65 years and older, deaths rose from 177 in 2022 to 234 in 2023 and 550 in 2024. In the 55–64 age group, mortality

increased from 54 in 2022 to 150 in 2024. Mortality remained relatively low and stable among younger age groups, particularly those under 25 years of age. By occupation, manual workers recorded the highest number of pneumonia-related deaths each year, with 193 deaths in 2022, 178 in 2023, and 163 in 2024. Individuals in agricultural and livelihood sectors experienced an increase in deaths from 34 in 2022 to 67 in 2024. Mortality among students, government officials, and retail workers remained consistently low. No deaths were reported among public health personnel, while religious practitioners and other unspecified occupations accounted for minimal deaths across the three years.

Table 1 Distribution of Pneumonia-related Hospitalizations and Mortality by Age Group and Occupation

Variables	2022		2023		2024	
	Hospitalization	Mortality	Hospitalization	Mortality	Hospitalization	Mortality
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Age in Groups						
Total	250884	284	298611	367	376838	865
< 5	75246 (30)	4 (1)	86403 (29)	7 (2)	87690 (23)	16 (2)
5 - 9 years	10351 (4)	2 (1)	12518 (4)	0 (0)	14379 (4)	3 (0)
10 - 14 years	3941 (2)	2 (1)	4821 (2)	1 (0)	11635 (3)	6 (1)
15 - 24 years	6725 (3)	4 (1)	5894 (2)	4 (1)	10878 (3)	9 (1)
25 - 34 years	9722 (4)	7 (2)	9598 (3)	9 (2)	14940 (4)	22 (3)
35 - 44 years	12111 (5)	8 (3)	12765 (4)	15 (4)	19776 (5)	39 (5)
45 - 54 years	18761 (7)	26 (9)	21207 (7)	44 (12)	29670 (8)	70 (8)
55 - 64 years	29437 (12)	54 (19)	35706 (12)	53 (14)	47386 (13)	150 (17)
>= 65 years	84590 (34)	177 (62)	109699 (37)	234 (64)	140484 (37)	550 (64)
Occupations						
Total	137915	260	170097	293	207091	321
Livelihood/ Agriculture	47365 (34)	34 (13)	60120 (35)	38 (13)	58879 (28)	67 (21)
Governments Officials and Military	4286 (3)	2 (1)	4815 (3)	17 (6)	9473 (5)	20 (6)
Person Manual Workers	53089 (38)	193 (74)	64384 (38)	178 (61)	71814 (35)	163 (51)
Retail Business	2871 (2)	8 (3)	3211 (2)	8 (3)	3957 (2)	4 (1)
Students	21404 (16)	7 (3)	27749 (16)	2 (1)	48041(23)	50 (16)

Variables	2022		2023		2024	
	Hospitalization	Mortality	Hospitalization	Mortality	Hospitalization	Mortality
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Religious Practitioner	1432 (1)	3 (1)	1898 (1)	3 (1)	336 (0)	5 (2)
Public Health	209 (0)	0 (0)	203 (0)	0 (0)	337 (0)	0 (0)
Others	7259 (5)	13 (5)	7717 (5)	47 (16)	14254 (7)	12 (4)

4. Temporal Trends in Hospitalization, Outpatient Visits, and Mortality After COVID-19

Table 2 presents the findings of Linear Mixed Models assessing changes in pneumonia-related hospitalizations, outpatient visits, and mortality from 2022 to 2024, as well as across health administrative zones. While the regression coefficients, standard errors, and confidence intervals are not reported due to limitations in the available data, the results provide important insights into the statistical significance and model fit.

Hospitalization rates showed highly significant changes across both years ($F = 32.592$, $p < 0.001$) and climate zones ($F = 4.867$, $p =$

0.002). The model indicates that approximately 33.5% of the total variance in hospitalization rates is attributable to provincial variation ($ICC = 0.335$), with a marginal R^2 of 0.499, suggesting that nearly half of the variance in hospitalizations is explained by the fixed effects in the model. Outpatient visit trends also showed significant differences over time ($F = 15.197$, $p < 0.001$) and across health zones ($F = 3.486$, $p = 0.013$), further emphasizing the regional and temporal variations in care. Similarly, pneumonia-related mortality demonstrated significant changes across years ($F = 7.368$, $p = 0.011$), while no significant differences were found between climate zones in terms of mortality rates.

Table 2 Fixed Effects Estimates from Linear Mixed Model Predicting Log-transformed Hospitalization, Outpatients, and Mortality with Year and Climate Zone as Predictors.

Predictor/Component	Hospitalization (IPD)		Outpatients (OPD)		Mortality	
	F-value	p-value	F-value	p-value	F-value	p-value
Fixed Effects						
Intercept	31.606	<0.001*	14.739	<0.001*	7.344	0.011*
Year (In continuous)	32.592	<0.001*	15.197	<0.001*	7.368	0.011*
Climate Zone	4.867	0.002*	3.486	0.013*	0.879	0.507
Model Fit						
AIC ¹	21.77		51.21		137.93	
ICC ²	0.335		0.213		0.278	
Marginal R ² (fixed effects)	0.499		0.363		0.171	
Conditional R ² (full model)	0.667		0.577		0.449	

* p -value less than 0.001; ¹ Akaike's Information Criterion; ² Intraclass Correlation Coefficient

DISCUSSION

This study reveals important shifts in pneumonia-related hospitalization, outpatient visits, and mortality in Thailand during the post-COVID-19 period (2022–2024), highlighting a

growing disease burden among vulnerable populations, particularly the elderly, manual laborers, and agricultural workers (12, 13). The rise in cases aligns with global trends showing a resurgence of respiratory infections following the

relaxation of pandemic control measures (14, 15). Provinces in the East and South, including Chanthaburi, Surat Thani, and Songkhla, experienced significant increases, suggesting geographic vulnerabilities influenced by environmental, demographic, and healthcare access factors (12).

Over 80% of pneumonia-related deaths occurred among inpatients, reinforcing the need for strengthened hospital-based care and early diagnosis. Older adults (≥ 65 years) consistently accounted for the majority of cases and deaths, with notable increases among those aged 55–64, indicating an expanding high-risk group (12, 13). Occupational analysis showed that manual workers and agricultural laborers bore a disproportionate mortality burden, likely due to occupational exposures and barriers to timely care.

The linear mixed model analysis confirmed significant temporal and regional effects on hospitalization and outpatient trends, while mortality increased over time but showed no variation across climate zones, suggesting more systemic vulnerabilities. Moderate provincial variation in mortality (ICC = 0.278) implies the influence of unmeasured local factors (12).

These findings are consistent with global evidence on post-pandemic respiratory disease rebounds and underscore the need for stronger surveillance, equitable access to care, and targeted interventions for high-risk populations (16). Incorporating demographic and occupational data into pneumonia control strategies will be critical for effective public health planning in the post-COVID context.

Despite the strengths of this study, several limitations should be acknowledged. First, as a secondary data analysis, the study is dependent on the completeness and accuracy of national surveillance data. While data cleaning and imputation procedures were applied, underreporting or misclassification may still occur, particularly in remote provinces or among informal workers. Second, the analysis was based on ICD-10 codes J12–J18, which may not fully capture atypical or secondary pneumonia cases linked to other diagnoses. Third, although we adjusted for year and climate zone in our models, other potentially important factors, such as

comorbidities, vaccination coverage, healthcare access, and environmental exposures, were not available in the dataset and therefore could not be controlled for. Finally, due to the aggregated nature of the data, individual-level causal inferences are limited, and the findings should be interpreted with caution.

CONCLUSION AND RECOMMENDATION

The findings from this study reflect a shifting pneumonia landscape in Thailand during the post-COVID-19 period from 2022 to 2024. As public health measures relaxed and routine activities resumed, pneumonia-related hospitalizations and deaths rose steadily, mostly among older adults, manual laborers, and agricultural workers. These groups were a consistently high-risk, pointing to both age-related vulnerability and possible occupational exposure risks that deserve closer attention.

Trends differed across provinces, with the eastern and southern regions reporting higher hospitalization and outpatient visit rates, while mortality increases were more uniformly distributed across the country. This suggests that while some areas face more acute service demands, systemic issues may be contributing to poor pneumonia outcomes nationwide. Moreover, the use of Linear Mixed Effects modeling confirmed the statistical significance of both time and regional effects on pneumonia burden.

In conclusion, the results show a need to reorient pneumonia prevention and response strategies. It is important to also focus on surveillance, early detection, and prevention efforts tailored to specific regions and high-risk populations. Community-based interventions, particularly for the elderly and workers in labor-intensive sectors, may be able to reducing the impact of pneumonia in this public health landscape.

RECOMENDATION

A comprehensive and coordinated public health response is needed to address the rising burden of pneumonia in Thailand's post-COVID-19 era. Strengthening the national pneumonia surveillance system with real-time data and better breakdowns by age, region, and occupation can support earlier detection and more effective, targeted interventions. At the same time,

vaccination coverage for pneumococcal and influenza infections should be focused among high-risk groups such as older adults, manual laborers, and agricultural workers, especially in provinces with consistently high case numbers. Workplace-based health education and improved access to care are also important steps to better protect those in labor-intensive occupations. In regions like the east and south, where hospitalizations and outpatient visits were highest, expanding healthcare capacity will be essential to ensure timely and equitable care. Promoting health equity through inclusive policies and outreach to underserved areas will help reduce regional and socioeconomic gaps in pneumonia outcomes. Finally, pneumonia prevention and control must be integrated into Thailand's broader post-pandemic preparedness plans to strengthen resilience against future respiratory threats.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest, financial or otherwise, related to the conduct, data analysis, or reporting of this study.

ETHICAL CONSIDERATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Subject, Health Science Group 1, Chulalongkorn University.

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ORAL HEALTH STATUS AND SALIVARY CHANGES IN OLDER ADULTS WITH UNCONTROLLED TYPE 2 DIABETES MELLITUS

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ABSTRACT

Introduction: Type 2 diabetes mellitus (T2DM) is a major public health issue worldwide. Poor glycemic control may affect the prevalence and severity of oral health problems and salivary quality, but research in older adults with diabetes remains limited.

Objective: To assess oral health status and salivary changes of older adults with uncontrolled, in comparison to well-controlled, T2DM.

Methodology: A cross-sectional study was conducted among older adults (≥ 60 years old) diagnosed with T2DM, recruited by purposive sampling from January to May 2025 (N=25). Patients with a recent HbA1c level of at least 7.5% were classified as having uncontrolled T2DM. Salivary flow rate (SFR) and pH of both stimulated and unstimulated whole saliva were measured. Periodontal conditions, assessed using UNC-15 probe, were classified based on clinical attachment loss (CAL) and probing depth, following CDC/American Academy of Periodontology (AAP) criteria. Statistical analysis was performed using independent T-tests for normally distributed data and Mann-Whitney U-tests for skewed data.

Results: Among 25 participants (20 females and 5 males, mean age 72.4 ± 7.41 years old), 7 (28%) had uncontrolled T2DM. Mean HbA1c levels in the uncontrolled vs well-controlled groups were 8.1 ± 0.8 and 6.8 ± 0.4 , respectively ($p < 0.001$). The prevalence of severe periodontitis was similar between groups (42.8% in uncontrolled and 44.4% in well-controlled groups). The mean SFR were slightly lower in the uncontrolled group, although not statistically significant. Unstimulated SFR was 0.22 ± 0.12 mL/min and 0.26 ± 0.12 mL/min, while stimulated SFR was 0.92 ± 0.61 mL/min and 1.31 ± 0.77 mL/min, for the uncontrolled and well-controlled groups, respectively. Interestingly, the mean pH of stimulated saliva was significantly lower in the uncontrolled group. (7.38 ± 0.44 in uncontrolled vs. 7.85 ± 0.50 in well-controlled, $p = 0.04$).

Conclusion:

This study observed a significantly lower stimulated salivary pH in uncontrolled T2DM patients, likely reflecting altered oral environment prone to dysbiosis and oral diseases. Integrating oral care into overall public health strategies is encouraged.

Keywords: Type 2 diabetes, older adult, salivary changes, oral health, SDG3

INTRODUCTION

Type 2 Diabetes mellitus (T2DM) is a significant public health challenge worldwide. In 2021, the global prevalence was 10.5% (536.6 million people) and is projected to increase to 12.2% (783.2 million) by 2045 (1). It involves various clinical and genetic factors that result in high blood sugar levels. This condition adversely affects individuals' health and quality of life, and contributes to increased

morbidity, mortality, and burdens to the healthcare system (2). Previous studies have often shown that oral health is closely related to various noncommunicable diseases, particularly diabetes and periodontal disease which show a bidirectional relationship (3).

Moreover, health complications and decreased well-being are more prevalent among older adults (4). A significant concern within

the increasing number of aging population is poor oral health, characterized by increased occurrences of dental caries, periodontal disease, tooth loss, dry mouth, and oral cancer (5). Process of aging disrupts the balance of saliva production, a problem worsened by systemic conditions, like diabetes, and the medications used to treat other illnesses that impact saliva secretion. Additionally, age-related changes influence the composition of the oral microbiome that contribute to pathogenesis of oral diseases (6). For instance, the prevalence of periodontitis increased from 45-50% in adults to over 60% in older adults (7).

The bidirectional relationship between diabetes and periodontal disease is likely mediated by inflammation and is related to increased blood sugar levels (8). In addition, DM can lead to various changes in the oral cavity and can also alter the function of the salivary glands affecting the composition and volume of the secreted saliva (9). These changes lead to environmental changes in the oral cavity that trigger the onset of other oral diseases. For example, changes in salivary flow rate and pH can increase the risk of dental caries, fungal infection, and periodontal diseases (10, 11). Poor glycemic control has been associated with an increased risk and severity of oral health problems, as well as alterations in salivary composition and flow (12). However, studies focusing specifically on these effects in older adults with diabetes are still limited. Therefore, the aim for this study is to assess the oral health status and salivary changes of older adults with uncontrolled, in comparison to well-controlled, T2DM.

METHODOLOGY

Study design and study population

This cross-sectional study was conducted among patients previously diagnosed with T2DM, recruited by purposive sampling, from January to May 2025 with 25 participants. This study involved older adults aged 60 years and above who had been diagnosed with T2DM. Participants were classified based on their glycemic status, with glycated hemoglobin (HbA1c) levels of $\geq 7.5\%$ categorized as uncontrolled diabetes, and levels $< 7.5\%$ as well-controlled (13). Individuals with a history of radiotherapy in the head and neck region, those who were fully edentulous,

and uncooperative participants were excluded from the study.

Data collection

Unstimulated whole saliva and stimulated whole saliva was obtained as described (14). Unstimulated whole saliva collection was conducted in the morning, between 8:00 a.m. and 12:00 p.m. Participants were instructed to refrain from eating, drinking, or brushing their teeth for at least one hour prior to the procedure. During saliva collection, each participant remained seated upright in a cool environment, with their head slightly tilted forward allowing the saliva to flow into a sterile container for 10 minutes. For stimulated whole saliva collection, participants were asked to chew a 5×5 cm piece of paraffin wax continuously and saliva were collected for 5 minutes (15). The salivary flow rate (SFR) was determined by measuring the volume of whole saliva in millilitres (mL) divided by collection time (min). Hyposalivation was defined as having < 0.1 mL/min of unstimulated SFR or < 0.7 mL/min of stimulated SFR (16, 17). Salivary pH was measured using a pH meter (LAQUA twin pH-22, compact pH meter, Horiba). The DMFT index was assessed by oral examination under dry conditions, with all findings of decayed, missing, and filled tooth surfaces recorded. Root caries index was recorded (18). Teeth with gingival recession were assessed for root caries on four surfaces mesial, distal, buccal, and lingual and the proportion of decayed and filled root surfaces was calculated about the total number of root surfaces examined. Periodontal examination was conducted to assess the full mouth, excluding third molars and furcation involvement. Gingival recession (GR), defined as the distance between the free gingival margin (FGM) and the cemento-enamel junction (CEJ), was measured first. This was followed by the measurement of probing depth (PD), which is the distance from the FGM to the base of the sulcus or periodontal pocket. Both GR and PD were recorded at six sites per tooth: mesio-buccal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual, and disto-lingual, using a UNC-15 periodontal probe (Hu-Friedy®, Hu-Friedy Group, Chicago, IL, USA). Clinical attachment loss (CAL) was then calculated by summing the GR and PD measurements, providing an estimate of the total periodontal tissue loss from the CEJ. Periodontal stages

were classified based on CAL and probing depth, following CDC/AAP (American Academy of Periodontology) criteria by Eke et al (19).

Data Analysis and Ethical Consideration

Statistical analysis was conducted using IBM SPSS Statistics version 29.0. Descriptive statistics included frequencies and percentages for categorical variables and means \pm standard deviations or medians with interquartile ranges for continuous data, depending on normality. The Shapiro-Wilk test ($p < 0.05$) assessed normality. Group comparisons between well-controlled and uncontrolled T2DM were performed using Independent T-tests, Mann-Whitney U tests, Chi-square tests, or Fisher's exact tests as appropriate. A p -value < 0.05 was considered statistically significant. The study protocol has been approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HREC-DCU 2024-119). Informed consent was obtained before demographic data collection by a structured interview and clinical data collection by oral examination.

RESULTS

Among 74 participants who registered for this study, a total of 25 participants were eligible after undergoing the screening process based on the inclusion and exclusion criteria and were included in this study. Characteristics of participants are shown in table 1. The majority of the participants were female ($N=20$, 80%). Ages range from 60 to 86 years old (mean age 72.4 ± 7.41 years). The overall mean level of HbA1c was 7.14 ± 0.82 , with 18 participants (72%) classified as well-controlled T2DM group (mean HbA1c= 6.76 ± 0.39) and 7 participants (28%) as uncontrolled (mean

HbA1c= 8.11 ± 0.85 , p -value < 0.001). Six subjects (24%) required insulin injections. With regards to oral healthcare, most participants ($N=18$, 72%) had a last visit dental office less than 1 year ago and 17 participants (68%) brushed their teeth once or twice a day. The majority of participants ($N=17$, 68%), had more than 20 natural teeth, with 52% wore acrylic removable partial denture. Eleven (44%) had severe periodontitis. There was no statistically significant differences among these characteristics between the well-controlled and uncontrolled groups. For salivary parameters, mean salivary flow rate of the unstimulated and stimulated saliva were not different between groups. The overall mean salivary pH of unstimulated and stimulated whole saliva were 7.44 ± 0.59 and 7.72 ± 0.52 , respectively. Interestingly, the mean pH of stimulated saliva was significantly lower in the uncontrolled group (7.38 ± 0.44 in uncontrolled vs. 7.85 ± 0.50 in well-controlled ($p=0.04$)). The prevalence of hyposalivation was higher in the uncontrolled (57.1%) than the well-controlled groups (27.8%), but the difference did not reach statistical significance.

The oral health status between well-controlled and uncontrolled subjects are shown in table 2. There was no statistically significant difference between groups on all parameters examined. While the number of remaining teeth was similar, the mean DMF-T (decayed, missing, and filled teeth) index was not different (17.2 ± 5.0 and 18.3 ± 6.4 for the well-controlled and uncontrolled group, respectively). For the Root Caries Index (RCI), the median (interquartile range) was lower in the well-controlled group 0.00 (range 0–25.87) comparing to 14.20 (range 0–37.50) in the uncontrolled group, but the difference was not statistically significant ($p = 0.673$).

Table 1 Characteristics of study population

variables	Study population N=25	Well controlled N=18	Uncontrolled N=7	<i>P</i> -Value
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	
Age (Years)	72.4 ± 7.41	71.89 ± 7.85	73.71 ± 6.47	0.591 ¹
HbA1c (%)	7.14 ± 0.82	6.76 ± 0.39	8.11 ± 0.85	<0.001 ¹
	N (%)	N (%)	N (%)	
Gender				
Male	5 (20)	4 (22.2)	1 (14.3)	1.000 ^F
Female	20 (80)	14 (77.8)	6 (85.7)	
Insulin injection				1.000 ^F
Yes	6 (24)	4 (22.2)	2 (28.6)	
No	19 (76)	14 (77.8)	5 (71.4)	
Last dental visit				0.487 ²
<1 year	18 (72)	12 (66.7)	6 (85.7)	
1-2 Year	4 (16)	3 (16.7)	1 (14.3)	
>2 years	3 (12)	3 (16.7)	0	
Tooth Brushing				0.362 ^F
1-2 times/day	17 (68)	11 (61.1)	6 (85.7)	
>2 times/day	8 (32)	7 (38.9)	1 (14.3)	
Number of Teeth				0.640 ^F
<20 Teeth	8 (32)	5 (27.8)	3 (42.9)	
≥ 20 Teeth	17 (68)	13 (72.2)	4 (57.1)	
Denture wearer				1.000 ^F
Yes	13 (52)	9 (50)	4 (57.1)	
no	12 (48)	9 (50)	3 (42.9)	
Severe Periodontitis	11 (44)	8 (44.4)	3 (42.9)	1.000 ^F
Salivary Flow rate (mean± SD mL/Min)				
Unstimulated	0.25 ± 0.12	0.26 ± 0.12	0.22 ± 0.12	0.512 ¹
Stimulated	1.20 ± 0.74	1.31 ± 0.77	0.92 ± 0.61	0.247 ¹
Salivary pH (mean± SD)				
Unstimulated	7.44 ± 0.59	7.48 ± 0.62	7.34 ± 0.51	0.604 ¹
Stimulated	7.72 ± 0.52	7.85 ± 0.50	7.38 ± 0.44	0.045 ^{1*}
Hyposalivation, N(%)				0.205 ^F
Yes	9 (36)	5 (27.8)	4 (57.1)	
No	16 (64)	13 (72.2)	3 (42.9)	

¹ Independent T-test² Pearson Chi-Square test^F Fisher's Exact Test

*Statistically significant difference (p<0.05)

Table 2 Comparison of oral health between Well-controlled and Uncontrolled subjects.

Variables	Study population N=25	Well-controlled N=18	Uncontrolled N=7	P- Value
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	
Number of teeth	22 ± 5.4	22.2 ± 5.3	21.4 ± 6.0	0.767 ¹
DMFT index	17.4 ± 5.3	17.1 ± 5.0	18.3 ± 6.4	0.614 ¹
	Median (P25-P75)	Median (P25-P75)	Median (P25-P75)	
Root Caries Index	6.3 (0-28.5)	0.0 (0-25.9)	14.2 (0-37.5)	0.673 ^M

^M Mann-Whittney U Tests¹ Independent T-test

DISCUSSION

This study evaluated oral health and salivary function in elderly individuals with T2DM, with a particular focus on those with poor glycemic control. By examining the relationship between HbA1c levels and salivary characteristics, the findings enhance our understanding of how metabolic control may impact oral health in older adults. We found that stimulated salivary pH was significantly lower in individuals with uncontrolled DM compared to those with well-controlled diabetes, while there was no significant difference in salivary flow rate between the two groups. The decrease of salivary pH may be due to metabolic changes in individuals with uncontrolled DM. In diabetes, decreased bicarbonate levels across body fluids contribute to metabolic acidosis including the acidic nature of saliva in diabetic patients (20). An alternative explanation for the lower mean stimulated salivary pH may involve age-related changes in salivary ion composition, as proposed by Bernardi et al. (21). It is interesting to note that the significantly lower pH was observed in stimulated saliva, but not unstimulated saliva. We hypothesize that this could be due to the different buffering capacity and salivary composition, but the underlying mechanisms require further investigation.

In this study, no significant differences of unstimulated or stimulated salivary flow

rates were found among well-controlled and uncontrolled groups, which may be due to the small sample size. However, previous research by Chávez, Borrell (22) reported that older adults with uncontrolled diabetes may have reduced salivary flow compared to those with better glycemic control and non-diabetic individuals. This study reported that approximately 57.1% of uncontrolled T2DM had hyposalivation. Although reduced salivary flow might not correspond with the perception of dry mouth or xerostomia (23) hyposalivation may contribute to gingival inflammation and oral health deterioration (24) hyposalivation-related, oral microbiota dysbiosis can negatively impact the microbiota of digestive system, commonly observed in older adults (15) In this study, 44% patients with diabetes had severe periodontitis. Consistently to Portes, Bullón (25) the diabetes group exhibited the highest severity of periodontitis, with a strong correlation between glucose levels in HbA1c and pocket depth of ≥6mm, clinical attachment loss of ≥5mm, and a high percentage of bleeding on probing. A study by Weijndijk, Van der Weijden and Slot (26) found that diabetic patients had higher DMFT scores compared to non-diabetic individuals. In this study, however, no statistically significant difference was observed in the incidence of DMFT scores or root caries

This study carries certain limitations. The cross-sectional design facilitates the identification of associations, but cannot establish causality. The small sample size comprises only 25 participants, with only 7 uncontrolled T2DM group, provide limited power for statistical analysis. Additionally, the use of purposive sampling limits the generalizability of the results. Consequently, the findings on oral health deterioration remain inconclusive. Future studies with a larger sample size, more diverse population, and probabilistic sampling methods, if possible, are warranted to better assess the impact of uncontrolled type 2 diabetes mellitus on oral health and salivary function in older adults.

CONCLUSION

This study observed a significantly lower pH of stimulated saliva in older adults with uncontrolled T2DM compared to the well-controlled group. Altered oral conditions in uncontrolled T2DM could favor microbial dysbiosis, potentially contributing to oral diseases. These results reinforce the importance of maintaining good glycemic control and ensuring regular oral health monitoring are essential to reduce the risk of oral complications in individuals with T2DM.

LIMITATIONS

This study's cross-sectional design limit causal relationship analysis. Participant recruitment was conducted through posters distributed in limited number of hospitals and diabetes communities. Furthermore, several older participants found it challenging to visit the hospital for sample collection.

RECOMMENDATION

Further study with a larger number of participants is warranted. Intervention to enhance good oral hygiene practices, regular dental visits and good glycemic control are essential for maintaining both oral and systemic health in older adults with diabetes. Public health measures should promote oral care as an integral part of overall health.

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STREET FOOD CONSUMPTION AND ITS DETERMINANTS AMONG UNDERGRADUATE STUDENTS IN QINGDAO, CHINA

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ABSTRACT

Introduction: Street food consumption is an emerging public health concern due to its links to poor dietary quality, foodborne illnesses, and non-communicable diseases. In urban China, street food remains a key part of the food system, especially for university students who often face time and financial constraints. These factors can lead to unhealthy eating patterns and increased health risks. Therefore, this study aimed to assess the frequency and determinants of street food consumption among undergraduate students in Qingdao, China.

Methodology: A cross-sectional study was conducted in May 2025 at Qingdao Institute of Technology. A total of 385 undergraduate students were recruited through convenience sampling. Data were collected using a self-administered online questionnaire via Wenjuanxing, covering demographics, environmental factors, peer and social media influence, food safety perceptions, and street food consumption frequency. Descriptive statistics were reported, and bivariate and multivariate logistic regression analyses were performed using SPSS Version 28 to identify significant predictors.

Results: Among the participants, 52.5% were aged 20 or younger and 52.5% were female. Most lived within 5–15 minutes of a street food vendor (62.9%), and a majority reported being influenced by peers (87.8%) and exposed to street food content on social media (49.4%). Frequent street food consumption (more than twice weekly) was reported by 37.9% of students. Significant predictors included year of study (aOR = 2.29, 95% CI: 1.32–3.98), peer influence (aOR = 2.16, 95% CI: 1.04–4.50), and high social media exposure (aOR = 2.18, 95% CI: 1.02–4.62).

Conclusions: Over one-third of students reported frequent street food consumption. Peer influence, social media exposure, and academic year were significant predictors. Universities should integrate nutrition education, improve healthy food access, and promote food safety awareness to support informed student choices.

Keywords: *Street Food, Undergraduate Students, Peer Influence, Social Media, China*

INTRODUCTION

Street food consumption has emerged as a public health concern due to its association with poor dietary quality, foodborne illnesses, and rising rates of non-communicable diseases (NCDs) such as obesity, hypertension, and diabetes (1-3). While street foods are popular for their affordability, convenience, and cultural

appeal, they are often prepared under unhygienic conditions, using unsafe water or improper handling methods. Despite these risks, street food plays an important role in sustaining local economies, preserving culinary traditions, and providing livelihoods for many vendors (1, 4).

According to the Food and Agriculture Organization (FAO), street food is defined as

“ready-to-eat food and beverages prepared and/or sold by vendors in streets and other public places”(1). In China, street food is deeply embedded in urban life and dietary culture, particularly in cities like Qingdao, a coastal tourist destination known for its seafood and fusion of regional culinary influences(5-7). Street food in Qingdao reflects both cultural heritage and the evolving demands of urban development(8, 9).

University students represent a key demographic in urban street food consumption. For many, street food offers an affordable, accessible, and socially integrated food source that aligns with student lifestyles and constraints(10). While students are often aware of hygiene risks, factors such as taste, convenience, peer influence, and social media exposure frequently outweigh concerns about food safety(11). As a result, students may prioritize sensory satisfaction and social experiences over health risks, potentially increasing their vulnerability to gastrointestinal illnesses and long-term diet-related NCDs(12, 13).

Beyond health risks, frequent consumption of street food has been linked to academic consequences. Unhealthy dietary patterns, high in fats and sugars, may impair concentration, memory, and academic performance. Studies have shown that students

with poor dietary habits are more likely to experience reduced achievement in reading, math, and science, even after adjusting for socioeconomic factors(14, 15).

Despite the prevalence of street food consumption among university students in urban China, research examining its underlying determinants, particularly in specific local contexts, remains limited. Therefore, the aim of this study is to examine the patterns and key factors associated with street food consumption among undergraduate students in Qingdao, China.

METHODS

Study Design and Settings

This study employed a cross-sectional quantitative design conducted in May 2025. The setting was the Qingdao Institute of Technology (QIT), located in Qingdao, a coastal city in Shandong Province known for its rich and diverse street food culture (as shown in Figure 1). Qingdao’s dynamic urban environment and culinary landscape provided an ideal context for exploring street food consumption behaviors among university students. The College of Food Engineering at QIT was purposively selected due to its relevance to food and health disciplines, offering valuable insights into the intersection of food environment, student lifestyle, and dietary behaviors.

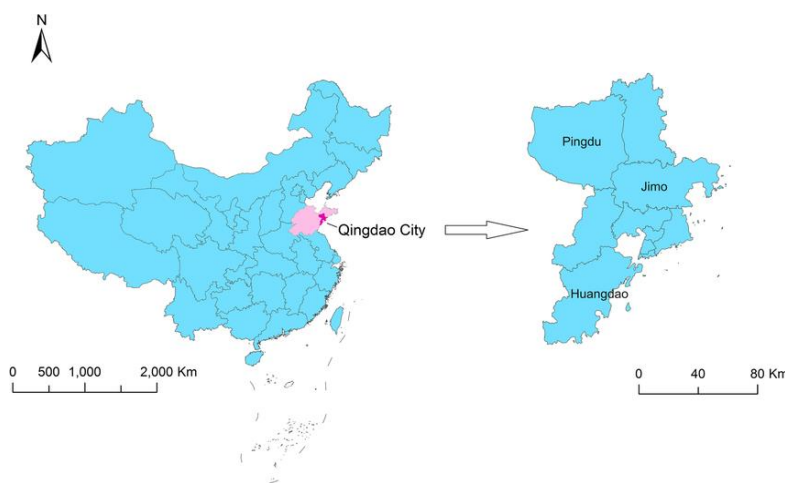


Figure 1 Map of Qingdao City, China

Study Population

The participants of this study are full-time undergraduate students aged 18 years and above, enrolled in the College of Food Engineering at QIT and able to access online data collection tools such as Wenjuanxing (an online survey platform widely used in China). Students from all academic years (freshman to senior) were eligible to participate. A sample size of 385 was calculated using Cochran's formula, considering an estimated prevalence of street food consumption, a 95% confidence level, and a 5% margin of error. Participants were recruited through convenience sampling using the Wen-Juan-Xiang online platform. Informed consent was obtained electronically before participation.

Data collection

Data were collected using a self-administered online questionnaire comprising five sections: (1) general characteristics (age, gender, academic year), (2) environmental factors (living arrangement, home cooking habits, distance to nearest stall), (3) media influence (exposure to street food content, influence of social media, trust in food safety recommendations), (4) peer influence (peer recommendations), (5) street food safety perception (overall hygiene and vendor hygiene), and (6) street food consumption practices. Media and Peer Influence were quantified based on exposure frequency, trust in recommendations, and peer encouragement, categorized as low, medium, or high. Street Food Consumption Practices were measured by the frequency of self-reported consumption. Respondents were categorized into "frequently" and "Rarely" consumers based on defined cut-off points (e.g., several times per week). In

summary, Sections (1), (2), (3), (4), and (5) are the independent variables, while Section (6) represents the dependent variables.

Data Analysis

Data were cleaned and recoded using Microsoft Excel and analyzed using SPSS Version 29.0. For all independent variables, data were classified into two types: continuous and categorical. Continuous variables included general characteristics (age item), media influence (all items), and street food safety perception (all items). These were analyzed for normality using the Kolmogorov–Smirnov test. If normally distributed, mean, standard deviation (SD), minimum, and maximum values were reported; if non-normally distributed, median, interquartile range (IQR), minimum, and maximum values were used. Categorical variables were summarized using frequencies and percentages. For the dependent variable (street food consumption), frequency was recoded into two categories: frequently consumption (defined as daily and/or 3–5 times per week) and Rarely consumption (defined as 1–2 times per week, a few times per month, rarely, or never). Chi-square tests were used to identify associations between independent variables and street food consumption. Variables with $p < 0.20$ in bivariate analysis were included in a multiple logistic regression model to identify independent predictors of frequent consumption. Multicollinearity was assessed using variance inflation factors ($VIF < 10$). Model fit was tested using the Hosmer–Lemeshow goodness-of-fit test ($p \geq 0.05$). Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were reported for significant predictors ($p < 0.05$).

RESULTS**Table 1** Relationship Between Participant Characteristics and Street Food Consumption (n = 385)

General Characteristics		Street Food Consumption					Chi-square	p-value
		Total (n, %)	Rarely (n, %)		Frequently (n, %)			
Age	20 years and younger	202 (52.5)	124	51.9%	78	53.4%	0.086	0.769
	21 years and above	183 (47.5)	115	48.1%	68	46.6%		
Gender	Female	202 (52.5)	122	51.0%	80	54.8%	0.511	0.475
	Male	183 (47.5)	117	49.0%	66	45.2%		
Academic Year	Freshman(Year1)	113 (29.4)	79	33.1%	34	23.3%	13.484	0.004
	Sophomore(Year2)	122 (31.7)	58	24.3%	61	41.8%		
	Junior(Year 3)	83 (21.6)	83	34.7%	40	27.4%		
	Senior and Above(Year4)	36 (9.3)	19	7.9%	11	7.5%		
Living Arrangement	University Dormitory	381 (99.2)	236	98.7%	145	99.3%	1.349	0.509
	Off-Campus apartment	2 (0.5)	1	0.4%	1	0.7%		
	With family	2 (0.5)	2	0.8%	0	0.0%		
Home Cooking	No	294 (76.4)	181	75.7%	113	77.4%	0.139	0.709
Yes	91 (23.6)	58	24.3%	33	22.6%			
Distance to Nearest Food Stall	< 5 mins walk	47 (12.2)	24	10.0%	23	15.8%	6.401	0.094
	5 to 15 mins walk	242 (62.9)	147	61.5%	95	65.1%		
	16-30 mins walk	71 (18.4)	52	21.8%	19	13.0%		
	> 30 mins walk	25 (6.5)	16	6.7%	9	6.2%		
Peer Influence	No	47 (12.2)	36	15.1%	11	7.5%	4.793	0.029
	Yes	338 (87.8)	203	84.9%	135	92.5%		
Safety Perception Level	Unfavourable	67 (17.4)	44	18.4%	23	15.8%	0.445	0.505
	Favourable	318 (82.6)	195	81.6%	123	84.2%		
Social Media Influence	Low Influence	45 (11.6)	33	13.8%	12	8.2%	3.235	0.198
	Median Influence	150 (39.0)	94	39.3%	56	38.4%		
	High Influence	190 (49.4)	112	46.9%	78	53.4%		

A total of 385 undergraduate students participated in the study. Slightly over half of the participants were 20 years or younger (52.5%), and were female (52.5%). The majority were in their first (29.4%) or second year (31.7%) of study, followed by third-year (21.6%) and fourth-year or higher (9.3%). Nearly all students (99.2%) lived in university dormitories. Most students (76.4%) did not engage in home cooking, and 65.1% reported a walking distance of 5–15 minutes to

the nearest street food stall (Table 1).

Peer influence was highly prevalent, with 84.9% of students reporting that their food choices were influenced by peers. Regarding social media influence, 53.4% reported high exposure, 38.4% moderate, and 8.2% low. Food safety perception was largely favorable, with 81.6% of participants expressing positive views of street food hygiene (Table 1).

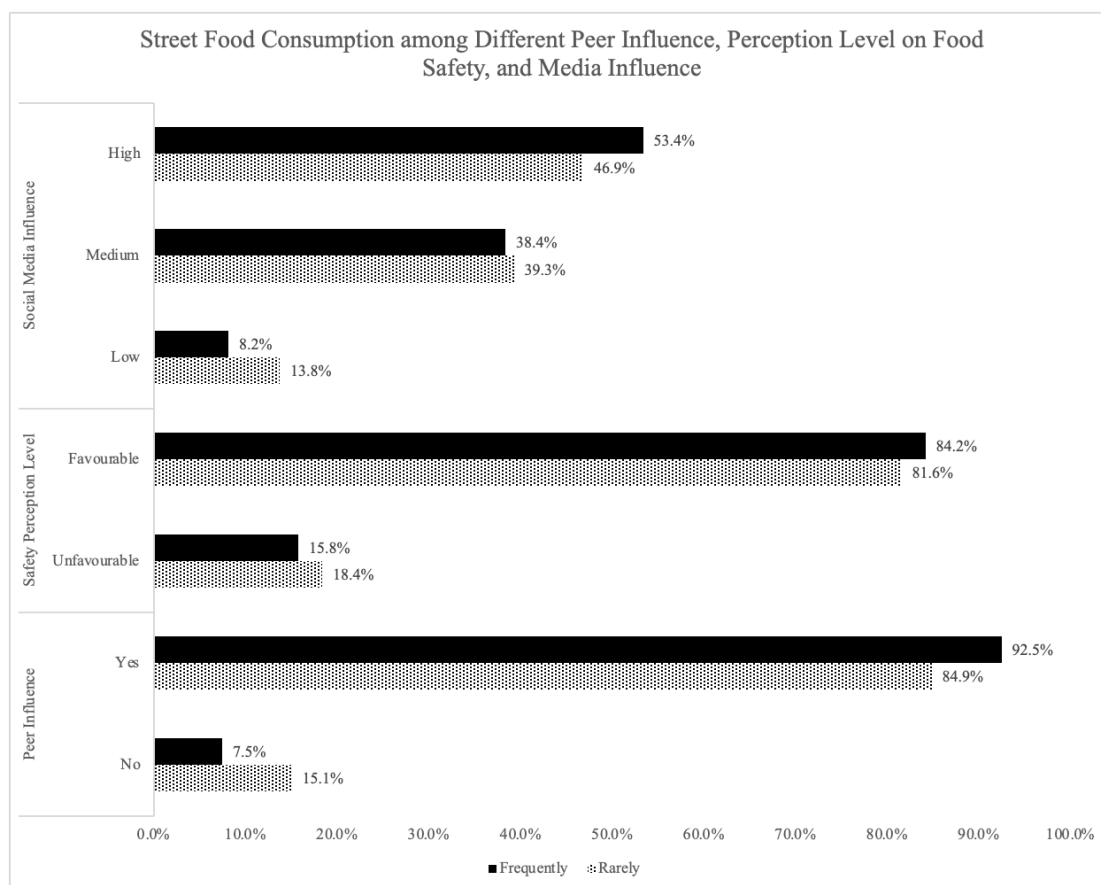


Figure 2 Prevalence of Street Food Consumption Among Undergraduate Students with Different Peer Influence, Perception on Food Safety, and Media Influence

Frequent street food consumption was common among students, with many consuming it several times per week. As shown in Figure 2, students who reported high peer influence (92.5%) and high social media exposure (53.4%) had the highest levels of frequent consumption. In contrast, food safety perceptions appeared to have a minimal impact on behavior, with 84.2% of students with favorable hygiene perceptions still reporting frequent consumption.

Bivariate analysis (Table 1) identified significant associations between street food consumption and academic year ($\chi^2 = 13.484$, $p = 0.004$) and peer influence ($\chi^2 = 4.793$, $p = 0.029$), while distance to the nearest food stall showed a marginal association ($\chi^2 = 6.401$, $p = 0.094$). No significant associations were found for age, gender, living arrangement, home cooking habits, food safety perception, or media influence at the bivariate level.

Table 2 Determinants of street food consumption among Undergraduate Students in Qingdao, China (n = 385)

Variables	Street Food Consumption			
	P-value	aOR	95%CI	
			Lower	Upper
Academic Year				
Freshman (Year 1)		Ref		
Sophomore (Year 2)	0.003	2.294	1.322	3.980

Variables	Street Food Consumption			
	P-value	aOR	95%CI	
			Lower	Upper
Junior (Year 3)	0.556	1.190	0.667	2.123
Senior or Above (Year 4)	0.399	1.458	0.607	3.502
Distance to Nearest Food Stall				
< 5 mins walk		Ref		
5 to 15 mins walk	0.298	0.707	0.367	1.360
16-30 mins walk	0.087	0.484	0.211	1.111
30 > mins walk	0.534	0.715	0.248	2.059
Peer Influence				
No		Ref		
Yes	0.038	2.166	1.042	4.501
Social Media Influence				
Low Influence		Ref		
Median Influence	0.104	1.895	0.877	4.096
High Influence	0.042	2.181	1.027	4.629

To determine independent predictors of frequent street food consumption, a multivariate logistic regression was conducted including variables with $p < 0.20$ from the bivariate analysis. As shown in Table 2, academic year remained a significant predictor. Sophomores were more than twice as likely to consume street food frequently compared to freshmen (aOR = 2.294, 95% CI: 1.322–3.980, $p = 0.003$). Peer influence was also significant, with students influenced by peers having over twice the odds of frequent consumption (aOR = 2.166, 95% CI: 1.042–4.501, $p = 0.038$). Social media exposure was associated as well: students with high exposure had significantly higher odds of frequent consumption (aOR = 2.181, 95% CI: 1.027–4.629, $p = 0.042$), although moderate exposure did not reach statistical significance ($p = 0.104$). Distance to the nearest food stall was not a significant predictor in the final model.

These findings indicate that social and academic-related factors; particularly peer influence, social media exposure, and academic year, are more influential than environmental or demographic factors in shaping street food consumption patterns among university students.

DISCUSSION

This study found that academic year, peer influence, and social media exposure were significant determinants of frequent street food consumption among undergraduate students in Qingdao, China. Sophomores were more likely than freshmen to consume street food frequently, supporting prior findings that dietary behaviors tend to shift as students' progress through university, gain autonomy, and adapt to new routines and environments (17).

Peer influence emerged as a strong predictor of frequent street food consumption, aligning with existing research that highlights the central role of social networks in shaping food choices among young adults (25). High social media exposure was also associated with increased odds of frequent street food consumption. This finding is consistent with other studies that demonstrate how digital platforms shape food preferences, promote popular eating trends, and influence consumer behavior through visual content and peer endorsement (16-19). Among university students, who are highly active online, such digital influences may outweigh concerns about food safety or

nutritional value.

Interestingly, this study did not find significant associations between street food consumption and several commonly cited factors, including age, gender, living arrangement, home cooking practices, or food safety perception. While previous studies have reported gender differences and highlighted the role of food hygiene concerns (16-19), these variables were not significant in this target population. This may reflect a normalized view of street food among students or the overriding influence of peer and digital environments.

In summary, the main associated factors including academic year, peer influence, and social media exposure, emphasize the need for interventions that address the social and digital contexts of student eating behavior. Strategies that leverage peer networks and digital communication channels may be more effective than traditional awareness-based approaches in promoting healthier dietary habits and reducing the health risks associated with frequent street food consumption.

LIMITATIONS

This study has limitations. First, using self-reported data may introduce recall bias or social desirability bias, especially in responses related to food safety perception or peer influence. Second, the cross-sectional nature of the study limits the ability to establish causal relationships between variables. Third, the use of a self-administered questionnaire may have limitations in measurement accuracy, particularly if some questions were misunderstood or interpreted differently by respondents. Fourth, some potentially relevant variables, such as nutritional knowledge, accessibility to alternative food

sources, or individual taste preferences, were not included and could have influenced the results. The study addresses a significant gap in the literature by examining the multifactorial determinants of street food consumption among university students in an urban Chinese context.

CONCLUSIONS

Street food consumption among undergraduate students in Qingdao is significantly shaped by academic standing, peer influence, and social media exposure. Sophomore students heavily influenced by their peers, and those with high engagement with street food content on social media are more likely to consume street food frequently. These findings highlight the critical role of both social networks and digital environments in influencing dietary behavior. Interventions aiming to improve student nutrition should; therefore, address these social and digital determinants to promote healthier eating habits within university populations.

RECOMMENDATIONS

Higher education institutions should integrate nutrition education into student wellness programs, leveraging peer-led campaigns and digital media strategies to reshape eating norms. Partnerships with student influencers and clubs can amplify health-promoting messages. Future research should consider longitudinal designs and more diverse student populations to better understand changes in food consumption patterns over time. Additionally, local governments should regulate and support the development of healthy, affordable, and hygienic street food options near university campuses.

ETHICAL APPROVAL

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University, approved the protocol for this study.

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LIVED EXPERIENCES AND UNDERSTANDINGS: A QUALITATIVE INQUIRY INTO DISPLACED MYANMAR YOUTH'S KNOWLEDGE AND ATTITUDES ON SEXUALLY TRANSMITTED INFECTIONS AT MIGRANT LEARNING CENTERS (MLCs) IN THAILAND

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ABSTRACT

Introduction: Sexually Transmitted Infections (STIs) pose significant global public health challenges, disproportionately impacting young and vulnerable populations. Despite research on STI awareness and prevention, misconceptions persist, especially among marginalized groups like displaced youth.

Objectives: This study addresses this gap by exploring knowledge, attitudes, and barriers related to STIs, particularly syphilis, among Myanmar displaced youth attending Migrant Learning Centers (MLCs) in Mae Sot, Thailand.

Methodology: Using a qualitative narrative approach, in-depth interviews were conducted with 30 displaced youth (ages 18–24), three teachers, and two school directors from five MLCs, selected via purposive sampling. Thematic analysis guided by the Social Ecological Model identified multi-level influences shaping STI understanding and access to education and services.

Results: Findings show that while students from different MLCs have good knowledge of HIV/AIDS, misinformation remains among some. Understanding of other STIs, like syphilis, is often limited and inaccurate, with misconceptions common among students and some educators. STI education in MLCs is irregular, superficial, and HIV-focused, with minimal curriculum integration. Cultural stigma, religious taboos, gender norms, and structural barriers such as teacher turnover and lack of resources restrict open dialogue and access to prevention tools. Despite challenges, students showed strong willingness to learn and supported peer education to improve knowledge and reduce stigma.

Conclusion: The study highlights the urgent need for culturally sensitive, comprehensive, and sustained STI education in humanitarian settings. Strengthening training/workshop, resources, incorporating other STIs content, engaging trusted community members, and enhancing youth-friendly services are essential to empower displaced youth in protecting their sexual health.

Keywords: attitudes, knowledge, Migrant Learning Centers (MLCs), Myanmar displaced youth, lived experiences, sexually transmitted infection (STIs)

INTRODUCTION

Political instability and economic hardship in Myanmar have driven many youths to migrate to Thailand, particularly Mae Sot, a major settlement area (1, 2, 3). Sexually transmitted infections (STIs) are infections primarily spread through unprotected sexual contact, and in some cases, through pregnancy, childbirth, breastfeeding, or contact with infected blood (19). Globally, STIs remain a significant public health concern due to their widespread

prevalence, asymptomatic nature, and severe long-term health consequences. If left untreated, STIs can result in complications such as infertility, ectopic pregnancy, stillbirth, cardiovascular and neurological disorders, and increased susceptibility to HIV. In addition, STIs are closely linked to stigma, discrimination, and domestic violence, all of which can negatively impact mental and emotional well-being (19). Youth, especially those in displaced or

marginalized settings, are particularly vulnerable due to limited access to sexual health education, constrained healthcare access, and sociocultural barriers.

These displaced youth face barriers to healthcare, especially sexual health education within Migrant Learning Centers (MLCs), which often lack resources to provide comprehensive programs (4,5,6). This gap increases vulnerability to misinformation and poor health outcomes. STIs are a significant global public health concern, especially among displaced populations with limited access to accurate information and services (7,8). Social stigma, language barriers, and socioeconomic challenges further increase STI risk among displaced Myanmar youth (9,10,11).

Youth and adolescents are particularly vulnerable due to risky sexual behaviors and limited service access (12). Nearly 27 million new STI cases occur annually in the U.S., with half among those aged 15–24; similar trends exist globally (13,14). This study focuses on Myanmar displaced youth in Mae Sot MLCs, a group at heightened risk due to insufficient STI information and services.

Despite STI prevalence, many in developing countries lack proper knowledge, as public health efforts focus mainly on HIV/AIDS (8), leading to delayed treatment and severe outcomes. Education and social norms shape attitudes that influence prevention (15). Stigma, misinformation, peer pressure, and misconceptions about condom use complicate youth behavior (16,10). Displacement worsens risks through poor living conditions, stigma, and cultural barriers (7, 17).

MLCs face financial and accreditation challenges, and sexual health education remains inadequate (4,6). Displaced youth also experience trauma and structural barriers restricting care and knowledge (15). Though STI research exists, displaced Myanmar youth in MLCs are underexplored, especially from qualitative perspectives capturing their socio-cultural contexts (19).

This study explores how displaced Myanmar youth at Migrant Learning Centers (MLCs) in Thailand understand and engage with information about sexually transmitted infections (STIs), focusing particularly on their knowledge,

attitudes, and the sociocultural factors that shape their experiences. Through in-depth interviews, it aims to inform interventions and policies to improve sexual health in humanitarian settings. Specifically, the research addresses the following questions: 1) What is the level of knowledge regarding STIs among displaced Myanmar youth? 2) How do they perceive the risks associated with STIs and their prevention? And 3) What barriers do they encounter in accessing STI-related information and healthcare services?

Review of Literature

This chapter reviews existing literature to build a foundation for understanding sexually transmitted infections (STIs) among displaced Myanmar youth in Migrant Learning Centers (MLCs). It highlights gaps in knowledge about socio-cultural factors influencing STI awareness and attitudes in these marginalized settings. Recognizing the limitations of quantitative research, this review advocates for qualitative approaches to better capture the lived experiences of displaced youth facing barriers such as cultural taboos and limited healthcare access, thus emphasizing the need for culturally sensitive, youth-centered interventions (18,19).

Globally, STIs remain a major public health concern, especially in underserved communities where many cases go untreated, leading to serious complications (18). Common STIs include gonorrhea, chlamydia, syphilis, and trichomoniasis, alongside manageable infections like herpes, HPV, and HIV. The WHO (2024) estimated 374 million new infections of four curable STIs in 2020 alone (19). Developing countries, including Thailand, bear 80% of these cases (20).

Displaced Myanmar youth face challenges due to political unrest, economic hardship, and ethnic conflicts, forcing migration to neighboring countries such as Thailand, home to millions of undocumented migrants mostly from Myanmar (1,21). Mae Sot district is a major hub with over 200,000 migrants, many children and youth excluded from formal education (4). Migrant Learning Centers (MLCs), supported by NGOs like UNESCO and UNICEF, provide alternative education but lack formal recognition, leading to diploma challenges and uneven sexual health education (3,4). Cultural stigma, language

barriers, and inconsistent curricula worsen youth vulnerability to misinformation on sexual health (7, 22).

The United Nations defines youth as individuals aged 15 to 24, a critical developmental stage marked by physical and cognitive changes and increased risk-taking behaviors (23). Youth are heavily influenced by peers and social structures, underscoring the importance of supportive adults in guiding healthier decision-making.

Research shows many displaced and migrant youth have limited STI knowledge, affected by misconceptions and stigma that hinder prevention and care (7, 24). Globally, misconceptions such as STIs being contracted only from sex workers or condom use only at ejaculation fully protecting are widespread, contributing to risky behaviors (9, 25). While HIV awareness is relatively high, knowledge of other STIs remains low among migrant youth in Southeast Asia (24, 26). Studies from Malaysia and refugee camps in Uganda emphasize the urgent need for tailored sexual health education for displaced youth (15, 27).

Cultural taboos in many Asian contexts, including Thailand, make sexual health discussions difficult, perpetuating stigma and misinformation that obstruct effective STI prevention and treatment. These barriers highlight the necessity for interventions addressing socio-cultural sensitivities to improve youth sexual health outcomes.

Thailand experienced a severe AIDS epidemic in the late 1980s, but early interventions, especially regulating sex work and treating STIs, greatly reduced HIV infections, preventing an estimated 8 million infections and 4 million AIDS-related deaths. In the early 2000s, the country strengthened its response by expanding antiretroviral therapy (ART) and prevention of mother-to-child transmission (PMTCT) programs (28). Despite progress, HIV remains a challenge, with new infections concentrated among younger key populations, notably men who have sex with men (MSM) who accounted for over 61% of cases in 2021 (28, 20). Concurrently, syphilis and gonorrhea cases are resurging after decades of decline. New syphilis cases between 2017 and 2021 were four times higher than in the previous decade, with youth

aged 15-24 seeing a 10-15 fold increase (28). The highest syphilis rates occur among male and transgender female sex workers but are also rising among young women. Gonorrhea has similarly spiked, peaking in 2017, highlighting the urgent need for improved STI prevention and treatment. Despite these challenges, Thailand remains committed to equitable HIV/AIDS services, but significant gaps persist for migrants and displaced groups, emphasizing the need for targeted efforts among Myanmar displaced youth (28).

Given resource constraints, this study focuses on syphilis, one of the most common and curable STIs globally and in Thailand, especially among youth aged 15-24 (18, 19, 28). There were reported 175 syphilis cases in Tak Province in 2018, predominantly among non-Thais in Mae Sot Sub-district, with most cases latent syphilis (29). While awareness of HIV/AIDS is high, knowledge of other STIs including syphilis remains low worldwide (12, 16, 26, 30). Since syphilis is curable, understanding its symptoms, transmission, and prevention is critical to promote early treatment and reduce spread. This study aims to provide in-depth insights into these aspects among Myanmar displaced youth in an underserved region of Thailand.

Syphilis, caused by the bacterium *Treponema pallidum*, spreads through sexual contact and from mother to fetus during pregnancy, potentially causing severe health complications if untreated (18, 31, 32, 33). It progresses through primary, secondary, latent, and tertiary stages, each with distinct symptoms. Primary syphilis appears about 21 days after exposure as a painless sore or chancre; secondary syphilis causes a non-itchy rash and lesions; latent syphilis shows no symptoms but remains infectious; tertiary syphilis, occurring years later if untreated, can cause serious damage to vital organs (31, 34). Congenital syphilis can result in severe birth defects and developmental issues (34). Prevention relies on consistent condom use, but transmission can occur in areas not covered by condoms. Rapid tests facilitate early detection and treatment (32, 34).

Regular testing is vital for high-risk groups like MSM, those with multiple partners, and pregnant women, who should be screened early in pregnancy to prevent congenital syphilis

(34). Partner notification following diagnosis helps reduce transmission. Together, screening, treatment, and partner notification are key to controlling syphilis and protecting public health (34).

The Socio-Ecological Model (SEM) provides a comprehensive framework for understanding the multi-level influences shaping STI knowledge and attitudes among displaced Myanmar youth (35). This study focuses on four SEM levels: individual (e.g., socioeconomic status, migration), interpersonal (family, peers), community (social stigma, resources), and institutional (healthcare, education) factors (15, 18, 25). Displaced youth face compounded challenges cultural, linguistic, economic, and trauma-related that affect their sexual health

knowledge and behaviors (7, 24). SEM's holistic, multi-layered approach surpasses individual-focused models like the Health Belief Model by incorporating social and environmental contexts critical in humanitarian settings. Unlike the Behavior Change Wheel, SEM better captures the complexity of influences on STI knowledge and attitudes, making it ideal for this exploratory study.

Qualitative research, such as in-depth interviews, is essential to explore the lived experiences and cultural contexts influencing STI knowledge and perceptions within displaced populations (24). It uncovers barriers like stigma, misconceptions, and service access difficulties that quantitative data may overlook.

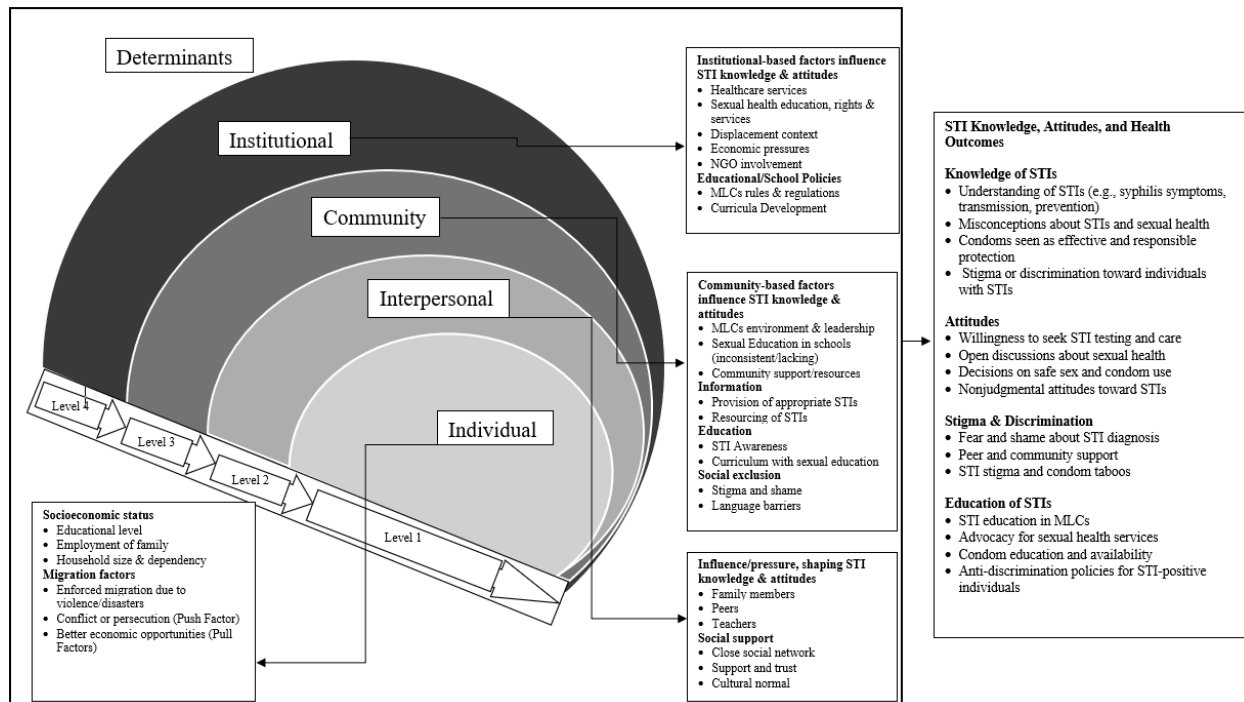


Figure 1 Conceptual Framework Applying the Socio-Ecological Model of Knowledge and Attitudes Toward STIs and Syphilis Specific Among Myanmar Displaced Youth at Migrant Learning Centers (MLCs), Mae Sot, Thailand

METHODOLOGY

This study used a narrative qualitative design to explore displaced Myanmar youths' understanding and attitudes toward sexually transmitted infections (STIs), with a focus on syphilis. Purposive sampling was used to recruit

30 youth (15 males, 15 females) aged 18–24 from five MLCs in Mae Sot, Thailand—both centrally located and remote. Participants varied by ethnicity, religion, education level, and living arrangements, but all had attended MLCs for at least one year. Five adult MLC staff (three

teachers and two school directors) were also interviewed for institutional insight.

Data collection occurred for approximately a month using semi-structured face-to-face interviews in Burmese, with Karen used when necessary. Interviews lasted 40–50 minutes, and written informed consent was obtained. The semi-structured interview guide consisted of 21 main questions. Around 6 questions focused on STI and syphilis knowledge, while 3 addressed information sources and reliability. Four questions explored attitudes toward STIs and condom use, and 5 examined cultural, religious, and social influences. Another 3 questions assessed perceived barriers to STI education and services. Additionally, 5 scenario-based questions were included to assess participants' ability to identify misinformation, use condoms, help someone with an STI, and design STI awareness campaigns. While formal reliability and validity testing was not conducted, the guide was reviewed by experts to ensure clarity and relevance.

Thematic analysis was conducted using both inductive and deductive coding, with data organization supported by Microsoft Word and Excel. Inductive coding allowed themes to emerge organically from participants' narratives, while deductive coding was guided by the research questions and the socio-ecological model. Interview transcripts were translated from Myanmar to English, then systematically coded and categorized into relevant themes and patterns. Peer debriefing was used to enhance the reliability of the coding process. Ethical approval was obtained from the Institutional Review Board of the Institute for Population and Social Research (IPSR), Mahidol University. All participants provided informed consent, were assured of confidentiality, and reminded of their right to withdraw at any time. Pseudonyms were used to protect identities, and all data were securely stored and accessed only by the research team.

Table 1 Demographic Profile of Displaced Myanmar Youth Participants Interviewed at Migrant Learning Centers (MLCs)

No.	Participant's Pseudonym	Gender	Age	Education	Ethnicity	Religion	Years at MLC	Living Status
1	M1	Male	21	Grade 12	Burmese	Buddhist	≥1	Cousins
2	M2	Male	18	GED	Karen	Buddhist	≥1	Family
3	M3	Male	21	Grade 11	Burmese	Islam	≥1	Family
4	F1	Female	18	Grade 12	Karen	Buddhist	≥1	Aunty
5	F2	Female	18	Grade 11	Burmese	Islam	>10	Family
6	F3	Female	18	GED	Chin	Christian	≥1	Relative
7	M4	Male	18	Grade 10	Karen	Christian	>10	Aunty
8	M5	Male	18	Grade 10	Karen	Buddhist	≥1	Aunty
9	M6	Male	19	Grade 10	Karen	Buddhist	6-10	Dormitory
10	F4	Female	18	Grade 10	Burmese + Karen	Buddhist	≥1	Family
11	F5	Female	18	Grade 10	Karen	Buddhist	2-5	Dormitory
12	F6	Female	18	Grade 10	Karen	Buddhist	2-5	Aunty
13	M7	Male	18	GED	Shan + Chin	Christian	2-5	Dormitory
14	M8	Male	23	GED	Karenni	Christian	6-10	Dormitory
15	M9	Male	19	Post-10	Burmese	Buddhist	2-5	Dormitory
16	F7	Female	18	Post-10	Burmese	Buddhist	≥1	Dormitory
17	F8	Female	18	Post-10	Burmese	Buddhist	≥1	Dormitory
18	F9	Female	20	Post-10	Burmese	Buddhist	≥1	Dormitory
19	M10	Male	20	Grade 12	Karen	Christian	2-5	Dormitory
20	M11	Male	19	Grade 12	Karen	Christian	2-5	Dormitory
21	M12	Male	18	Grade 11	Karen + Lahu	Christian	≥1	Dormitory
22	F10	Female	18	Grade 12	Pa'O	Buddhist	2-5	Dormitory
23	F11	Female	20	Grade 12	Burmese	Buddhist	2-5	Dormitory
24	F12	Female	18	Grade 11	Karen	Christian	2-5	Dormitory

No.	Participant's Pseudonym	Gender	Age	Education	Ethnicity	Religion	Years at MLC	Living Status
25	M13	Male	18	GED	Burmese	Buddhist	>10	Family
26	M14	Male	20	GED	Mon	Buddhist	≥1	Family
27	M15	Male	18	Pre GED	Burmese	Buddhist	>10	Family
28	F13	Female	18	GED	Burmese	Buddhist	≥1	Self
29	F14	Female	20	GED	Burmese	Buddhist	≥1	Self
30	F15	Female	18	Pre GED	Burmese	Buddhist	2-5	Family

Table 2 Background Information of Teachers and School Directors Interviewed at Migrant Learning Centers (MLCs)

No.	Participant's Pseudonym	Gender	Age	Education	Position	Religion	MLC Work Years	Teaching Subject	SRH Training Received
1	SD1 <i>SD = School Director</i>	Male	31	Grade 12	School Director	Buddhist	15	Math	Yes (From Suwanimit Foundation; Organization)
2	SD2	Male	69	Diploma	School Director	Christian	30	Labor Rights & Social Studies Science	Yes (from organization)
3	T_F1 <i>T = Teacher</i>	Female	26	Bachelor's Degree	Teacher + was a UNFPA trainer	Buddhist	2		Yes (From Medical College, organization)
4	T_F2	Female	56	Bachelor's Degree	Teacher + Vice School Director	Buddhist	3	Math	Yes (From Suwanimit Foundation about Comprehensive Sexuality Education - CSE)
5	T_M1	Male	32	Bachelor's Degree	Teacher + Academic Coordinator	Christian	7	Social Studies, Career Planning, Scholarship Info Sharing	Yes (From University, just general health)

RESULTS

The landscape of Sexually Transmitted Infection (STI) knowledge and education among displaced Myanmar youth in Migrant Learning Centers (MLCs) is complex, marked by significant gaps, misconceptions, and persistent social and structural barriers. This study reveals a critical need for comprehensive, culturally sensitive, and youth-centered interventions.

The combined perspectives of students, teachers, and school directors present a nuanced view of the challenges and opportunities surrounding STI education in MLCs. While many youth are familiar with STIs like HIV/AIDS, their understanding of other infections, such as syphilis, remains limited. This knowledge gap is compounded by social stigma, irregular training opportunities, the absence of dedicated STI

subjects in the curriculum, high teacher turnover, and limited teaching resources.

Theme 1: STIs Knowledge in General & Specific to Syphilis

Sub-theme 1.1: General STI Knowledge

Most students across different MLCs demonstrated good awareness of HIV/AIDS, mainly due to exposure through NGO trainings or school health sessions. However, even with this emphasis, misconceptions about HIV transmission still persisted. Several participants, for instance, expressed confusion about whether HIV could be transmitted through casual contact or poor hygiene. In contrast, knowledge of other sexually transmitted infections, such as syphilis, was significantly limited. When asked, Male 10 responded, “Umm... What is

syphilis? I've never heard of that disease before," highlighting a complete lack of familiarity. Similarly, Female 5 said she felt

"shocked" upon hearing the term syphilis, indicating it was new and unfamiliar

Sub-theme 1.2: Syphilis-Specific Misconceptions

Misunderstandings about syphilis transmission were widespread among both students and educators, including school directors. For example, Female 4 assumed syphilis could be transmitted through *"utensils,"* showing confusion about transmission routes. SD 1, a school director, expressed beliefs that syphilis could be contracted by *"wearing wet underwear or sharing clothes,"* or through *"poor body hygiene."* Such misconceptions from school leadership likely influence students' own misunderstandings. Several students also believed that *"using two condoms is safer,"* while others were unsure if this practice offered extra protection. In reality, using two condoms simultaneously increases the risk of breakage due to friction. These persistent myths reflect a broader issue in STI education, where inaccurate knowledge held by both educators and students perpetuates misinformation and leaves critical gaps unaddressed.

Across different ethnic, religious, and school backgrounds, many displaced Myanmar youth shared a common lack of knowledge about syphilis and other STIs beyond HIV/AIDS. This highlights that STI education in Migrant Learning Centers (MLCs) is limited and mostly focused on HIV, with little coverage of other infections. The repeated misunderstandings among students reflect broader gaps in current sexual and reproductive health education in these humanitarian settings.

Theme 2: Access to Information and Reliability

Sub-theme 2.1: Inconsistent Educational Sources

Access to STI information among displaced Myanmar youth in Migrant Learning Centers (MLCs) was inconsistent and fragmented. Most schools did not have a dedicated STI curriculum, and information was often delivered sporadically, either through science lessons or occasional NGO-led sessions. Teachers T_F1 and T_M1 stated, *"There is no specific course; sometimes it's in science,*

sometimes through NGOs." Female 16, a student, echoed this concern, saying, *"We don't learn much... only sometimes if someone from NGOs comes to teach."*

This irregular delivery model led to gaps in knowledge retention and continuity. Even students who received some form of education reported that the information faded over time due to a lack of reinforcement. As Male 1 explained, *"Even though I received training... I don't think it's enough... We need to keep updating our knowledge."* Other students, such as Female 4 and Female 7, also mentioned the lack of depth and consistency in the information shared at school.

Sub-theme 2.2: Unequal Access to External Training

Students also highlighted unequal opportunities in accessing external STI workshops. Not all students were invited to attend NGO-led sessions, and selection was limited to a few individuals per school. Female 1 shared, *"The school just chooses a few students. For me, I was never chosen to attend that kind of workshop, even though I really wanted to."* For those excluded, this resulted in frustration and a sense of missed opportunity to learn critical health information.

Additionally, students noted that the method of sharing information from those who attended workshops was not effective. As Female 2 described, *"Students who joined the workshop just share during assembly, but it's only around 10 minutes, and all students of different ages are there. It's not really effective."* This short and generalized delivery during school assemblies did not allow for in-depth discussion or age-appropriate understanding.

Sub-theme 2.3: Teacher Preparedness and Curriculum Limitations

Teachers' ability to deliver STI education was constrained by limited training opportunities and a lack of comprehensive sexual and reproductive health knowledge. T_F2, a teacher,

admitted, *“I don’t have a medical background, so it’s difficult for me to teach and discuss STI-related topics.”* Others shared similar discomfort in addressing sensitive issues due to outdated knowledge, the absence of a formal curriculum, and inadequate teaching resources.

High teacher turnover, often driven by low salaries, further disrupted continuity in STI education. As Teacher, T_F1 explained, *“Low salaries make it difficult to retain teachers.”* For example, Teacher A, who had received STI training from an NGO in 2023, left her position in 2024 before she could apply or share her knowledge with students in the following academic year. Her departure meant that the next incoming teacher, Teacher B, who had not received any STI-related training, had to start from scratch. This cycle of knowledge loss and repeated restart illustrates how structural challenges weaken the consistency and effectiveness of STI education in MLCs.

The recurring reflections from both students and teachers reveal that STI education in MLCs is not only inconsistent but also inequitably distributed and poorly sustained. Despite varied ethnic and school backgrounds, participants shared similar experiences of missed opportunities, irregular information, and a lack of reinforcement. These narratives highlight a systemic issue: without structured curricula, trained staff, and inclusive access to external workshops, students continue to face fragmented and unreliable STI education.

Theme 3: Attitudes Toward STIs and Condom Use

Sub-theme 3.1: Mixed Attitudes and Social Pressure

Many students expressed discomfort and embarrassment when discussing or accessing STI prevention tools like condoms. Most female students mentioned that many young people *“feel shy or lack knowledge, including them, when it comes to using condoms,”* while Female 7 shared, *“I will avoid buying condoms if others are nearby.”* Teacher, T_F2 also observed, *“Boys talk openly, girls stay silent,”* pointing to gendered communication norms around sexual health.

These responses reflect how social pressure, internalized stigma, and gender expectations shape attitudes and behaviors.

Sub-theme 3.2: Peer Influence and Misinformation

Peers played a significant role in reinforcing either supportive or risky behaviors. According to T_F1, *“Boys talk about sex without condoms,”* indicating how peer discussions can normalize unprotected sex among male students. Male 1 explained, *“Condoms are at 7-Eleven, but as youths, including me, feel too shy to buy them.”* Misinformation was also present; some students believed alternatives to condoms could be used to prevent STIs. For instance, one said, *“If we have sex and don’t use a condom, it’s okay, because we can take a pill to prevent STIs as well,”* confusing emergency contraception with STI prevention.

Despite having some knowledge about STI prevention, displaced youth face social and psychological barriers that discourage condom use. Shame, gender norms, and fear of public judgment restrict students from practicing safe sex, even when condoms are accessible. Male 1 shared, *“Even if condoms are available at 7-Eleven or stores, it depends on the student whether they will buy them. For me, I would avoid buying condoms if people are around because I feel ashamed, shy, and worried that people will think negatively about me.”* This insight reflects an internal conflict between awareness and action, rooted in broader cultural and social influences.

Theme 4: Cultural, Religious, and Social Influences

Sub-theme 4.1: Taboos and Parental Beliefs

Cultural and religious values strongly shaped students’ attitudes toward STI education and communication. Many participants described how stigma and moral judgments discouraged open discussions about sexual health. SD1, SD2, T_F2, stated, *“Some parents believe STI education encourages sex,”* reflecting a widespread belief that talking about STIs could promote sexual behavior early. Female 1 said she feared punishment from her parents, and Female 4 explained she felt *“uncomfortable to ask openly”* due to shame or misunderstanding.

Some students and teachers further reinforced this tension:

“Some parents may not want their children to learn or discuss STIs... they think it’s inappropriate and might encourage sexual activity.”

These social taboos can isolate young people from credible information sources, further increasing their vulnerability to misinformation or risk-taking behavior. In more extreme cases, students feared physical punishment for engaging in STI discussions. Female 2, a Muslim girl, revealed:

“If my father knows that I am having an interview with you about STIs, I will be beaten for sure.”

Such responses demonstrate the powerful role of cultural and religious norms in restricting youth access to health knowledge.

Sub-theme 4.2: Preferred Sources of Support

Despite these barriers, students expressed a clear desire to talk about STI-related topics, just not with regular school staff. Instead, they preferred turning to individuals they perceived as less judgmental or more approachable. These included healthcare workers, trainers from NGOs, or family members such as aunts. T_F1 noted that students *“feel safer asking personal questions to temporary trainers they won’t see every day,”* underscoring the significance of perceived safety and confidentiality.

This preference for alternative, supportive figures reveals how youth navigate restrictive cultural environments to seek the knowledge they need. It also highlights an important opportunity for intervention programs to engage trusted community members as conduits for STI education.

These stories reveal how structural, cultural, and religious contexts continue to silence youth voices and discourage honest and open discussions about sexual health. However, the strong desire expressed by students to access trusted, non-judgmental support systems signals potential for culturally sensitive and youth-

centered interventions. A successful STI education strategy must not only counter misinformation but also build safe spaces that reflect the realities of students’ lives and relationships.

Theme 5: Structural and Systemic Barriers to STI Education and Services

Sub-theme 5.1: Legal and Logistical Constraints

As displaced youth, they would face multiple constraints in accessing STI-related services if they were to become infected. A lack of legal documentation would severely limit their ability to travel freely or seek care at clinics. As Female 10 explained, *“Traveling to clinics is difficult without documents.”* Others cited barriers such as *“the distance and the transportation,”* which would further hinder their ability to obtain timely medical attention. Financial hardship also emerged as a major concern, especially for those without stable income or family support, making it difficult to afford transportation, treatment, or even basic health consultations. These systemic limitations mean that even if services exist, they remain out of reach for many at-risk youth.

Sub-theme 5.2: Persistent Willingness to Learn Despite Challenges

Despite these significant structural constraints, many students expressed a strong desire to learn more about STIs. They demonstrated eagerness to improve their understanding and adopt preventive behaviors, even when educational and healthcare services were limited or difficult to access. This willingness highlights the resilience and motivation among displaced youth to protect their health, provided that appropriate, inclusive, and accessible learning opportunities are offered.

While facing barriers such as legal status, poverty, and limited mobility, displaced Myanmar youth continued to show interest in STI prevention and education. Their responses reflect a readiness to engage, if given the chance. This underscores the urgent need for targeted, youth-centered interventions that remove systemic obstacles and empower students with accurate, life-saving knowledge.

This study found that while HIV/AIDS awareness was widespread among displaced Myanmar youth, understanding of other STIs, including syphilis, was limited or newly acquired. Many participants held misconceptions about transmission and prevention, such as believing hygiene alone could prevent infection. These gaps suggest that current education efforts are overly focused on HIV and lack comprehensive STI coverage.

While some participants received training from NGOs or school programs, these were often irregular and superficial. Youth clearly expressed a desire for practical, age-appropriate education that is repeated and culturally relevant. The overreliance on social media for information, like Facebook, increased the risk of misinformation.

Despite cultural and gender-based taboos, participants generally are willing to show compassionate attitudes toward peers with STIs. However, fear of stigma, shame, and embarrassment, especially among girls, may limit open discussions and access to protection tools like condoms. Structural barriers such as cost, distance, and lack of legal documents may further hinder clinic access.

Family dynamics may play a dual role. While some youth may be open-minded relatives, others may fear punishment or disapproval in discussing STI-related topics or seeking treatment if they have one. Trusted adults like aunts or healthcare workers emerge as important sources of support, underscoring the potential of community-based education. Youth are more likely preferred visual, discussion-based, and peer-led approaches, suggesting that participatory learning methods can boost knowledge and reduce stigma. These findings indicate that future efforts must go beyond basic information-sharing and address deeper social and structural challenges.

RECOMMENDATIONS

Based on these findings, STI education programs for displaced youth should be strengthened through frequent, engaging, and age-specific sessions. Interactive tools such as video content, discussions, and games should be used to improve understanding and retention. Campaigns should empower youth to lead peer

education and normalize conversations around sexual health.

To address stigma and cultural taboos, trusted community figures like aunts, older siblings, or trained youth leaders should be engaged as “cultural connectors” to facilitate sensitive topics. Girls in particular need discreet access to condoms and services without shame or judgment.

Improved access to care is also essential. Mobile services or clinic outreach to MLCs can help overcome geographic, legal, and financial barriers. Services should prioritize confidentiality and inclusivity for undocumented youth. Family awareness programs can also reduce resistance and build supportive environments for open health discussions.

LIMITATIONS

This study has several limitations. As a qualitative study based on a small, purposively selected sample from five Migrant Learning Centers (MLCs), the findings may not be generalizable to all displaced youth in Thailand or other contexts. While efforts were made to include schools located at varying distances from central areas, extremely remote schools were difficult to access due to transportation challenges. Despite this, logistical constraints limited outreach to more distant sites. However, two schools located farther from the central city, compared to the others, were included to enhance diversity. Despite this, logistical constraints limited outreach to more distant sites. In some schools, a lack of cooperation from staff made it difficult to locate quiet, private environments for student interviews. Even in supportive schools, limited infrastructure posed challenges in finding suitable spaces; however, teachers and school directors did their best to provide appropriate interview locations.

Additionally, language translation from Burmese and Karen to English may have led to some loss of nuance in participant responses. Social desirability bias may also have influenced how openly participants discussed sensitive topics such as use of condoms and STIs.

Despite these limitations, the study offers important insights into the knowledge gaps, attitudes, and barriers related to STI education

population. A key strength lies in its inclusion of multiple perspectives, students, teachers, and school directors, which allowed for a more comprehensive understanding of the issue. Thematic analysis helped identify recurring patterns across different levels, making the findings valuable for informing the development of youth-friendly, context-specific STI education in humanitarian settings.

CONCLUSION

In conclusion, while displaced Myanmar youth at MLCs show a growing willingness to learn and support one another, serious gaps remain in STIs knowledge, including syphilis. Education efforts are too narrow, and structural and cultural barriers persist. However, the participants' openness and creative suggestions offer a promising path forward.

To improve STI outcomes in humanitarian settings, health education must be frequent, inclusive, and culturally sensitive. At the same time, access to care must be made easier, safer, and more youth-friendly. With the right interventions rooted in trust, community, and empowerment, youth can become strong advocates for their own health and that of their peers.

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PREVALENCE OF ELECTRONIC CIGARETTE USE AND ITS ASSOCIATED FACTORS AMONG SUBURBAN DWELLERS IN YANGON, MYANMAR

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ABSTRACT

Introduction: Electronic cigarettes have gained popularity globally, particularly among younger populations, raising public health concerns. Suburban Yangon is rapidly urbanizing, and adults aged 18–44 with increasing incomes and exposure to global trends are highly susceptible to adopting new smoking behaviors. Research on electronic cigarette use in Myanmar remains limited. This study aimed to determine the prevalence and factors associated with current electronic cigarette use among suburban residents in Yangon.

Methodology: A cross-sectional survey was conducted using convenience sampling among suburban individuals aged 18–44 years. A self-administered online questionnaire collected data on demographic characteristics, psychological influences, social exposure, and attitudes. Chi-square tests identified associations and multiple logistic regression determined predictors of current electronic cigarette use.

Results: Among 466 participants, 23.4% reported current use. Multiple logistic regression revealed participants aged ≤ 29 years (AOR=3.78; 95%CI:1.36-10.52) and 30-39 years (AOR=3.41; 95%CI:1.21-9.59) were significantly more likely to use than those ≥ 40 years. Females were 73% less likely to be current users than males (AOR=0.27; 95%CI:0.14-0.51). Individuals earning over 1,500,000 MMK monthly were nearly four times more likely to use (AOR=3.89; 95%CI:1.52-9.94). High perceived stress (AOR=4.65; 95% CI: 1.52-14.17), peer use (AOR=6.88; 95%CI:2.52-18.79), partner use (AOR=3.05; 95%CI:1.36-6.86), and favorable attitudes (AOR=3.26; 95%CI:1.87-5.70) were significantly associated with increased likelihood of current electronic cigarette use.

Conclusion: Electronic cigarette use is substantial among suburban residents in Yangon, with nearly one-fourth reporting current use. Key predictors include younger age, male, higher income, stress, social exposure, and favorable attitudes, with peer use being the strongest. These findings indicate the urgent need for comprehensive interventions to prevent experimentation, reduce ongoing use and dependence, enforce sales and marketing restrictions by strengthening regulations addressing multiple determinants of this emerging public health issue.

Keywords: Electronic cigarette, Myanmar, Suburban, Yangon

INTRODUCTION

Electronic cigarettes, or e-cigarettes or vapes, are electronic nicotine delivery systems (ENDS) that entered the global market in 2006 (1). They were introduced as safer alternatives to conventional cigarettes, free from harmful combustion products (2). Over the past decade, these devices have evolved significantly, offering advanced technology, appealing designs, various flavors, and lower costs than tobacco cigarettes (3). Strong social media promotion and marketing

has portrayed them as socially acceptable and safe product, leading to rising use especially among youths (4). Globally, electronic cigarette users grew from 7 million in 2011 to 82 million in 2021 (5). Lifetime prevalence of electronic cigarette use is estimated at 23% and 11% are current users (6). WHO stated that rising electronic cigarette use poses major public health challenges and may undermine tobacco control efforts (7).

The increasing number of users has raised concerns for both users and bystanders. Electronic

cigarettes contain nicotine, a highly addictive substance that can affect brain development in younger people leading to learning and anxiety disorders (8). Prolonged use is associated with increased risk of chronic respiratory and cardiovascular diseases (9). EVALI (electronic cigarette or vaping-associated lung injury), a rare but fatal condition causing severe lung inflammation, has been reported worldwide (10). Bystanders can also be harmed by second-hand aerosol (SHA) containing harmful substances including fine particles, heavy metals, volatile organic compounds, and nicotine. These exposures increase the risk of respiratory and cardiovascular problems, especially in individuals with pre-existing respiratory conditions (11).

To reduce the use of electronic cigarettes and protect non-smokers, WHO recommends the M-POWER strategy: Monitor tobacco use, Protect people from tobacco smoke, Offer help to quit, Warn about the dangers, Enforce bans on advertising, and Raise taxes on tobacco. By 2024, 155 countries had implemented at least one measure at the highest level. However, only four countries have adopted all measures at best-practice level. Despite the progress, barriers such as tobacco industry interference, limited funding and staffing hinder full success in reducing tobacco and electronic cigarette use (7).

Myanmar, a lower-middle-income country, has the highest adult smoking rates in ASEAN in 2020, with 44.1% of adults and 68.7% of men (12). Despite ratifying the WHO Framework Convention on Tobacco Control (FCTC) in 2005, Myanmar remains among the 62 countries globally without specific electronic cigarettes regulations (7). Myanmar's tobacco control policy exhibits regulatory gaps in import, sale, taxation, and marketing of electronic cigarettes, including no restrictions on indoor use, age, advertising, packaging warnings, and flavor (7). It is anecdotal that the use is increasing in Myanmar. A study in 2020 across six states and regions of Myanmar reported 11.6% prevalence of ever-use (13). However, empirical research on the prevalence and associated factors of electronic cigarette use in Myanmar remains limited. This study aims to determine the prevalence and associated factors of current electronic cigarette use among suburban dwellers in Yangon. This research will provide essential data to support

targeted interventions and strategies to prevent a new wave of nicotine addiction in Myanmar.

METHODOLOGY

Study design and population

A cross-sectional study was conducted from February to March 2025 in suburban areas of Yangon. These areas represent rapidly urbanizing communities with growing exposure to global trends, including electronic cigarette use. The study population was Burmese adults aged 18-44 living in suburban areas of Yangon. Eligible participants were adults aged 18-44, residing in Yangon for at least six months, able to read and write Burmese or English and consenting to participate.

Sample size and sampling technique

The sample size of 446 was calculated using the Taro Yamane formula with 95% confidence level and an additional 10% for anticipated non-response. Participants were recruited via convenience sampling. To minimize sampling bias, the survey was distributed via multiple online platforms (Facebook, Messenger, Viber, Line, Telegram) to reach diverse occupations, with clear eligibility screening and real-time monitoring of daily responses to identify potential issues.

Measurement tool, validity and reliability

Data were collected using a self-administered online questionnaire via Google Forms chosen for feasibility, wide accessibility, cost-effectiveness, reduced interviewer bias and safe data collection during Myanmar's political crisis. It included participant information, consent, screening questions, and a questionnaire containing four sections: (1) general characteristics of participants (2) perceived stress using Perceived Stress Scale-10, (3) social exposure and influence from family members, friends and social media, (4) attitude towards the electronic cigarette use, using a five-point Likert scale. Higher scores indicate a more favorable attitude.

Three experts reviewed the questionnaire using Item-Objective Congruence (IOC) for content validity. Pilot testing showed good reliability, with Cronbach's alpha of 0.80 for PSS-10 and 0.84 for Attitude.

Variables

The dependent variable was current electronic cigarette use, defined as use within the past 30 days.

The independent variables were categorized into four main groups; (1) General characteristics (age, gender, education, religion, marital status, occupation, monthly income and perception of overall health) (2) Psychological influence (perceived stress measured by PSS-10) (3) Social exposure (Electronic cigarette use among parents, relatives, peer and partner, social media normalization of electronic cigarette use, peer influence on obtaining these devices), (4) Attitude towards use.

Data analysis

Data were analyzed using IBM SPSS version 29. Chi-square tests assessed the relationships between current electronic cigarette use and independent variables. Multiple logistic regression identified the predictors of current electronic cigarette use. The results were reported as adjusted odds ratios (AORs) with 95% confidence intervals, considering $p < 0.05$ as statistically significant.

RESULTS

Prevalence of current electronic cigarette use

A total of 466 individuals participated. The prevalence of current electronic cigarette use among suburban dwellers in Yangon was 23.4%, indicating that nearly one in four participants reported using electronic cigarettes within the past 30 days.

Characteristics of current electronic cigarette users

Table 1 describes the general characteristics of participants. Most current users were aged 29 or younger (56.9%), male (66.1%), and possessed at least a bachelor’s degree (65.1%). The majority of current users identified as Buddhist (91.7%), and approximately half were single (46.8%). Over one-third of current users worked in the private sector (34.9%), and around one-fourth of the current users earned 300,000 to 500,000 MMK monthly (28.4). Nearly all reported overall health as good (97.2%). Notably, most current users reported high perceived stress (94.5%). Most users had peers who had ever used electronic cigarettes (94.5%). Over one-fourth perceived social media as normalizing the use, while half were neutral. About one-third denied peer influence in obtaining devices. Importantly, most current users (78.0%) expressed favorable attitudes.

Table 1 Characteristics of the participants by current electronic cigarette use (n=466)

Characteristics	Electronic Cigarette Use Status (n=466)		Chi-square	p-value
	Current Users (n=109) (n, %)	Non-current Users (n=357) (n, %)		
I. General Characteristics				
Age Groups (Years)			4.912	0.086
≤ 29	62 (56.9)	179 (50.1)		
30-39	40 (36.7)	127 (35.6)		
≥ 40	7 (6.4)	51 (14.3)		
Gender			16.961	<0.001*
Male	72 (66.1)	157 (44.0)		
Female	35 (32.1)	195 (54.6)		
Others	2 (1.8)	5 (1.4)		
Education			0.758	0.384
Less than Bachelor ‘s degree	38 (34.9)	141 (39.5)		
Bachelor’s degree and above	71 (65.1)	216 (60.5)		
Religion			0.234	0.629
Buddhism	100 (91.7)	322 (90.2)		

Characteristics	Electronic Cigarette Use Status (n=466)		Chi-square	p-value
	Current Users (n=109) (n, %)	Non-current Users (n=357) (n, %)		
Non-Buddhism	9 (8.3)	35 (9.8)	10.355	0.035*
Marital Status				
Single	51 (46.8)	184 (51.5)	21.429	0.011*
In a relationship	28 (25.7)	54 (15.1)		
Married	29 (26.6)	97 (27.2)		
Divorced/Separated	1 (0.9)	20 (5.6)		
Widowed	0 (0.0)	2 (0.6)		
Occupation			19.205	<0.001*
Unemployed	3 (2.8)	22 (6.2)		
Student	14 (12.8)	46 (12.9)		
Healthcare professional	13 (11.9)	39 (10.9)		
Government employee	3 (2.8)	20 (5.6)		
Private sector employee	38 (34.9)	130 (36.4)		
Self-employed / Business owner	15 (13.8)	39 (10.9)		
Service industry worker	7 (6.4)	9 (2.5)		
Manual laborer	2 (1.8)	29 (8.1)		
Freelancer / Contractor	12 (11.0)	23 (6.4)		
Retired	2 (1.8)	0 (0.0)		
Monthly Income			0.821	0.365
< 300,000 MMK	20 (18.3)	106 (29.7)		
300,000 - 500,000 MMK	31 (28.4)	128 (35.9)		
500,001 - 1,000,000 MMK	21 (19.3)	60 (16.8)		
1,000,001 - 1,500,000 MMK	10 (9.2)	27 (7.6)		
> 1,500,000 MMK	27 (24.8)	36 (10.1)		
Perception of Overall Health			4.320	0.038*
Poor	3 (2.8)	17 (4.8)		
Good	106 (97.2)	340 (95.2)		
II. Psychological Influence			3.767	0.052
PSS-10				
Low Perceived Stress (0-13)	6 (5.5)	45 (12.6)	5.195	0.023*
High Perceived Stress (14-40)	103 (94.5)	312 (87.4)		
III. Social Exposure			31.960	<0.001*
Parents Use				
No Use	106 (97.2)	328 (91.9)	33.861	<0.001*
Ever-Use	3 (2.8)	29 (8.1)		
Relatives Use			31.960	<0.001*
No Use	57 (52.3)	230 (64.4)		
Ever-Use	52 (47.7)	127 (35.6)		
Peers Use			33.861	<0.001*
No Use	6 (5.5)	117 (32.8)		
Ever-Use	103 (94.5)	240 (67.2)		
Partner Use			1.319	0.517
No Use	55 (50.5)	234 (65.5)		
Ever-Use	35 (32.1)	34 (9.5)		
Not Applicable	19 (17.4)	89 (24.9)		
Social Media normalizing Electronic Cigarette Use				

Characteristics	Electronic Cigarette Use Status (n=466)		Chi-square	p-value
	Current Users (n=109) (n, %)	Non-current Users (n=357) (n, %)		
Disagree	25 (22.9)	99 (27.7)	12.787	0.002*
Neutral	55 (50.5)	160 (44.8)		
Agree	29 (26.6)	98 (27.5)		
Peer influence on obtaining Electronic Cigarette				
Agree	22 (20.2)	37 (10.4)	36.834	<0.001*
Neutral	46 (42.2)	123 (34.5)		
Disagree	41 (37.6)	197 (55.2)		
IV. Attitude				
Attitude towards Electronic Cigarette Use				
Min-Max (18-90), Median (IQR): 61 (55 - 68)				
Favorable Attitude towards use (> 61)	85 (78.0)	160 (44.8)		
Unfavorable Attitude towards use (≤ 61)	24 (22.0)	197 (55.2)		

*Significant at p-value <0.05

Currency Exchange Rate – 1,000 MMK = 0.28 USD = 7.7 Thai Baht

Factors associated with current electronic cigarette use

Chi-square analysis showed significant associations with gender, marital status, occupation, monthly income, perceived stress, relatives, peer and partner use, peer influence, and attitude (p < 0.05). Table 1.

Multiple binary logistic regression analysis examines the factors associated with current electronic cigarette use. Table 2. Participants aged 29 years or younger were almost four times more likely to use (AOR=3.781; 95%CI:1.358–10.524; p=0.011), and those aged 30 to 39 years were over three times more likely to use (AOR=3.411; 95%CI:1.213–9.593; p=0.020), compared to those ≥40. Female were significantly less likely to be current users than males (AOR=0.270; 95% CI:0.144–0.507; p<0.001). Participants earning above 1,500,000 MMK were nearly four times more likely to use (AOR=3.891; 95%CI:1.523–

9.938; p=0.005) than those with lower incomes. High perceived stress was also strongly associated with current use, with stressed participants being over four times more likely to use (AOR=4.645; 95%CI:1.522–14.172; p=0.007). Individuals with peers who had ever used electronic cigarettes were over five times more likely to be current users (AOR=5.398; 95%CI:2.000–14.570; p<0.001), and those with partners who had ever used were almost seven times more likely to use (AOR=6.715; 95%CI:3.141–14.356; p<0.001). Favorable attitudes toward use was also significant, with participants over four times more likely to be current users (AOR=4.304; 95%CI: 2.384–7.771; p<0.001) than those with an unfavorable attitude. In summary, age, gender, income, perceived stress, peer and partner use, and attitude were identified as key factors associated with current electronic cigarette use in suburban Yangon.

Table 2 Multiple logistic regression of factors associated with current electronic cigarette use (n=466)

Variables	AOR	(95% CI)		p-value
		Lower	Upper	
Age groups (Years)				
≥ 40	Reference			
≤ 29	3.781	1.358	10.524	0.011*
30-39	3.411	1.213	9.593	0.020*
Gender				
Male	Reference			
Female	0.270	0.144	0.507	<0.001*
Others	0.172	0.025	1.189	0.074
Education				
Bachelor's degree and above	Reference			
Less than Bachelor 's degree	1.366	0.709	2.630	0.351
Religion				
Buddhism	Reference			
Non-Buddhism	0.826	0.324	2.109	0.690
Marital Status				
Unpartnered	Reference			
With Partner	1.636	0.877	3.054	0.122
Occupation				
Employed	Reference			
Not employed	1.088	0.491	2.412	0.836
Monthly Income				
< 300,000 MMK	Reference			
300,000 - 500,000 MMK	1.199	0.550	2.613	0.649
500,001 - 1,000,000 MMK	1.796	0.731	4.412	0.202
1,000,001 - 1,500,000 MMK	2.104	0.700	6.323	0.185
> 1,500,000 MMK	3.891	1.523	9.938	0.005*
Perception of Overall Health				
Poor	Reference			
Good	1.372	0.314	5.996	0.674
PSS-10				
Low Perceived Stress (0-13)	Reference			
High Perceived Stress (14-40)	4.645	1.522	14.172	0.007*
Parents Use				
No Use	Reference			
Ever-Use	0.394	0.102	1.524	0.177
Relatives Use				
No Use	Reference			
Ever-Use	1.516	0.876	2.624	0.137
Peers Use				
No Use	Reference			
Ever-Use	5.398	2.000	14.570	<0.001*
Partner Use				
No Use	Reference			
Ever-Use	6.715	3.141	14.356	<0.001*
Not applicable	1.077	0.491	2.362	0.853
Social media is normalizing Electronic Cigarette Use				
Disagree	Reference			

Variables	AOR	(95% CI)		p-value
		Lower	Upper	
Neutral	1.011	0.511	2.003	0.975
Agree	0.839	0.396	1.778	0.647
Peer influence in obtaining Electronic Cigarettes				
Agree	Reference			
Neutral	0.635	0.289	1.397	0.259
Disagree	0.583	0.267	1.274	0.176
Attitude				
Unfavorable Attitude	Reference			
Favorable Attitude	4.304	2.384	7.771	<0.001*

*Significant at p-value<0.05

AOR: Adjusted Odd Ratio, CI: Confidence Interval

DISCUSSION

The prevalence of current electronic cigarette use in this study was 23.4%, substantially higher than global and regional estimates in 2022 (global prevalence of 11%, 10% in Americas, 14% in Europe, 11% in Asia, and 6% in Oceania) (6). This indicates the rapid growth of electronic cigarette use in Yangon, and is concerning for Myanmar, where smoking rates are already among the highest in ASEAN (12). This situation signals an emerging public health challenge if electronic cigarette use continues to rise or contributes to dual use with conventional cigarettes.

Our study found higher electronic cigarette use among younger adults, consistent with previous studies showing peak use among those aged 18–24 (14). Males were also more likely users, aligning with international findings (15). The tobacco industry has targeted women by promoting appealing electronic cigarettes in U.S. magazines such as *Star* and *Us Weekly*, aimed at female audiences, portraying them as desirable lifestyle accessories (16). Higher-income participants were more likely to use, possibly due to the cost of devices and supplies (17). Individuals with higher perceived stress were more likely to use electronic cigarettes, supporting evidence that psychological distress can drive use as a coping mechanism (18). The strong influence of peers was evident, as having friends who used electronic cigarettes increased the likelihood of use, consistent with research showing peer shapes smoking and vaping behaviors among adolescents and young adults (19). Partner use was another important factor, as shared lifestyle habits in romantic relationships

influence initiation and continued use (20). Favorable attitudes toward electronic cigarettes were linked with higher use, supporting that positive perceptions increase the likelihood of use (21).

LIMITATIONS

This study is among the first to explore the electronic cigarette use and associated factors among suburban Yangon adults, featuring a large sample and a comprehensive assessment of social, psychological, and attitudinal factors. The online survey enabled data collection despite Myanmar's ongoing political challenges. However, the cross-sectional design cannot establish causality. Convenience sampling may limit generalizability. Self-reported data may cause recall and social desirability biases. This study did not explore cultural factors or policy gaps that may influence electronic cigarette accessibility in Myanmar.

CONCLUSION

This study highlighted a high prevalence of current electronic cigarette use among suburban adults in Yangon, particularly young males with higher income, perceived stress, social exposure, and favorable attitudes toward use. These findings emphasize the urgent need for comprehensive control strategies, educational programs addressing psychological and social factors, awareness campaigns and stricter access regulations to prevent youth experimentation and continued use. A national regulatory framework is crucial as the foundation for developing and implementing measures to protect public health and prevent further uptake in Myanmar.

RECOMMENDATION

Based on these findings and the WHO M-POWER framework, public health professionals should implement educational campaigns highlighting health risks of electronic cigarettes, cessation support, and target youths. Campaigns should correct misconceptions, address favorable attitudes, and leverage social and peer networks to shift norms. Healthcare providers should screen for use, offer mental health support, and involve families in prevention.

Policymakers should strengthen sales, advertising, and flavors regulation, impose taxes to reduce affordability, and ensure monitoring and enforcement.

Future researchers should include adolescents and employ longitudinal and qualitative designs to explore causal relationships and intervention effectiveness.

ETHICAL DECLARATION

Ethical approval was obtained from the Ethical Committee for Research Involving Human Subjects, Health Science Group, Chulalongkorn University, on 18 February 2025 (COA No. 045/68).

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MALARIA KNOWLEDGE, ATTITUDE AND HEALTH-SEEKING BEHAVIOR OF MIGRANT POPULATION IN A THAI BORDER DISTRICT: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Malaria remains a life-threatening disease, with global cases on the rise. Since the 2021 military coup in Myanmar, malaria incidence in the country has increased, contributing to a higher number of imported cases in Thailand, especially in border areas. The influx of migrants has intensified the demand for healthcare services in these regions. Understanding the knowledge, attitudes, and health-seeking behaviors of Myanmar migrants is critical for designing effective malaria interventions in high-transmission zones.

Objectives: To assess factors associated with malaria-related knowledge, attitudes, and health-seeking behaviors among Myanmar migrants residing in Phop Phra District, Tak Province, Thailand.

Methodology: A cross-sectional survey was conducted among 210 Myanmar migrants aged 18–59 years using chain-referral sampling. Data were collected through structured, face-to-face interviews and analyzed using descriptive statistics, Chi-square tests, and logistic regression. Knowledge and attitude scores were categorized, and health-seeking behavior was dichotomized into formal and informal care utilization.

Results: Most participants demonstrated moderate levels of malaria knowledge (69.0%) and attitudes (75.2%). Among those who experienced fever with chills (60.5%), 60% sought formal healthcare services, while 40% relied on informal care. Logistic regression revealed that individuals with a history of malaria diagnosis were significantly more likely to seek formal healthcare (AOR = 2.234; 95% CI: 0.998-5.001; $p = 0.051$).

Conclusion: Findings suggest that prior experience with malaria is the key factor influencing formal treatment-seeking among Myanmar migrants. Moderate knowledge and attitude levels highlight the need for targeted health education. Due to the use of chain-referral sampling, the findings are generalizable primarily to the survey respondents and may not reflect the broader migrant population. Inclusive health policies and improved service accessibility are essential to ensure timely malaria care for this at-risk group.

Keywords: Malaria, Myanmar Migrants, Knowledge and Attitude, Health Seeking Behavior

INTRODUCTION

Malaria remains a significant global health concern, particularly in tropical and subtropical regions. In 2023, the World Health Organization (WHO) estimated 263 million malaria cases worldwide, with an incidence rate of 60.4 per 1,000 individuals at risk, an increase of 11 million cases from the previous year (1). While some countries in South and Southeast Asia showed declines in malaria, such as India and Bangladesh, others including Myanmar and Thailand saw substantial increases. Myanmar's estimated malaria cases surged more than tenfold from 78,000 in 2019 to 847,000 in 2023, largely

due to ongoing political instability that has disrupted malaria prevention and healthcare systems (1).

Thailand, which shares a porous and highly mobile border with Myanmar, has experienced a parallel trend. From 2021 to 2023, local malaria cases in Thailand tripled (from 2,426 to 9,169), and imported cases rose sharply (from 800 to 7,276), mostly concentrated in border provinces such as Tak and Kanchanaburi (1). Migrants and displaced persons from Myanmar comprise the majority of these cases, posing challenges to malaria elimination efforts

and increasing the burden on local health infrastructure (1-3).

Despite Thailand's national malaria elimination goal by 2026, malaria transmission persists in provinces bordering Myanmar, Cambodia, and Malaysia (4). A malaria stratification mapping study in Thailand confirmed that areas with sustained local transmission align with international borders, driven by high population movement, environmental conditions conducive to mosquito breeding, and limited access to healthcare (4). The WHO emphasizes that early diagnosis and prompt treatment within 24 hours of symptom onset are critical to controlling malaria transmission and reducing mortality (1).

The political unrest in Myanmar since early 2021 has catalyzed mass migration into Thailand, with 4–5 million migrants currently residing in the country, 75% of whom are from Myanmar (2). Many migrants are undocumented and face substantial barriers in accessing healthcare services due to legal status, cost concerns, and fear of arrest or deportation (2-5). In border districts like Phop Phra in Tak Province, migrants depend on a fragmented system of care including NGO-run clinics, refugee camp facilities, and occasional use of public hospitals. Undocumented individuals particularly avoid government services, preferring humanitarian clinics such as Mae Tao Clinic (5, 6).

In 2025, the U.S. government froze foreign aid, resulting in the suspension of key health services in refugee camps and nearby communities along the Thailand-Myanmar border (7, 8). The abrupt withdrawal of support from organizations such as the International Rescue Committee led to the closure of critical clinics in camps like Mae La, Umpiem Mai, and Nu Po (7). These disruptions have compounded existing challenges in providing care to migrant populations, especially in areas targeted by cross-border malaria elimination campaigns (8).

A mixed-methods study conducted in 2019 revealed how migrants conceptualize fever and decide when and where to seek care. Many participants initially resorted to self-medication. If symptoms persisted, they turned to free humanitarian clinics (45.5%), private clinics (43.1%), health posts (36.1%), public hospitals (33.7%), and primary care units (14.9%) (9).

Barriers to care included distance to health facilities and undocumented legal status. Those with legal documents were more likely to use formal healthcare services, whereas undocumented migrants relied on cost-free or informal care (9).

Additional studies across Asia and Africa corroborate these findings. In India, over 45% of households sought care from informal providers, influenced by factors such as education, socioeconomic status, and proximity to health facilities (10). In Cambodia, limited understanding of malaria symptoms and treatment, especially during pregnancy, reduced care-seeking behavior (11). In Laos and Ghana, access was further hindered by shortages of medications and high treatment costs, even among insured individuals (12, 13).

A cross-sectional study in Indonesia showed that 60.4% of rural adults had poor knowledge of proper malaria treatment-seeking behavior. Contributing factors included low education, agricultural occupations, and geographic isolation (14). Among migrants, additional barriers such as unstable employment, short-term residence, and poor familiarity with local health systems influenced treatment choices. A study in Myanmar found that only 17% of migrant workers preferred public healthcare; most turned to informal providers due to convenience, trust, and accessibility of low-cost antimalarials (15).

Despite malaria being preventable and treatable, Myanmar migrants in Thailand remain disproportionately affected due to structural, legal, and knowledge-related barriers. Although WHO emphasizes early diagnosis and treatment, limited data exists on the knowledge, attitudes, and health-seeking behaviors of Myanmar migrants in Thailand, particularly since the onset of political unrest in 2021. Understanding how this vulnerable group responds to malaria symptoms, especially fever, is essential for designing targeted interventions.

Two theoretical frameworks were applied in this study. The Health Belief Model was used to assess participants' attitudes toward malaria. According to the Health Belief Model, health behavior is influenced by perceptions of susceptibility, severity, benefits, and barriers, as well as cues to action and self-efficacy (16). In

this study, questionnaire items for attitude were developed based on these constructs to capture beliefs regarding risk, seriousness, preventive actions, perceived obstacles, and triggers for action.

The Andersen's Health Seeking Behavior Model was also employed to examine factors influencing care-seeking. Within this model, determinants of health-seeking behavior are categorized into predisposing factors (demographics, prior experiences), enabling factors (income, healthcare access, transportation), and need factors (perceived or actual illness) (17). These domains were used as a framework for analyzing how socio-demographic and contextual factors shape malaria-related health-seeking behavior among migrants.

This study aims to assess malaria-related knowledge, attitudes, and health-seeking behaviors among Myanmar migrants residing in Phop Phra District, Tak Province. The findings will help fill critical gaps in understanding and inform strategies to enhance malaria control and equitable healthcare access for migrant populations along the Thailand-Myanmar border.

METHODOLOGY

Study Design and Study Area

This study employed a quantitative cross-sectional design and was conducted in Phop Phra District, Tak Province, Thailand; a key location along the Thailand-Myanmar border. The district is a common destination for Myanmar migrants engaged in agricultural work and also hosts the Umpiem Mai refugee camp, sheltering over 10,000 refugees as of May 2023 (18). In 2023, Tak Province reported more than 10,000 malaria cases, with Phop Phra among the top three districts most affected (3).

Study Population and Sample

The study population comprised Myanmar migrants aged 18–59 years residing in Phop Phra for at least six months. This age group represents the most economically active and mobile population, aligning with International Organization for Migration (IOM)'s 2025 demographic profile (19). The required sample size was calculated using Cochran's formula with a 95% confidence level, 5% margin of error, and

an assumed proportion of 0.5 due to the absence of prior estimates. Accounting for a 10% non-response rate, the final sample size was 210 participants, as determined from preliminary analysis.

A combination of purposive and chain-referral sampling was employed. Initial participants were selected based on recommendations from key informants familiar with migrant communities, such as healthcare workers and NGO staff. These participants then referred others within their networks. This method was appropriate given the undocumented status of many migrants, which made probabilistic sampling impractical.

Research Instrument

Data were collected using a structured questionnaire, developed based on prior studies on malaria knowledge, attitudes, and treatment-seeking behaviors. The knowledge section was scored using Bloom's cut-off criteria, while the attitude section applied a five-point Likert scale, with categorization based on mean \pm standard deviation. Health-seeking behavior questions focused on actions taken after symptom onset, source of care, and timeliness. The questionnaire was developed in English, validated by experts using the Index of Item-Objective Congruence (IOC), and translated into Myanmar language.

Data Collection Procedure

Data collection was carried out through face-to-face interviews by four trained Myanmar-speaking enumerators. Eligibility criteria for data collectors included fluency in Burmese, prior experience in interview-based research, and familiarity with the study area. Training sessions covered interview techniques, ethical procedures, and questionnaire content. Informed consent was obtained prior to each interview. Completed questionnaires were reviewed daily for completeness and accuracy.

Statistical Analysis

Data were analyzed using SPSS version 29. Descriptive statistics summarized demographic variables and outcome measures. Categorical variables were presented as frequencies and percentages, while continuous variables were reported as means and standard

deviations. The Chi-square test was used to assess associations between independent variables (socio-demographic characteristics, knowledge level and attitude levels) and health-seeking behavior among participants who reported malaria-like symptoms. Health-seeking behavior was dichotomized into formal (hospital, clinic, pharmacy, village health volunteer) and informal (traditional healer, self-treatment, no action) categories. Variables with $p < 0.05$ in Chi-square tests were entered into a binary logistic regression model. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were reported to determine the strength of associations.

Ethical Consideration

This study was submitted to the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1 (COA No. 175/68) in June 2025. Informed consent was obtained from all participants after they were provided with a participant information sheet and a detailed explanation of the study procedures, which were included with the questionnaire.

RESULTS

The majority of the study participants ($n = 210$) were aged between 26 and 47 years, with a mean age of 37.05 years ($SD = 11.87$). Participants were predominantly female (72.9%), and most had attained only primary school education or lower (72.9%). The average monthly family income was 7,311.90 THB ($SD = 5,216.17$), with over half (53.3%) earning between 4,001 and 8,000 THB. Two-thirds of the participants (66.7%) had resided in Thailand for more than four years. About half (52.4%) reported living within 30 minutes of the nearest health facility, suggesting relatively good physical access to healthcare. The majority of participants demonstrated a moderate level of knowledge about malaria, accounting for 69.0% of respondents. A smaller proportion had high knowledge (19.5%), while 11.4% had low knowledge. Similarly, attitude levels toward malaria were also predominantly moderate at 75.2%, followed by low attitude (12.9%) and high attitude (11.9%).

Table 1 Characteristics of respondents (n=210)

Characteristics	Study participants (n=210)	
	Number	Percent (%)
Age (years)		
18 - 25	46	21.90
26 - 38	64	30.50
39 - 47	53	25.20
>47	47	22.40
Mean (SD)	37.05 (11.87)	
Gender		
Male	57	27.10
Female	153	72.90
Education		
Primary School and Lower	153	72.90
Middle School and Above	57	27.10
Marital Status		
Single	19	9.00
Married	166	79.00
Divorced/Widowed/Separated	25	12.00

Characteristics	Study participants (n=210)	
	Number	Percent (%)
Family Size		
Up to 3	88	41.90
4 - 6	101	48.10
7 and above	21	10.00
Family Income (Baht)		
4000 and Lower	47	22.40
4001 to 8000	112	53.30
Above 8000	51	24.30
Mean (SD)	7311.90 (5216.17)	
Duration in Thailand		
Up to 4 years	70	33.30
Above 4 years	140	66.70
Duration to reach health facility		
Less than 30 minutes	110	52.40
More than 30 minutes	100	47.60
Occupation		
Agricultural worker	125	59.50
Construction worker	8	3.90
Unemployment	45	21.40
Other*	32	15.20
Health insurance status		
No	183	87.10
Yes	27	12.90
Residency status		
No	187	89.00
Yes	23	11.00
History of malaria		
No	157	74.80
Yes	53	25.20
Received malaria preventive service		
No	35	16.70
Yes	175	83.30
Where to take malaria diagnosis		
No	25	11.90
Yes	185	88.10
Accessibility to the service**		
No	71	33.80
Yes	114	54.20

*Other - Casual worker, work at restaurant, selling

****Among whom know where to take malaria diagnosis**

Out of the 210 respondents, 127 participants (60.5%) reported having experienced fever with chills while staying in Thailand, while 83 participants (39.5%) had not experienced such symptoms. Regarding the socio-demographic factors, duration of stay in Thailand was significantly associated with healthcare-seeking behavior ($p = 0.045$). Among those who had stayed in Thailand for up to 4 years, 54.29% sought informal care and 45.71% formal care. In

comparison, among those who had stayed for more than 4 years, 34.78% sought informal care and 65.22% formal care. A significant association was also found with malaria history ($p = 0.022$). Among those with no history of malaria, 47.56% used informal care and 52.44% formal care. Among those who had previously had malaria, only 26.67% used informal care, while 73.33% sought formal healthcare.

Table 2 Association between socio-demographic characteristics and malaria health-seeking behavior (n=127)

Factors	Informal Healthcare seeking		Formal Healthcare seeking		P-value*
	n	%	n	%	
Age (years)					
18 - 25	16	57.14	12	42.86	0.167
26 - 38	11	33.33	22	66.67	
39 - 47	14	41.18	20	58.82	
>47	10	31.25	22	68.75	
Gender					
Male	13	36.11	23	63.89	0.558
Female	38	41.76	53	58.24	
Education					
Primary School and Lower	37	38.14	60	61.86	0.405
Middle School and Above	14	46.67	16	53.33	
Marital status					
Single	6	50.00	6	50.00	0.347
Married	36	36.73	62	63.27	
Divorced/Widowed/Separated	9	52.94	8	47.06	
Family Size					
Up to 3	21	42.86	28	57.14	0.164
4 - 6	23	34.33	44	65.67	
7 and above	7	63.64	4	36.36	
Family Income					
4000 and Lower	10	38.46	16	61.54	0.135
4001 to 8000	23	33.82	45	66.18	
Above 8000	18	54.55	15	45.45	
Duration in Thailand					

Factors	Informal Healthcare seeking		Formal Healthcare seeking		P-value*
	n	%	n	%	
Up to 4 years	19	54.29	16	45.71	0.045*
Above 4 years	32	34.78	60	65.22	
Duration to reach health facility					
Less than 30 minutes	23	33.82	45	66.18	0.118
More than 30 minutes	28	47.46	31	52.54	
Occupation					
Agricultural worker	28	36.84	48	63.16	0.725
Construction worker	3	50.00	3	50.00	
Unemployment	11	40.74	16	59.26	
Other (Specify)	9	50.00	9	50.00	
Health insurance status					
No	45	40.54	66	59.46	0.817
Yes	6	37.50	10	62.50	
Residency status					
No	47	40.87	68	59.13	0.612
Yes	4	33.33	8	66.67	
History of malaria					
No	39	47.56	43	52.44	0.022*
Yes	12	26.67	33	73.33	

Table 3 Association between the knowledge level and malaria health-seeking behavior (n=127)

Knowledge Level	Informal Healthcare seeking		Formal Healthcare seeking		P-value*
	n	%	n	%	
Low	6	50.00	6	50.00	0.27
Moderate	38	42.70	51	57.30	
High	7	26.92	19	73.08	

Table 4 Association between the attitude level and malaria health-seeking behavior (n=127)

Attitude Level	Informal Healthcare seeking		Formal Healthcare seeking		P-value*
	n	%	n	%	
Low	8	50.00	8	50.00	0.485
Moderate	34	36.96	58	63.04	
High	9	47.37	10	52.63	

However, there is no significant association was found between knowledge level, attitude level and health-seeking behavior.

Table 5 Related factor of malaria health-seeking behavior

Factors	P-value	AOR	95% C.I.for EXP(B)	
			Lower	Upper
History of malaria (yes)	0.051	2.234	0.998	5.001

DISCUSSION

This study examined factors influencing health-seeking behavior among Myanmar migrants in Phop Phra District, Thailand, particularly in response to malaria-like symptoms. The findings indicate that nearly 61% of respondents reported experiencing fever with chills while residing in Thailand. Among them, approximately 40% sought informal healthcare services, such as self-treatment or traditional healers, while 60% accessed formal healthcare facilities, including hospitals and clinics.

The logistic regression analysis identified a borderline significant association between prior malaria diagnosis and formal healthcare-seeking behavior. Participants who had previously been diagnosed with malaria were 2.234 times more likely to seek formal healthcare compared to those without such a history. This aligns with findings from a mixed-methods study along the Thailand-Myanmar border, which noted that familiarity with illness symptoms often encourages migrants to seek timely and appropriate care (9). Past experiences may increase awareness of the disease's seriousness, thereby motivating individuals to utilize formal health services when symptoms recur.

Duration of stay in Thailand showed a near-significant trend, with migrants residing in the country for over four years being more likely to seek formal healthcare. Although not statistically significant in the final model, this factor aligns with prior literature highlighting that longer duration of residence may enhance knowledge of local health systems and build trust in available services (9, 15). Migrants who are more established may also face fewer language barriers and be better integrated into social support networks that facilitate healthcare access (20).

Knowledge and attitude scores among participants were predominantly in the moderate range, with only 19.5% and 11.9% scoring in the high range for knowledge and attitude, respectively. These findings suggest a gap between awareness and action, consistent with previous studies indicating that positive attitudes or basic malaria knowledge do not always translate into preventive behavior or prompt treatment-seeking (21, 22). This discrepancy emphasizes the need for continuous community-level education that not only imparts knowledge but also reinforces actionable steps during suspected malaria episodes (23, 24).

The high percentage of respondents lacking health insurance and legal documentation may further contribute to informal healthcare reliance. This is supported by earlier findings indicating that undocumented migrants tend to avoid public hospitals due to fear of legal repercussions, instead opting for low-cost, informal providers (9, 15). Inclusive health policies are critical in reducing such disparities and encouraging equitable access to healthcare, irrespective of documentation status.

In this study, variables such as age, gender, education, marital status, family size, family income, distance to health facility, and occupation were not significantly associated with health-seeking behavior. One possible explanation is the relative homogeneity of the migrant population, with most participants sharing similar socioeconomic backgrounds, which limited observable differences across groups. Similar patterns have been observed in research on migrant health, where demographic characteristics alone did not significantly predict utilization of malaria services among Myanmar migrants in Thailand (20). Moreover, structural barriers such as language difficulties, and

unfamiliarity with the healthcare system often outweigh individual sociodemographic attributes in influencing health-seeking behavior among migrants (9).

CONCLUSION AND RECOMMENDATION

In conclusion, this study found that although both history of malaria and duration of stay in Thailand were initially associated with formal healthcare-seeking behavior, only history of malaria remained statistically significant in the final regression model. Migrants with prior malaria experience were more likely to seek formal care when experiencing malaria-like symptoms. Moderate levels of knowledge and attitudes suggest the potential for improvement through targeted health education. To strengthen malaria control efforts, strategies should focus on promoting malaria-related knowledge and awareness among migrants early in their stay. Community-based health education, outreach by migrant health volunteers, and multilingual information campaigns could help improve understanding of malaria symptoms and the benefits of formal treatment.

LIMITATIONS

The study specifically targeted Myanmar migrants, a high-risk group often underrepresented in public health research, particularly in malaria-endemic areas along the Thailand-Myanmar border. Findings may provide practical insights for public health interventions in border regions experiencing high migration and malaria transmission.

As for the limitations, the use of chain-referral (snowball) sampling may introduce selection bias and limit the generalizability of findings beyond the study participants. Information on health-seeking behavior was self-reported, which may be subject to recall bias or social desirability bias.

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FACTORS ASSOCIATED WITH REPRODUCTIVE HEALTH SERVICES UTILIZATION AMONG JAPANESE FEMALE EXPATRIATES IN BANGKOK

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ABSTRACT

Introduction: Reproductive health (RH) refers to a state of complete physical, mental, and social well-being in all matters relating to the reproductive system. Improving health service utilization (HSU), is one key strategy for enhancing RH outcomes. Despite availability, many individuals do not access RH care.

Objectives: This study aims to find factors associated with RH service utilization (RHSU) for RH problems among Japanese female expatriates in Bangkok, using Andersen's Behavioural Model of HSU framework.

Methodology: A community-based, cross-sectional quantitative study was conducted in Bangkok, Thailand. A total of 326 respondents who experienced either dysmenorrhea, premenstrual syndrome (PMS), menopausal symptoms, or contraceptive use, were recruited through a snowball sampling method and completed an online survey.

Results: Overall, RHSU was observed by 35.3% of all respondents. The mean age of the respondents was 40.08 ± 6.90 years. In bivariate analysis, age, length of residence, Thai language fluency, self-efficacy, usual source of RH, knowledge on health system, self-rated health status, daily life interference, and RH medical history indicated significant association with RHSU. In the multiple logistic regression, among 294 respondents, age of 37 to 44 years (AOR = 0.478, 95%CI = 0.236-0.969, p-value = 0.041), insurance (AOR = 0.323, 95%CI = 0.108-0.963, p-value = 0.043), usual source of RH (AOR = 0.421, 95% CI: 0.210-0.845, p = 0.015) and medical history of PMS (AOR = 0.264, 95% CI: 0.114-0.613, p = 0.002) were identified as significant factors associated with RHSU.

Conclusion: Despite experiencing RH problems, majority of women do not visit gynecologists, even in the presence of severe symptoms. This study emphasizes the need for interventions not only to improve women's understanding of their own RH but also to enhance their knowledge and ability to navigate the local Thai healthcare system.

Keywords: Reproductive Health, Health Service Use, Japanese Expatriates, Bangkok, Thailand, Andersen's Behavioural Model of Health Service Use, Dysmenorrhea, Premenstrual Syndrome, Menopausal Symptoms, Contraceptives

INTRODUCTION

Reproductive health (RH) is defined as a state of physical, mental and social well-being in relation to the reproductive system according to World Health Organization (WHO). It includes the ability to have a safe and satisfying sex life, the ability to reproduce, and the freedom to decide when, how often, and if to do so. RH cannot be enhanced in a better form, unless inequities related to gender, taboos and norms about sexuality, and poverty are improved.

Strengthening the health system's capacity, particularly through improving health service utilization (HSU), is one key strategy for enhancing RH outcomes (1).

There are many reasons why people nevertheless use reproductive health service (RHS). Reproductive health service use (RHSU) differs according to the countries. In US, 85% of women visit RHS annually or more whereas, in Japan, it is 55% (2, 3). Common reasons for RHSU among the Japanese are menstrual related

symptoms, including dysmenorrhea and premenstrual syndrome (PMS), followed by pregnancy-related problems, prescription for oral contraceptive (OC)s, and other gynecological morbidities including menopausal symptoms (3). The number of women utilizing RHS is very low due to the perception that RH conditions are more of a natural status rather than a medical status.

The significant impact of dysmenorrhea, PMS, and menopausal symptoms extends beyond negatively affecting women's education, career, and overall quality of life (4, 5). These conditions also contribute to substantial economic losses in labor productivity when not appropriately managed (6). Due to this fact, RHSU has become one of the essential public health problems which should be taken into consideration more seriously.

Currently, there are 50,146 Japanese residing in Bangkok and this is the second largest number in the world after Los Angeles (7). Japanese culture possesses a distinct characteristic concerning perception on HS, privacy, communicating style, and decision-making process. The influence of cultural factors on HSU is particularly pronounced when dealing with sensitive issues related to RH. In terms of HSU, 95% have used HS in Thailand and 81% have used Japanese in the HS. The most common source of information regarding HS was word-of-mouth (8).

HSU of individuals with RH problems can be better understood by using the Andersen's Behavioural Model of Health Service Utilisation (BMSU) framework (9). This model includes predisposing characteristics (demographic factors, social structure, and health beliefs), enabling resources (personal, family, and community enabling), and need factors (perceived needs and evaluated needs), which interact and influence the individual's decision-making of HSU (9).

Evidence on RHSU among Japanese female expatriates is scarce, especially through the lens of Andersen's BMSU. Therefore, the aim of this study is to find factors associated with RHSU on dysmenorrhea, PMS, menopausal symptoms, and contraceptive use among Japanese female expatriates in Bangkok. The findings of this study will become essential not only to increase RHSU of Japanese expatriates,

but understand why some women do not seek care from the RHS to develop effective strategies and policies to overcome these barriers.

METHODOLOGY

This study was designed as a community based-quantitative cross-sectional descriptive and analytic study, conducted in the 50 districts of Bangkok Metropolitan area, Thailand. Study population was Japanese female expatriates with RH problems (dysmenorrhea, PMS, menopausal symptoms, and contraceptive users), aged between 18 to 55 years, who reside in Bangkok, Thailand and are able to use internet to answer the questionnaire. Respondents who were not willing to participate were excluded. In this study, Cochran's formula $n = \frac{Z^2 p(1-p)}{d^2}$ ($p = 0.7$ for prevalence of menopausal symptoms, $Z = 1.96$, margin of error 5%) was used to calculate the sample size of 323 respondents.

The measurement tool for the study variables was a self-administered online questionnaire. The questionnaire was divided into four components namely, RHSU, predisposing characteristics, enabling resources, and need factors based on the Andersen's BMSU to ensure the construct validity, with total of 69 questions. Questionnaire was created based on the literature review. However, 37 questions which were not taken from already validated in previous literature was validated using item-objective congruence (IOC) by three RH experts. The IOC score which was more than 0.5 was accepted. The internal consistency was calculated with Cronbach alpha test for self-efficacy and attitude (natural, debilitating, and bothersome) and Kuder-Richarson formula-20 for personal knowledge recording a score of 0.754, 0.724 (natural), 0.785 (debilitating), and 0.599 (bothersome), and 0.732 respectively. In addition, for bothersome factor of the attitude, inter-item correlation was 0.472, 0.383, and 0.403 which was within the acceptable range (10). In addition, the questionnaire was translated into Japanese and back-translated by two RH Japanese experts (11).

Data collection took place between May, 2025. The survey was pilot tested with 5% of the sample size who met the eligibility criteria and modified the questionnaire according to their

results. Snowball sampling was used to recruit the respondents. However, it has a limitation of recruiting respondents with similar characteristics. While the use of respondent-driven sampling was initially considered, the time required to recruit the sample size was insufficient in the framework of an MPH thesis data collection. Respondents were identified by contacting them using researcher’s own network and then circulated via respondents’ network. The purpose of this study was briefed to respondents before they electronically gave their informed consent. In their own time, respondents completed the questionnaire through Google Form online survey platform. Data analysis was process by using Microsoft® Excel® and SPSS software version 29 (licensed from Chulalongkorn University) for windows.

For descriptive analysis, number and percentage were used for categorical variables and mean, standard deviation (SD), median, interquartile range (IQR) for numerical variables. In bivariate analysis, the associations between independent variables and the dependent variable (use of RH services) were performed using independent samples t-test for normal distributed independent variables and Mann-Whitney U-test for non-normal distributed continuous and discrete independent variables. To assess the relationship between the dependent variable and nominal, ordinal, and dichotomous independent variables, Pearson’s chi-square test was used. Fisher’s exact test was used if the expected frequency was less than 5 in any cell. In the

bivariate analysis, variables with a p-value of less than 0.2 were included in the multiple logistic regression model. This analysis was conducted on the 294 non-contraceptive users who had a known insurance status due to the skip patterns of the questionnaire. All analysis were conducted in SPSS and p-value < 0.05 was considered statistically significant.

RESULTS

A sample of 327 individuals participated in the online survey. Of these, one case was removed from the dataset due to the age over 55. This left a sample of 326 respondents for analysis. Of the 326 respondents, 175 (65.3%) experienced dysmenorrhea, 199 (74.3%) had premenstrual syndrome (PMS), 76 (23.3%) reported menopausal symptoms, and 27 (8.3%) were contraceptive users, with some reporting more than one condition. In addition, RHSU in Bangkok was reported by 115 respondents (35.3%).

Table1 shows the characteristics of the respondents. The age of participants ranged from 18 to 55 with a mean age of 40.08 ± 6.90. Majority of them were married (93.6%), had children (80.4%). The mean length of residence in Bangkok was 45.78 ± 52.52. More than half of the respondents have completed undergraduate level or higher for their education. Respondents who have Thai language fluency was observed only 13.2% of all respondents. Most of the respondents were not employed (88.0%).

Table 1 Respondents Characteristics (n = 326)

Respondents Characteristics	n	%
Age		
18-36	97	29.8
37-44	139	42.6
45-55	90	27.6
Mean ± SD (Range)	40.08 ± 6.90 (18-55)	
Marital Status		
Single	15	4.6
Married	305	93.6
Divorced	6	1.8
Number of Children		

Respondents Characteristics	n	%
0	64	19.6
1	84	25.8
2	132	40.5
≥ 3	46	14.1
Length of Residence in Bangkok		
1-14 months	86	26.4
15-51 months	156	47.9
52-304 months	82	25.2
Mean ± SD (Range)	45.78 ± 52.52 (1-304)	
Highest Education Level		
Junior High School / High School	37	11.3
Two-Year College	42	12.9
Professional Training College	44	13.5
University (Undergraduate)	187	57.4
Graduate School	16	4.9
Language Proficiency ^a		
Japanese (mother language)	326	100
English	141	43.3
Thai	43	13.2
Others	11	3.4
Occupation		
Yes	39	12
No	287	88.0

^An = 324. 1 participant did not have units. 1 participant wrote their answer in decimals. ^aMultiple response.

Table 2 shows the bivariate analysis between predisposing characteristics and RHSU among 326 Japanese female expatriates in Bangkok. For bivariate analysis of predisposing characteristics, Pearson’s chi-square test and Fischer’s exact test were performed for the categorical variables and for self-efficacy, Mann-

Whitney U-test was performed. Among the predisposing characteristics, age (p = 0.045), length of residence (p = 0.044), Thai language proficiency (p = 0.019), and self-efficacy (p = 0.013) emerged as a significant predictor of RHSU.

Table 2 Bivariate Analysis between Predisposing Characteristics and RHSU (n = 326)

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
Age (n, %) ^A					
18-36 years	28	28.9	69	71.1	
37-44 years	46	33.1	93	66.9	0.045*
45-55 years	41	45.6	49	54.4	

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
Marital Status (n, %) ^A					
Single	7	46.7	8	53.3	0.163
Married	104	34.1	201	65.9	
Divorced	4	66.7	2	33.3	
Number of Children (n, %) ^A					
0	24	37.5	40	62.5	0.423
1	35	41.7	49	58.3	
2	42	31.8	90	68.2	
≥3	14	30.4	32	69.6	
Length of Residence in Bangkok (n, %) ^{A a}					
1-14 months	22	25.6	64	74.4	0.044*
15-51 months	56	35.9	100	64.1	
52-304 months	36	43.9	46	56.1	
Highest Education Level (n, %) ^{A b}					
Junior High School / High School	13	35.1	24	64.9	0.947
Two-Year College	15	35.7	27	64.3	
Professional Training College	14	31.8	30	68.2	
University (Undergraduate)	66	35.3	121	64.7	
Graduate School	7	43.8	9	56.3	
Thai Language Proficiency ^A					
Yes	22	51.2	21	48.8	0.019*
No	93	32.9	190	67.1	
Occupation (n, %) ^A					
Yes	19	48.7	20	51.3	0.061
No	96	33.4	191	66.6	
Personal Attitude (Median, IQR) ^{C c}					
Natural	3	2.33-3	2.67	2.33-3	0.419
Debilitating	3	2.67-3.33	3	2.67-3.33	0.523
Bothersome	3.33	2.75-3.67	3	2.67-3.67	0.584
Personal Knowledge (n, %) ^A					
Poor level	78	34.7	147	65.3	0.203
Fair level	19	30.2	44	69.8	
Good level	18	47.4	20	52.6	
Perception on Health Providers (n, %) ^{A d}					
Every time	16	34	31	66	0.338
Almost every time	78	39.4	120	60.6	
Almost never	13	38.3	33	71.7	
Never	0	0	0	0	
Perception on Trans-Vaginal Ultrasound Scan (n, %) ^A					
Not a difficult experience at all	16	39	25	61	

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
Not a difficult experience	27	34.2	52	65.8	0.915
Difficult experience	56	38.6	89	61.4	
Very difficult experience	14	38.9	22	61.1	
Perception on Medicine (n, %) ^A					
Positive	18	31	40	69	0.456
Negative	97	36.2	171	63.8	
Self-Efficacy (Median IQR) ^{C e}					
	4	3-5	4	4-6	0.013*

^A Pearson's Chi-Square Test, ^B Fischer's Exact T-Test, ^C Mann-Whitney U-Test, ^a n = 324. 1 participant didn't have its unit written and 1 participant wrote their answer in decimals. ^b n = 267. Respondents with menstruation. ^c n = 291. Respondents who had experienced using general health service before were included. ^d n = 301. Respondents who had never experienced trans-vaginal ultrasound scan was excluded ^e n = 299. 27 contraceptive users were excluded. *p-value < 0.05

Table 3 shows the bivariate analysis between enabling resources and RHSU among 326 Japanese female expatriates in Bangkok. For bivariate analysis of enabling resources, Pearson's chi-square test and Fischer's exact test

were performed. Among enabling resources, usual source of RH (p < 0.001), knowledge about HS (p = 0.012), knowledge about insurance coverage (p = 0.010) were also significantly associated with RHSU.

Table 3 Bivariate Analysis between Enabling Resources and RHSU (n = 326)

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
Insurance (n, %) ^{A a}					
Yes	107	37.3	180	62.7	0.093
No	8	22.9	27	77.1	
Personal Health Practice					
Receiving Health Check-ups					
Every Year (n, %) ^A					
Yes	94	35.1	174	64.9	0.870
No	21	36.2	37	63.8	
Receiving Cervical Cancer Screening					
Every Two Years (n, %) ^A					
Yes	89	35.3	163	64.7	0.977
No	26	35.1	48	64.9	
Family Monthly Income (n, %) ^B					
<250,000 Yen	4	50.0	4	50.0	
≥250,000, <500,000 Yen	20	29.4	48	70.6	
≥500,000, <750,000 Yen	36	36.7	62	63.3	0.516
≥750,000, <1,000,000 Yen	24	38.7	38	61.3	
≥1,000,000, <1,500,000 Yen	11	36.7	19	63.3	
≥1,500,000 Yen	19	38.0	31	62.0	

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
None (Student)	1	10.0	9	90.0	
Decision-Making Autonomy (n, %) ^A					
Yes	89	35.2	164	64.8	0.945
No	26	35.6	47	64.4	
Usual Source of RH (n, %) ^A					
Yes	39	53.4	34	46.6	< 0.001**
No	76	30.0	177	70.0	
Health System Information Knowledge (n, %)					
Health Services ^A					
Yes	101	38.5	161	61.5	0.012*
No	14	21.9	50	78.1	
Insurance Coverage ^A					
Yes	50	44.6	62	55.4	0.010*
No	65	30.4	149	69.6	
Social Support (n, %) ^A					
Spouse / Partner ^A					
Yes	101	35.2	186	64.8	0.931
No	14	35.9	25	64.1	
Parents ^A					
Yes	77	35.3	141	64.7	0.981
No	38	35.2	70	64.8	
Children ^A					
Yes	19	33.3	38	66.7	0.735
No	96	35.7	173	64.3	
Friends ^A					
Yes	86	35.4	157	64.6	0.941
No	29	34.9	54	65.1	
Medical Professionals ^B					
Yes	2	18.2	9	81.8	0.340
No	113	35.9	202	64.1	
Others (Religious Leader, House-keeper, etc.) (n, %) ^B					
Yes	4	36.4	7	63.6	1.000
No	111	35.2	204	64.8	
Social Norm / Embarrassment (n, %) ^B					
Strongly disagree	36	35.0	67	65.0	0.359
Disagree	54	40.0	81	60.0	
Agree	23	28.0	59	72.0	
Strongly agree	2	33.3	4	66.7	

^A Person's Chi-Square Test, ^B Fischer's Exact T-Test, ^a n = 322. 4 respondents did not know their possession of insurance. * p-value < 0.05, ** p-value < 0.001

Table 4 shows the bivariate analysis results between need factors and RHSU among 326 Japanese female expatriates in Bangkok. For bivariate analysis of need factors, Pearson's chi-square test and Fischer's exact test were performed. Among need factors, statistically significant association with RHSU was

observed for self-rated health status (p = 0.034), the extent of daily life interference caused by RH issues (p = 0.008), and RH history of dysmenorrhea (p < 0.001), PMS (p < 0.001), and menopausal disorders (p = 0.002) were significantly associated with RHSU.

Table 4 Bivariate Analysis with Need Factors and RHSU (n = 326)

Variables	RHSU				p-value
	Yes		No		
	n	%	n	%	
Self-Rated Health Status (n, %) ^B					
Good	41	29.1	100	70.9	0.034*
Fair	67	38.5	107	61.5	
Poor	7	63.6	4	36.4	
Dysmenorrhea Related Pain-Intensity (n, %) ^A					
Mild	4	23.5	13	76.5	0.741
Moderate	21	33.3	42	66.7	
Severe	30	31.6	65	68.4	
Daily Life Interference (n, %) ^B					
Not at All	15	26.8	41	73.2	0.008*
A Little Bit	44	29.9	103	70.1	
Quite a Bit	42	47.2	47	52.8	
Very Much	6	60	4	40	
General Medical History (n, %) ^A					
Yes	13	44.8	16	55.2	0.259
No	102	34.3	196	65.7	
RH Medical History (n, %)					
Dysmenorrhea ^A					
Yes	27	67.5	13	32.5	< 0.001**
No	88	30.8	198	69.2	
PMS ^A					
Yes	33	67.3	16	32.7	< 0.001**
No	82	29.6	195	70.4	
Menopausal Disorder ^A					
Yes	12	70.6	5	29.4	0.002*
No	103	33.3	206	66.7	

^A Pearson's Chi-Square Test, ^B Fischer's Exact Test, * p-value < 0.05, ** p-value < 0.001

Multiple logistic regression with enter method was used among 294 non-contraceptive users with known insurance status to analyze the associations between independent variables that had a p-value less than 0.2 in bivariate analysis and dependent variables, RHSU. According to the Nagelkerke R² value which was 0.300, the analyzed independent variables can explain 30.0% the variation in RHSU. According to the p-value from the Hosmer and Lemeshow test, which was 0.855, not less than 0.05 indicating that the datasets fit the model.

Table 5 shows the results of multiple logistic regression with 14 variables which had shown p-value < 0.2 in bivariate analysis. Among these variables, 4 variables namely, age of 37 to 44 years, insurance, usual source of RH, and

medical history of PMS had statistically negative significant association with RHSU at p-value < 0.05. Respondents in age range of 37 to 44 years had 52.2% lower odds of RHSU compared to those who are in the age range of 45 to 55 years (AOR = 0.478, 95%CI = 0.236-0.969, p-value = 0.041). Respondents without insurance had 67.7% lower odds of RHSU compared to those who had insurance (AOR = 0.323, 95%CI = 0.108-0.963, p-value = 0.043). Respondents without a usual source of RH were 57.9% lower odds of RHSU compared to those who have (AOR = 0.421, 95%CI = 0.210-0.845, p-value = 0.015). Similarly, respondents without medical history of PMS had 73.6% lower odds of RHSU compared to those who had such history (AOR = 0.264, 95%CI = 0.114-0.613, p-value = 0.002).

Table 5 Multivariate Analysis between Variables with P-value < 0.2 and RHSU (n = 294)

Variables	B	S.E.	P-value	AOR	95% CI	
					Lower	Upper
Age (ref. 45-55)						
18-36 years	-0.651	0.414	0.115	0.521	0.232	1.173
37-44 years	-0.738	0.361	0.041*	0.478	0.236	0.969
Length of Residence in Bangkok (ref. 52-304)						
1-14 months	0.217	0.466	0.642	1.242	0.498	3.098
15-51 months	0.396	0.388	0.308	1.485	0.694	3.177
Thai Language Proficiency (ref. Yes)						
No	-0.853	0.457	0.062	0.426	0.174	1.044
Occupation (ref. No)						
Yes	0.335	0.488	0.493	1.398	0.537	3.639
Self-Efficacy (Ln)						
	-0.005	0.477	0.992	0.995	0.391	2.534
Insurance (ref. Yes)						
No	-1.131	0.558	0.043*	0.323	0.108	0.963
Usual Source of RH (ref. Yes)						
No	-0.864	0.355	0.015*	0.421	0.210	0.845
Health System Information Knowledge HS (ref. Yes)						
No	-0.676	0.396	0.088	0.509	0.234	1.105
Health Insurance Coverage (ref. Yes)						
No	-0.144	0.309	0.642	0.866	0.472	1.587
Self-Rated Health Status (ref. Poor)						
Good	-0.583	0.789	0.460	0.558	0.119	2.619
Fair	-0.360	0.785	0.647	0.698	0.150	3.253

Variables	B	S.E.	P-value	AOR	95% CI	
					Lower	Upper
Daily Life Interference (ref. Very Much)						
Not at all	-0.822	1.062	0.439	0.440	0.055	3.527
A Little Bit	-0.685	1.000	0.494	0.504	0.071	3.583
Quite A Bit	0.249	1.004	0.804	1.283	0.179	9.189
Medical History						
Dysmenorrhea (ref. Yes)						
No	-0.879	0.484	0.069	0.415	0.161	1.073
PMS (ref. Yes)						
No	-1.331	0.430	0.002*	0.264	0.114	0.613
Menopausal Disorder (ref. Yes)						
No	-0.971	0.713	0.173	0.379	0.094	1.530

AOR: Adjusted Odd Ratio * p-value < 0.05

DISCUSSION

This study indicated factors associated with RHSU among Japanese female expatriates in Bangkok based on Andersen's BMSU. Among predisposing characteristics, age, length of residence in Bangkok, Thai language proficiency, and self-efficacy were important factors. Other significant factors for RHSU among enabling resources were usual source of RH and knowledge about health system information. Need factors had self-rated health status, daily life interference, and medical history indicating as significant factors. In multivariate analysis, age, insurance, usual source of RH, and medical history of PMS indicated significant association with RHSU.

To increase the RHSU among Japanese expatriates in Bangkok, the results from this study suggest two key factors; an understanding of their own RH conditions and greater knowledge of local Thai health system.

Importance of understanding one's own RH condition is evident in several significant factors. Age was a notable determinant; while previous study among Vietnamese migrants indicated that younger women possess inadequate RH knowledge leading to underestimation of the severity of their symptoms (12), this study indicates similar findings within older study population. Physical changes attributed to aging process might have prompted some participants to pursue RHSU (13). Self-efficacy also emerged as a significant factor. Higher self-efficacy is

linked to lower anxiety and stress, which can improve menstrual management and overall understanding of RH conditions (14, 15). Furthermore, usual source of RH and RH medical history underscored the importance of receiving a professional diagnosis and accurate information, which can shift women's perception of RH from a natural physiological experience to one requiring attention (16). In terms of awareness on RH conditions, women with poor self-rated health status feel necessity in using HS (13, 17). Daily life interference is also another factor which can create awareness on RH conditions. A previous study among dysmenorrhea in Malaysia states that women seek care from the health providers more when the pain was too intense or unbearable (18). In multivariate analysis, PMS was the only RH medical history significantly associated with RHSU. This association may stem from the common perception of PMS as a natural physiological experience. However, a formal diagnosis of these conditions through RHS may increase women's awareness of their RH condition, consequently leading to RHSU.

A second key finding is the importance of knowing about the local health system in Thailand. This is supported by the significant associations found between RHSU and length of residence in Bangkok, Thai language proficiency, and knowledge of health system information. The study highlights that Thai language proficiency is crucial, as the language barrier can lead to not

only misunderstanding of medical conditions but also delay in diagnosis due to a lack of information about local health system (19). This is a critical factor influencing health outcomes. Furthermore, the study indicates that expatriate women who have lived longer in Bangkok are more likely to use RHS. This aligns with the idea that a longer duration of residence leads to greater familiarity and receptiveness toward the local health system, which facilitates RHSU (20). Both Thai language proficiency and length of residence in Bangkok enable women to gain knowledge on health system information of Thailand leading to RHSU among Japanese female expatriates in Bangkok (21).

In multivariate analysis, insurance emerged as a significant factor. Generally, use of out-of-pocket payments can decrease the access to the HS (22). Therefore, retaining health insurance is an essential factor for RHSU.

This is the first study to investigate factors associated with the RHSU among Japanese female expatriates in Bangkok based on Andersen's BMSU model. By assessing the potential factors of RHSU based on Andersen's BMSU model, this study can provide a structured approach to understand RHSU. Moreover, due to the distinct characteristics which Japanese culture possess regarding healthcare perceptions, privacy, communication style, and decision-making processes, this study is uniquely positioned to uncover this specific cultural influence on RHSU, which might be overlooked in broader expatriate research. In contrast, due to the cross-sectional study design, it cannot provide information about the cause and effect of RHSU among the study population. The snowball sampling technique might have introduced selection bias. Similarly, the findings in this study rely exclusively on self-reported data with the absence of observational data, which the results may not fully reflect the true situation of RHSU. Inconsistency in respondents' answers were observed, due to the ambiguity of a shared Japanese term encompassing both oral contraceptives and hormonal therapy. Furthermore, data obtained in this study was among Japanese female expatriates in Bangkok. Therefore, the results may be different from the general Japanese female in Japan.

CONCLUSION

In general, the results show that most Japanese female expatriates did not utilize RHS for conditions including dysmenorrhea, PMS, menopausal symptoms and contraception. This study provides valuable insights into the factors influencing RHSU among Japanese female expatriates in Bangkok. The results emphasize the need for interventions not only to improve women's understanding of their own RH but also to enhance their knowledge and ability to navigate the local Thai healthcare system.

RECOMMENDATION

Maintaining a usual source of RH remains crucial for diagnosis and management of RH conditions. While the importance of establishing a usual source of RH is widely acknowledged, this practice has not yet become common in Japan. To address this challenge, the Japanese government could mandate RH check-ups integrate into existing health examinations. The relatively low Thai language proficiency observed among Japanese female expatriates in Bangkok limits access to health system information. To overcome this barrier, community organizations, such as Japanese Association in Thailand, should offer RHSU focused lectures and workshops on health system and RH conditions by Japanese-speaking professionals.

Further research is required to conduct similar studies in different regions of Japan and focus on specific RH conditions to establish the RHSU of Japanese individuals and to compare RHSU patterns between expatriates and domestic residents. This would enable future development of public health interventions to promote appropriate HSU and facilitate adequate clinical and self-management of RH problems to optimize RH outcomes of Japanese.

ETHICAL DECLARATION

This study was approved by The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (COA No. 111/68). Electronically informed consent was obtained for anonymized patient information to be published in this article. The authors declare that there is no conflict of interest. This study was supported by

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WHEN “HE HAS TO BE AT WORK” BECOMES A BARRIER TO MALE INVOLVEMENT IN FAMILY PLANNING: PERSPECTIVES OF HEALTHCARE PROVIDERS IN PERI-URBAN YANGON, MYANMAR

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ABSTRACT

Introduction: The World Health Organization emphasizes shared responsibility in family planning to improve reproductive health outcomes, especially in resource-limited settings. Despite close proximity to the city, women in peri-urban Yangon face disparities in utilization of family planning services. Healthcare providers' attitude and behavior play a crucial role in integrating men into traditionally women-centered services. As the key gatekeepers of family planning services, they can suggest context-specific strategies to promote male involvement. However, the provider perspectives on male involvement and its perceived barriers in these under-resourced areas have been understudied.

Objectives: This study aimed to explore healthcare providers' perspectives on male involvement in family planning and perceived barriers to male participation in peri-urban Yangon, Myanmar.

Methodology: A cross-sectional qualitative study was conducted using in-depth interviews with 30 purposively selected private healthcare providers across nine peri-urban townships in Yangon. An open-ended question guide was used to explore provider attitudes and perceived barriers to male involvement. Data were analyzed thematically to identify key patterns and themes.

Results: Three major themes emerged from the analysis. “Together or Alone: Concerns for Her Privacy and Autonomy” reflected providers' mixed views in recognizing the value of male involvement while stressing the importance of preserving women's right to private counseling. “Men Have to Be at Work” described structural barriers to participation in family planning, particularly time and economic constraints faced by peri-urban residents. “Irrelevance to Male Identity” captured providers' observations that men's view of family planning as a woman's domain limit their engagement.

Conclusion: Providers identified key barriers to male engagement in family planning, including conflicting dynamics between involvement and women's autonomy, structural barriers, and entrenched gender norms. Addressing these challenges requires targeted health education, gender-transformative community interventions, and provider training to support inclusive family planning services.

Key Words: Family Planning, Healthcare Providers, Male Involvement, Myanmar, Peri-urban townships

INTRODUCTION

Male involvement in family planning (FP) has been recognized as a critical factor in enhancing reproductive health outcomes and promoting healthier spousal relationships. Whether through direct use of contraceptive methods such as condoms or by supporting their partners' access to services, men play a significant role in the uptake and sustained use of FP (1). The World Health Organization (WHO) has emphasized the importance of male

engagement and calls for culturally appropriate reproductive health (RH) programs that actively encourage men's participation in contraceptive decision-making (2).

In many resource-limited countries, including Myanmar, men often hold dominant decision-making power within the household, which significantly shapes women's fertility intentions and access to contraceptive services (3, 4). A range of physical, social, and cultural

factors, such as health knowledge, attitudes, spousal communication, and prevailing gender norms further influence whether men act as supporters or barriers to FP use (5, 6). Although promoting male involvement holds great potential, programs must also be designed with care to avoid reinforcing gender hierarchies that could undermine women's reproductive autonomy (7).

Despite improvements in FP coverage within the Yangon Region, peri-urban communities face distinct reproductive health disparities, compounded by rapid urbanization and economic instability. Associated with urban poverty, residents often exhibit low levels of health awareness, have low interest and little spousal discussion in reproductive health matters, and hold deeply entrenched misconceptions about FP (8, 9). Consequently, barriers to male involvement in FP in both rural and urban areas of Myanmar can co-exist in peri-urban Yangon, where abundance and scarcity intersect. Understanding challenges in the peri-urban context can serve as a foundation to further explore the FP disparities and male engagement in different regions of Myanmar.

Healthcare providers play a pivotal role in shaping how FP information is delivered and how male participation is encouraged or discouraged, depending on their attitudes toward gender roles and communication styles. Moreover, through their comprehensive vision based on diverse clinical experiences, they can provide insights into FP service uptake in the peri-urban landscape and context-specific barriers to male involvement (10, 11). Especially in peri-urban Yangon, private health facilities—general practitioner (GP) clinics and non-governmental organization (NGO)-affiliated clinics—are the preferred sources of FP services due to their proximity, affordability, and convenience. Additionally, ongoing resource shortages in the public sector have led increasing number of individuals to rely on private providers for health needs (8, 12). Therefore, private providers are well-positioned to offer deep insights into the current state of male involvement in peri-urban Yangon.

While existing research in Myanmar has begun to examine men's limited involvement in antenatal care, childbirth, and FP (13-15),

perspectives of frontline healthcare providers who directly interact with FP clients remain understudied. Specifically, in peri-urban settings, few have captured provider insights on the barriers and dynamics shaping male participation in FP, which are essential for designing community-responsive and gender-inclusive FP programs. This study addresses this gap by exploring how private healthcare providers in peri-urban Yangon perceive male involvement in FP and the barriers limiting it.

METHODOLOGY

Study Design and Theoretical Framework

This cross-sectional qualitative study was guided by two theoretical models. The Health Belief Model is applied to understand providers' individual perspectives and attitudes towards male involvement, which eventually shape the provider behavior of engaging or disengaging men in FP. The Socioecological Model is used to explore the broader cultural and structural barriers limiting men's participation. In-depth interviews were conducted with 30 primary healthcare providers, including doctors and nurses who were actively delivering FP services at private GP clinics or NGO-affiliated clinics located in one of nine peri-urban townships of Yangon, Myanmar.

Sampling and Participant Recruitment

Initially, the potential participants were contacted by purposive sampling through the primary researcher's professional networks. To capture the perspectives of participants from diverse demographic backgrounds, chain-referral sampling is also employed to contact potential participants outside the researcher's immediate network. The sample size was determined when data saturation was achieved. After 25 interviews, no new theme emerged, and an additional 5 interviews were conducted to ensure data saturation.

Data Collection

From May to June 2025, interviews were conducted online using the Zoom meeting platform, during the participants' free and private time to ensure their privacy. Each interview lasted around 40 minutes. An open-ended question guide, capturing the provider

perspectives, including their attitudes, experiences, and perceived barriers related to male involvement in FP, was applied in the interview. The validity of the question guide is ensured with an expert review of item-objective congruence. Back translation verified the accuracy of cross-cultural translation. The single-interviewer approach, with the primary researcher being the interviewer, ensured consistency in questioning technique, probing style, and rapport-building across all interviews.

Data Analysis

All interviews were audio-recorded, transcribed verbatim, and translated into English. Thematic analysis was employed, following a rigorous and iterative process. The analysis began with data familiarization, followed by the generation of initial codes and identification of potential themes. These codes and themes were then reviewed and refined to ensure consistency and relevance. A coding framework was developed and systematically documented to maintain transparency in the decision-making process. Themes were defined by identifying recurring patterns in the coded data to represent key insights drawn from participants' narratives. To enhance the credibility of the findings, member checking was conducted by sharing preliminary results with selected participants for feedback. Investigator triangulation was also performed through independent coding and interpretation by a second researcher to ensure analytical rigor.

Ethical considerations

Ethical approval was granted by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University on 15th May 2025, at approval number (131/68). Due to the nature of online interviews, signing on the consent form has been waived. The audio recordings and transcripts were stored in password-protected folders of the primary researcher's personal computer.

RESULTS

A total of 30 healthcare providers participated in the study, with the majority aged 30–39 years (53%), followed by those aged 20–29 years (as shown in Table 1). Participants were recruited from both private GP clinics and NGO clinics, providing a balanced representation of both settings across the study area. There were 27 doctors and 3 nurses in this study, and majority of the participants (50%) had clinical practice of 6–10 year-duration.

Thematic analysis of in-depth interviews revealed three key themes including (1) Together or Alone: Concerns for Her Privacy and Autonomy, (2) Men Have to Be at Work, and (3) Irrelevance to Male Identity. Each theme reflects healthcare providers' perspectives of male involvement in family planning and the sociocultural and structural barriers that shape it

Table 1 Demographic Characteristics of Participants

Demographic Characteristics	Frequency (n)	Percentage (%)
Age (years)		
20-29	10	33%
30-39	16	53%
40-49	4	14%
Clinic Type		
NGO clinic	13	44%
GP clinic	17	56%
Occupation		
Doctor	27	90%
Nurse	3	10%

Demographic Characteristics	Frequency (n)	Percentage (%)
Duration of Clinical Practice (years)		
1-5	9	30%
6-10	15	50%
>10	6	20%

Theme (1) Together or Alone: Concerns for Her Privacy and Autonomy

All participants expressed positive attitudes toward male involvement in FP, with approximately 43% specifically highlighting the importance of shared responsibility between partners. One provider stated,

“If the men are involved, it is beneficial for the whole family, starting from better health, followed by a better economy in the household and a happier family life.” (Participant N2).

Another emphasized the importance of joint planning:

“However, in the use of an FP method, rather than just the woman having to manage everything, the husband being involved as the partner in counseling – helps them build a good family plan.” (Participant D11)

However, enthusiasm for male involvement was accompanied by caution. About 46% of providers raised concerns that involving men might risk compromising women's autonomy in FP decision-making. Some recommended private counseling with women first, especially when there was a risk of male dominance:

“It depends on the couples’ individual situation. Private counseling with the woman only is better when the man tends to influence the wife’s decision.” (Participant D6)

Approximately 23% of providers emphasized the importance of seeking women’s consent before involving their partners:

“Another important thing is that, before we engage in male involvement, we have to ask the woman first. If she wants her husband to be involved, then we can let them.” (Participant D26)

“Actually, I would first ask the woman what she wants. I would discuss with her alone first, and then I would just guide the husband during the counseling in a way that favors the woman client’s choice.” (Participant D21)

Theme (2) Men Have to Be at Work

A main theme, mentioned by 70% of participants, was the structural barrier of men’s work schedules. In peri-urban Yangon, where many residents are manual laborers or daily wage earners, long working hours and the inability to take leave were frequently identified as obstacles to male involvement:

“They cannot skip work or take leave from work. They are daily wage earners, so they have to work every day. Even the female clients, they would come to the clinic and receive their regular Depo injection by the nurse and then tend to go back quickly because they cannot spend time waiting to meet the doctor. So, both the couple coming to the clinic and queuing to meet the doctor is not possible for them.” (Participant D15)

This barrier was further compounded by limited childcare options and economic stressors:

“Men in this township have to go to work from dawn to dusk. Even though our clinic opens on the weekend, when the woman comes to the clinic, she has to leave her husband at home to watch over the children. There is no one else to watch the kids.” (Participant N2)

In many cases, providers noted that FP was not even discussed between spouses:

“In these populations, it is usual that the women don’t even bother to tell the husband what they’re doing about FP, and the men don’t also bother to have an interest in it too, overwhelmed with their daily work.” (Participant N3)

Theme (3) Irrelevance to Male Identity

About 63% of providers shared that men commonly viewed FP as a woman's responsibility. This perception contributed to a general lack of engagement among male clients:

“But the possible reason for men not being involved is that they don't know they should be involved. Men could be like such matters are not relevant to them, but related to the woman, although it takes two to make a child.”
(Participant D24)

In addition, cultural beliefs about gender roles discouraged men from participating in what are seen as “feminine” health issues. Even supportive husbands were often hesitant to engage without explicit encouragement from providers:

“Some people want to get involved, but they are shy. Such men would be trying to peek from the waiting room but they don't ask the provider anything. I think, in our country's tradition and practice, it was commonly believed that men should not be involved in matters like FP, so I think they feel reluctant or shy to ask for getting involved even when they are interested.”
(Participant D9)

DISCUSSION

This study examined healthcare providers' perspectives on male involvement in FP in peri-urban Yangon, revealing key barriers. Although all providers expressed positive attitudes toward male participation, many emphasized the importance of private counseling to protect women's autonomy. This concern is supported by previous studies in Myanmar, which showed that male influence can significantly affect women's FP decisions (4, 16). Providers faced challenges in encouraging male engagement while safeguarding women's reproductive rights, highlighting the necessity to empower providers in gender-sensitive FP service delivery.

A major barrier identified was men's inability to attend FP services due to work obligations—an issue also observed in other low-resource settings (11, 17). Peri-urban Yangon is characterized by urban poverty, poorly regulated

working conditions, and a highly mobile population (18). Several men work long hours in manual labor jobs, with limited flexibility to engage in FP services along with their partners. While extending clinic hours may help, structural changes such as workplace leave policies are needed (19). In the short term, community-based education that promotes sexual and reproductive health and rights (SRHR) and positive masculinity can help increase male engagement.

Sociocultural norms shape male involvement in family planning (11, 17). Healthcare providers noted that widespread perception of FP as a woman's responsibility discourages men from participating, even when they are interested. Echoing previous studies, the traditional FP service delivery model was identified as needing reform to better engage men (20).

The overlapping barriers of “men's work obligations” and “the belief that FP is irrelevant to men” reflect broader socioeconomic expectations. As “primary breadwinners”, men are expected to provide, while women are tasked with childbearing and caregiving. These entrenched gender roles limit male participation in reproductive health, a pattern observed not only in peri-urban Yangon but also across diverse cultural settings (21).

LIMITATIONS

Relevant to the nature of in-depth interviews, social desirability bias might take place where participants may 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 healthcare providers in Myanmar. Instead, this study captured in-depth insights that are contextually relevant to peri-urban Yangon, offering rich qualitative evidence rather than broad representativeness.

RECOMMENDATIONS

Improving male involvement in FP requires coordinated efforts that address both provider practices and broader structural and cultural

barriers. Healthcare providers play a key role and should be equipped with gender-sensitive counseling skills to support shared decision-making while protecting women's autonomy. Expanding successful male engagement models, such as programs using trained male volunteers, can help foster supportive attitudes among men in culturally relevant ways.

Evidently, men's limited availability due to demanding work schedules calls for structural solutions. Policy reforms that introduce parent-friendly leave and flexible service hours could ease access. While these systemic changes take time, community-level initiatives that promote SRHR and couple-centered care offer practical next steps. In addition, cultural norms that frame FP as solely a woman's responsibility should also be challenged. National campaigns featuring male advocates can normalize men's participation and should be broadcast through both traditional and digital media to reach a wide audience. Embedding messages of empathy and gender equality into early education can help shift attitudes from a young age.

Finally, future research should broaden the demographic scope of healthcare providers and explore the perspectives of men and women directly. Mixed-method and anonymous online surveys can strengthen the evidence base for inclusive and responsive FP policies in Myanmar.

CONCLUSION

This study revealed that while healthcare providers support male involvement in FP, they also face significant challenges particularly navigating power imbalances, work-related barriers, and gendered cultural expectations. Often intertwined with low socioeconomic status, structural and cultural barriers—along with systemic-level constraints—were identified as peri-urban-specific challenges to male participation in FP. Addressing these issues requires coordinated efforts including SRHR promotion, provider empowerment, male-inclusive service delivery, and policy reforms that support equitable, respectful, and couple-centered FP counseling in Myanmar.

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SESSION 2: 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, Health Promotion, Health Behaviours. One Health, Zoonoses and Antimicrobial Resistance

ANTIBIOTIC SELF-MEDICATION AND RELATED FACTORS AMONG MYANMAR MIGRANTS IN MAE SOT, THAILAND

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ABSTRACT

Introduction: Antimicrobial resistance (AMR) is one of the top global public health threats. Bacterial AMR was directly responsible for 1.27 million global deaths in 2019 and contributed to 4.95 million deaths. The World Bank estimates that AMR could result in US\$1 trillion additional healthcare costs by 2050, and US\$1 trillion to US\$3.4 trillion GDP losses per year by 2030. In Thailand, there were 10,800 deaths attributable to AMR and 43,900 deaths associated with AMR in 2019. While not exclusive to Myanmar migrants, migrants are associated with inappropriate antibiotic use such as purchasing non-prescribed medicines.

Objectives: The study aims to examine the prevalence of antibiotic self-medication and associated factors among Myanmar migrants in Mae Sot, Thailand.

Methodology: A cross-sectional study was conducted among 248 participants of Myanmar migrants aged 18 and above, who had lived in Mae Sot for at least three months. Data was collected through face-to-face interviews using a structured questionnaire that had been developed from validated tools. Descriptive analysis and Chi-square test were performed using SPSS version 26.

Results: Of the 248 participants surveyed, 24.6% reported practicing self-medication with antibiotics. The respondents with age 22 and above, married, widow, divorce or separated, negative social influence, smaller family size (≤ 5), no difficulty in Thai language, perceived high affordability, and experience of paying low cost for antibiotics (<50 Baht) were highly associated with self-medication of antibiotics.

Conclusion: The findings point out that self-medication with antibiotics remains a public health concern because nearly one-fourth of participants engage in this practice. The results suggest the need for targeted interventions such as strengthening health education, and improving access to appropriate healthcare services, particularly for those who can easily obtain antibiotics without prescriptions.

Keywords: Antibiotic Self-Medication, Myanmar Migrants, Antimicrobial Resistance, Thailand

INTRODUCTION

Antimicrobial resistance (AMR) is one of the top global public health and development threats. It is estimated that bacterial AMR was directly responsible for 1.27 million global deaths in 2019 and contributed to 4.95 million deaths (1). Antimicrobial Resistance (AMR) happens when antimicrobial medicines such as antibiotics, antivirals, antifungals and antiparasitic no longer destroy or inhibit bacteria, virus, fungus and parasites which leads to infections more difficult to treat and increasing the risk of severe complications, including prolonged illness, disability, and death (2).

AMR is a problem for all countries at all income levels. Its spread does not recognize country borders. The global rise in antibiotic resistance poses a significant threat and can reduce the efficacy of common antibiotics against widespread bacterial infections (2). Even though new antibiotics have been developed, if the speed of the development of resistance is faster than that of the development of new antibiotics, then there will be few antibiotic choices for treatment of bacterial infection (3). In addition to death and disability, AMR has significant economic costs. The World Bank estimates that AMR could result

in US\$1 trillion additional healthcare costs by 2050, and US\$1 trillion to US\$3.4 trillion gross domestic product (GDP) losses per year by 2030(4). A global report estimated that without further action, by 2050, 10 million people per year will be dead and 100 trillion USD worth of global production will be lost due to AMR (5).

The South-East Asia Region is one of the most vulnerable areas to antimicrobial resistance (AMR), according to WHO risk assessments (6). Southeast Asia bears a disproportionate burden of antimicrobial resistance, with the region experiencing approximately 700,000 AMR-related deaths in 2019 (7). In Thailand, there were 10,800 deaths attributable to AMR and 43,900 deaths associated with AMR in 2019. The number of AMR deaths in Thailand is higher than deaths from respiratory infections and tuberculosis, digestive diseases, neurological disorders, chronic respiratory diseases, and transport injuries (8).

Thailand hosts one of Southeast Asia's largest migrant populations, especially from neighboring Myanmar. The Thailand-Myanmar border is among the world's top 20 largest migration corridors, with over 2,400 km of movement. Myanmar migrants represent a significant proportion of Thailand's foreign labor force (9). These challenges have contributed to the widespread use of non-prescribed medications, such as "Yaa Chud", poly-pharmaceutical packs containing a mix of drugs, including antibiotics and steroids. Despite being illegal, these packets remain easily accessible and are commonly used for self-medication. Although not exclusive to Myanmar migrants, studies have identified them as a key group sustaining demand for Yaa Chud due to its affordability, availability, and perceived effectiveness in treating common ailments (10).

While direct data quantifying antibiotic use specifically among Myanmar migrants in Thailand is limited in the available research, several studies provide insights into health-seeking behaviors, self-medication practices, and barriers to healthcare that likely influence antibiotic self-medication in this population. The evidence suggests Myanmar migrants often rely on self-medication for minor health problems. Therefore, this study aims to examine the prevalence of antibiotic self-medication and its

associated factors among Myanmar migrants living in Mae Sot, Thailand.

METHODOLOGY

Study design and population

A cross-sectional study was used in identifying prevalence of antibiotic self-medication and related factors among Myanmar Migrants in Mae Sot, Thailand. As the actual population size of Myanmar migrants in Mae Sot is not definitively known, this study used Cochran's formula for infinite population size with a 95% confidence interval and a 5% margin of error. The result showed the appropriate sample size of 384 participants. Nevertheless, this study is a preliminary study that aims to identify the prevalence of antibiotic self-medication and associated factors. Therefore, the total sample size of 248 participants was determined.

Mae Sot District consists of 10 subdistricts. These subdistricts served as the sampling frame for the selection of migrant clusters. From this list, three subdistricts were selected using simple random samplings to serve as study clusters. The random selection was performed using an online randomization tool. Within these three selected communities, participants were recruited through a voluntary response process. Participants included in this study were Myanmar migrants aged 18 years or older who had been residing in Mae Sot, Thailand, for a minimum duration of three months. Only individuals who expressed a willingness to participate were considered eligible for inclusion. Individuals with a medical background, including doctors, pharmacists, nurses, paramedical staff, and other allied health professionals, were excluded from the study to reduce bias in knowledge and attitude measurements.

Research instrument

The research instrument used in this study was a structured questionnaire specifically developed to assess the antibiotics self-medication and related factors among Myanmar migrants in Mae Sot, Thailand. The questionnaire was designed after an extensive review of relevant literature and previously validated tools. The development process involved adapting questions from several studies (11-17) to suit the

study population, and to ensure cultural relevance and clarity. The content validity of the instrument was reviewed by a 3 panel of experts in the relevant field to ensure that each item is appropriate and effectively measures the intended constructs. Approval from these experts was obtained by using IOC form prior to initiating data collection and got almost every item in score 1 in IOC. To assess the internal reliability of the questionnaire, a pretest was conducted among 30 Myanmar migrants near Bang Chalong Market in Samut Prakan which has the same characteristics to the actual study area. The reliability analysis was performed using Cronbach's Alpha coefficient and achieved 0.79 for knowledge about antibiotics and AMR and 0.78 for attitude and social influence respectively.

Data collection procedures

Data collection was conducted after the approval from the Mahidol University Central Institutional Review Board (MU-CIRB). In this study, the data collection team consisted of the principal researcher and two trained research assistants. To obtain the necessary permissions for fieldwork, the researcher contacted local authorities and community leaders through advocacy visits, accompanied by an official request letter issued by Mahidol University. All participants were provided with an informed consent form in Burmese language. They were informed of their right to refuse or withdraw at any time, the purpose of the study, and the confidentiality of their responses.

The data was collected using face-to-face interviews with the help of mobile devices running the Kobo Collect app, a mobile data collection tool from the Kobo Toolbox platform. Data was collected using a voluntary response approach within residential areas and public gathering locations and these included individual's house, Mae Sot Evangelical Church (MEC), shops and informal education schools. To minimize non-response rates and ensure data completeness, responses were reviewed immediately after collection. Any incomplete questionnaires were excluded during the data cleaning process prior to data entry.

Statistical analysis

Statistical analyses were performed using SPSS version 26. Prior to conducting the analyses, the dataset was cleaned. Descriptive statistics were employed to summarize the distribution of findings. To interpret the participant's knowledge, attitudes and social influence, median cut-off point was applied. Knowledge about antibiotics and AMR had 10 items, attitude questions contained 7 items, and social influence had 3 items in which the variables were categorized into 2 groups. Then, the Chi-square test was applied to assess the relationships between each independent variable and the antibiotic self-medication. Variables with p-values less than 0.05 were considered statistically significant.

RESULTS

General characteristics of respondents

Table 1 shows the general characteristics of the respondents. The study involved 248 Myanmar migrants, with aged 18-21 (55.2%), and the rest aged between 22 (44.8%) and above in which the median value for age was 21 years to ensure equal distribution and appropriate statistical comparison. Females comprised a higher proportion (60.9%) than males (39.1%). 74.6% of respondents were single while the others were ever married. Nearly half of the participants had completed high school (46.4%), and 31.0% had attained university or higher education. Unemployed or dependent accounted for the large group (29.4%), whereas the participants who were working in agricultural sectors were 13.3%. The median monthly family income was 8000 Baht, with a slight majority earning less than or equal to this amount (51.2%). Only 21% reported having health insurance, and most lived in households of five or fewer members (53.6%).

In terms of knowledge and attitude, 66.9% of respondents demonstrated poor knowledge, and 60.9% had a negative attitude toward antibiotic use. A high level of negative social influence was observed in 64.9% of participants. Language barriers were reported by 74.2%, while 50% perceived antibiotics as affordable and 36.3% as expensive and very expensive. Regarding the actual cost, 28.2%

reported paying less than 50 THB, followed by 23% who paid 50-100 THB. The prevalence of antibiotic self-medication was nearly one fourth

of the total respondents with 24.6%, while 75.4% using prescribed antibiotics.

Table 1 General characteristics of the respondents (n=248)

Variables	Categories	Number	Percent (%)
Age group (median=21, min=18, max=72, IQR=8)	18-21	137	55.2
	22 and above	111	44.8
Sex	Male	97	39.1
	Female	151	60.9
Marital status	Single	185	74.6
	Married, Widowed, Divorce/Separated	63	25.4
Education	No formal school education	8	3.2
	Primary school level	31	12.5
	Middle school level	17	6.9
	High school level	115	46.4
	University or higher education	77	31.0
Occupation	Unemployment/dependent	73	29.4
	Construction	9	3.6
	Manufacturing	3	1.2
	Domestic work	7	2.8
	Agriculture	33	13.3
	General worker/manual labor	15	6.0
	Other	108	43.5
Family income (median=8000, min=0, max=70000, IQR=8000)	≤ 8000 BAHT	127	51.2
	>8000 BAHT	121	48.8
Health insurance	Yes	52	21.0
	No	196	79.0
Family size (median=5, min=1, max=13, IQR=3)	≤ 5	133	53.6
	>5	115	46.4
Knowledge (median=4, min=0, max=10, IQR=2)	Poor (0-4)	166	66.9
	Good (5-10)	82	33.1
Social influence (median=8, min=3, max=14, IQR=3)	Negative (8-20)	151	60.9
	Positive (21-35)	97	39.1
Language barrier	Yes	184	74.2
	No	64	25.8
Affordability of antibiotics	Very affordable	34	13.7
	Affordable	124	50.0
	Expensive, very expensive	90	36.3
Cost of antibiotics	Less than 50 THB	70	28.2
	50–100 THB	57	23.0
	101–200 THB	25	10.1
	More than 200 THB	21	8.5
Prevalence of antibiotic self-medication	I don't remember	75	30.2
	Self-medication	61	24.6
	Prescribed medication	187	75.4

IQR=Interquartile Range

Table 2 Reasons, symptoms, and Yaa Chud use among participants who practiced antibiotic self-medication (n = 61)

Reasons for antibiotic self-medication	Responses		Percent of actual participants (n=61)
	Number of responses (n=83)	Percent (%)	
To save money	18	21.7	29.5
It was more convenient	38	45.8	62.3
I had previous experience with similar symptoms	14	16.9	23
Healthcare services were too far or hard to access	12	14.5	19.7
Others	1	1.2	1.6
What symptoms led you to take antibiotics without prescription	Responses		Percent of actual participants (n=61)
	Number of responses (n=83)	Percent (%)	
Sore throat	12	12.2	19.7
Cold/flu	23	23.5	37.7
Fever	26	26.5	42.6
Diarrhea	7	7.1	11.5
Skin infection or wound	14	14.3	23
Painful urination	9	9.2	14.8
Others	7	7.1	11.5
Number and percentage distribution of use of Yaa Chud among self-medication group (n=61)			
Use of Yaa Chud	Categories	Number	Percent (%)
	Yes	19	31.1
	No	42	68.9

Reasons, symptoms, and Yaa Chud use among participants who practiced antibiotic self-medication

Table 2 describes the reasons, symptoms, and Yaa Chud use among participants who practiced antibiotic self-medication. Among the 61 participants, the most common reason for antibiotic self-medication was convenience (62.3%), followed by saving money (29.5%), prior experience with similar symptoms (23%), and difficulty accessing healthcare services (19.7%). In total, 83 responses from 61 participants were recorded, as participants could select multiple reasons. Regarding symptoms that led to self-medication, fever (42.6%), cold/flu (37.7%), and skin infections or wounds (23%) were the most frequently reported symptoms, with some also citing sore throat, painful urination, and diarrhea. In total, 93 symptom-

related responses were reported by 61 participants. Notably, 31.1% of the individuals reported using Yaa Chud, non-prescribed poly-pharmaceutical packets, highlighting potential risks associated with informal antibiotic use.

Association between independent variables and antibiotic self-medication

Table 3 reveals statistically significant associations between independent variables and the practice of antibiotic self-medication using Chi-square analysis. A significant association was found between age and self-medication ($p = .010$), with a higher prevalence observed among participants aged 22 and above compared to those aged 18–21. A statistically significant association was observed between marital status and antibiotic self-medication ($p = .004$). The prevalence of self-medication was higher among

participants who were married, widowed, or separated compared to those who were single. Family size showed a strong association ($p = .000$), as individuals from smaller families (≤ 5 members) reported higher rates of antibiotic self-medication. Participants who reported no language difficulties had a higher rate of self-medication ($p = .002$). Negative social influences

were associated with increased self-medication (28.6%) compared to positive social influence (17.2%) ($p = .048$). Participants who perceived antibiotics as very affordable had higher self-medication rates ($p = .006$). Similarly, those who spent less than 50 THB had significantly higher rates of self-medication compared to others ($p = .003$).

Table 3 Association between independent variables and antibiotic self-medication

Variables	Number of respondents (n)	Prevalence of antibiotic self-medication n (%)		P-value
		Self-medication	Prescribed Medication	
Total	248	61 (24.6)	187 (75.4)	
Age group				.010
18-21	137	25 (18.2)	112 (81.8)	
22 and above	111	36 (32.4)	75 (67.6)	
Sex				.518
Male	97	26 (26.8)	71 (73.2)	
Female	151	35 (23.2)	116 (76.8)	
Marital status				.004
Single	185	37 (20.0)	148 (80.0)	
Married, Widow, Divorce/Separated	63	24 (38.1)	39 (61.9)	
Education				.313*
No formal school education	8	4 (50.0)	4 (50.0)	
Primary school level	31	10 (32.3)	21 (67.7)	
Middle school level	17	3 (17.6)	14 (82.4)	
High school level	115	28 (24.3)	87 (75.7)	
University or higher education	77	16 (20.8)	61 (79.2)	
Occupation				.567*
Unemployment/dependent	73	16 (21.9)	57 (78.1)	
Construction	9	3 (33.3)	6 (66.7)	
Manufacturing	3	1 (33.3)	2 (66.7)	
Domestic work	7	2 (28.6)	5 (71.4)	
Agriculture	33	12 (36.4)	21 (63.6)	
General worker/manual labor	15	4 (26.7)	11 (73.3)	
Other	108	23 (21.3)	85 (78.7)	
Family income				.715
≤ 8000 BAHT	127	30 (23.6)	97 (76.4)	
>8000 BAHT	121	31 (25.6)	90 (74.4)	
Health insurance				.423
Yes	52	15 (28.8)	37 (71.2)	
No	196	46 (23.5)	150 (76.5)	
Family size				.000
≤ 5	133	46 (34.6)	87 (65.4)	
>5	115	15 (13.0)	100 (87.0)	

Variables	Number of respondents (n)	Prevalence of antibiotic self-medication n (%)		P-value
		Self-medication	Prescribed Medication	
Knowledge				.958
Poor (0-4)	166	41 (24.7)	125 (75.3)	
Good (5-10)	82	20 (24.4)	62 (75.6)	
Attitude				.795
Negative (8-20)	151	38 (25.2)	113 (74.8)	
Positive (21-35)	97	23 (23.7)	74 (76.3)	
Social influence				.048
Negative (0-8)	161	46 (28.6)	115 (71.4)	
Positive (9-15)	87	15 (17.2)	72 (82.8)	
Language barrier				.002
Yes	184	36 (19.6)	148 (80.4)	
No	64	25 (39.1)	39 (60.9)	
Affordability of antibiotics				.006
Very affordable	34	12 (35.3)	22 (64.7)	
Affordable	124	37 (29.8)	87 (70.2)	
Expensive, very expensive	90	12 (13.3)	78 (86.7)	
Cost of antibiotics				.003*
Less than 50 THB	70	24 (34.3)	46 (65.7)	
50–100 THB	57	19 (33.3)	38 (66.7)	
101–200 THB	25	7 (28.0)	18 (72.0)	
More than 200 THB	21	3 (14.3)	18 (85.7)	
I don't remember	75	8 (10.7)	67 (89.3)	

*Fisher's Exact Test

DISCUSSION

This study found that antibiotic self-medication was significantly associated with several sociodemographic and behavioral factors. The prevalence of self-medication among Myanmar migrants in this study was 24.6%, which is slightly lower than the 29.7% reported in the Thailand National Household Survey on antibiotic use (18). While the national estimate includes the general population, the similarity in magnitude highlights that self-medication is also a concern among migrant groups. A significant association was observed between age and self-medication behavior, with a higher prevalence among participants aged 22 and above. This aligns with the study that suggests a higher risk for self-prescription of antibiotics among certain adult age groups (19). Marital status was also significantly associated with self-medication. Participants who were married, widowed, or separated reported a higher prevalence than those

who were single. This finding aligns with the study in Iraq (20).

Surprisingly, participants who reported no language barrier have significantly higher prevalence of antibiotic self-medication. This finding deviates from the literature among immigrants in Dutch (21). In the context of Mae Sot, where the migrant population is considerably larger than the local Thai population, many migrants can access goods and services within their own linguistic networks. In this environment, language is less of a barrier, even for those who do not speak Thai fluently. In addition, negative social influence led to increased self-medication. This aligns with a study in China (15). This suggests that the opinions and behaviors of one's social network play a crucial role in shaping health decisions. Furthermore, individuals from smaller families (≤ 5 members) exhibited higher rates of self-medication. While the previous studies did not

directly address family size, this finding suggests that individuals in smaller households might have less access to familial support or perhaps greater autonomy in making health-related decisions, including self-medication.

Finally, participants who perceived antibiotics as "very affordable" had higher self-medication rates, and those who spent less than 50 THB on antibiotics showed significantly higher rates of self-medication compared to others. This strongly corroborates previous research in Malaysia and Myanmar (12, 22, 23). This finding emphasizes the need for stricter regulations on antibiotic sales and pricing, especially over-the-counter availability.

CONCLUSION

This study identified age, marital status, family size, language barrier, social influence, and the affordability and cost of antibiotics as significant factors influencing antibiotic self-medication. Those factors highlight the urgent need for preventing antibiotic self-medication and mitigating antimicrobial resistance.

RECOMMENDATIONS

Self-medication with antibiotics remains a public health concern because nearly one-fourth of participants engage in this practice according to the findings. Given that higher prevalence was observed among participants aged 22 and above, health education programs should specifically target young adults and early working-age migrants through platforms they regularly engage with such as workplaces, informal schools, and religious centers. These programs should focus on correcting misconceptions, increasing awareness of antimicrobial resistance (AMR), and promoting appropriate antibiotic use. The health education sessions should be culturally sensitive and combined with community-based approaches. Furthermore, policy makers should consider stricter regulations on over-the-counter antibiotic sales and explore strategies to improve access to appropriate healthcare services, particularly for those who can easily obtain antibiotics without prescriptions. These interventions are crucial for promoting responsible antibiotic use and mitigating the global threat of antimicrobial resistance.

ETHICAL DECLARATION

The study protocol obtained approval from the Mahidol University-Central Institutional Review Board (MU-CIRB), Office of the President, Mahidol University and Community Ethical Approval Board (CEAB). Informed consent was obtained from all participants before starting the interviews. Participation in the study was voluntary, and all the information collected was kept confidential and not shared with any local authorities. The researcher informed the participants that they had the right to refuse to answer any questions if they felt uncomfortable at any time during the interview. To protect privacy, participants were assigned three-digit identification codes, and no names were recorded.

LIMITATIONS

The study employed a cross-sectional design and conducted among a specific population subgroup of Myanmar migrants living in Mae Sot, and the findings may not be generalizable to all demographic or geographic contexts such as migrants living or working in other areas of Thailand and the Thai citizens. Moreover, the statistical analysis relied on Pearson's Chi-square test, which identifies associations but does not estimate predictive strength or likelihood. Thus, interpretations are limited to observed relationships rather than causation.

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EXPLORING PREVENTIVE MEASURES AND ASSOCIATED FACTORS AGAINST ZONOTIC DISEASES AMONG THE PET OWNERS IN NAKHON PATHOM, THAILAND

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ABSTRACT

Introduction: Zoonotic disease, infections transmitted from animals to humans, poses significant global public health threat, accounting for up to 75% of new or emerging infectious diseases, and causing approximately 2.7 million deaths annually. Due to increasing pet ownership, urbanization, and closer human-animal bonds, transmission risks have been increasing. In Thailand, with increasing pet populations, and the past evidence of zoonotic pathogens in pets, emphasize the need for preventive measures. A research gap remains regarding zoonotic disease preventive behaviors among the pet owners in Thailand, and the associated factors.

Objectives: To explore the level of preventive measures against zoonotic diseases, and its associated factors among the pet owners in Nakhon Pathom, Thailand.

Methodology: A cross-sectional survey was conducted among 430 pet owners, according to inclusion criteria and through purposive sampling, at Prasuarthorn small animal hospital, in Nakhon Pathom, Thailand. After checking validity, reliability, modification and ethical approval, data collection was done. Descriptive analysis of variables and chi-square tests at 5% level of significance were calculated. Preventive practices were scored and classified as low and high based on the 75th percentile.

Results: 24.9% of respondents (n=430) reported having good preventive measures. Detailed descriptive results regarding sociodemographic and psychosocial factors were obtained. Variables with statistical significance to higher preventive measures levels were age, gender, education, monthly income, marital status, housing type, knowledge level, and attitudes.

Conclusion: As high knowledge and a positive attitude were significantly associated with the high level of preventive measure, the findings can be useful for public health and one health organizations to reach the people with significant sociodemographic characteristics to enhance knowledge and attitude.

Keywords: Pet owners, Preventive measures, zoonotic diseases, one health, Thailand

INTRODUCTION

Zoonotic diseases, caused by bacteria, viruses, parasites, and fungi, can be transmitted from animals to humans, resulting in mild to severe illnesses or death in humans and animals (1, 2). Globally, over 200 known types of zoonoses are responsible for 2.7 million deaths annually, an estimated 60% of known infectious diseases, and up to 75% of new or emerging infectious diseases are zoonotic in origin (3, 4). 70 human diseases, potentially caused by companion animals, might even be an underestimated number (5, 6). Despite this, zoonotic infections remain underdiagnosed and underreported, especially in developing countries.

With the growing domestication of animals and closer human-animal interactions, in urbanizing settings, the potential risk for zoonotic transmission is increasing. Among household risks, pets, particularly dogs and cats, serve as reservoirs for various zoonotic pathogens including *Toxoplasma gondii*, *Salmonella spp.*, and other companion vector-borne parasites (7).

Transmission can occur through direct contact (e.g., licking, biting, scratching), indirect pathways (contact with feces, food, bedding, shared utensils), or vectors. Certain behaviors such as allowing pets on beds, sharing utensils, kissing, and infrequent handwashing increase the likelihood of exposure (2). Alarmingly, many zoonotic infections present asymptotically in pets, making preventive behaviors critical in households with vulnerable individuals such as children, elderly persons, pregnant women, or immunocompromised family members (8).

In Southeast Asia, and Thailand, pet ownership has surged recently. Pet humanization is becoming popular, where animals are treated as family members, sharing living spaces and routines with humans (9). Limited awareness of safe pet-

husbandry practices can increase the risk of zoonotic disease transmission. Additionally, Thailand faces challenges regarding free-roaming stray dogs and cats, which are intermediary hosts for parasitic and vector-borne zoonoses (10). Zoonotic pathogens thrive during environmental degradation, urbanization, and inadequate sanitation, conditions which can be found in peri-urban areas with high pet ownerships like Nakhon Pathom, bridging rural and urban zones (11).

Global and national policy put effort into integrated, cross-sectoral approaches. Thailand is involved in One Health workforce to address these challenges and is part of SEAHOHUN (Southeast Asia One Health University Network), which promotes collaborative efforts among human, animal, and environmental health disciplines (12). Although there are campaigns around rabies and deworming, systematic educational outreach regarding hygiene and handling practices is lacking (13, 14).

Older adults and those with higher educational attainment are generally more compliant with hygiene standards, as seen in comparative studies in Bhutan, and Thailand (15). Similarly, individuals with greater knowledge about zoonotic transmission and positive attitudes toward pet care are more likely to engage in consistent preventive practices such as handwashing or regular veterinary visits (15, 16).

However, there is a study gap in exploring preventive measures against zoonotic diseases among the pet owners and associated sociodemographic factors including housing types and presence of vulnerable household members. By addressing these questions, this study contributes not only to the academic understanding of zoonosis prevention but also provides insights for local governments, health educators, and veterinarians.

This study draws upon the PRECEDE-PROCEED model, where it

stated that behavior is shaped by predisposing factors (knowledge, attitudes), and enabling factors (resource and services availability). Existing studies suggest that demographic and psychosocial factors influence pet-care practices (17).

METHODOLOGY

Study design and population

This study is quantitative cross-sectional survey, to explore the preventive measures against zoonotic diseases among pet owners in Nakhon Pathom, Thailand, at Mahidol Veterinary Hospital “Prasuarthorn Small Animal Hospital”, the biggest small animal hospital around the area where the Bangkok Metropolitan urban area and Nakhon Pathom’s rural area coincide. Purposive sampling was done, and questionnaires were provided to 430 pet owners, with face-to-face support from two research assistants. The inclusion criteria included pet owners aged 18 years and older, residing within Nakhon Pathom Province, being at the animal hospital for treatment, diagnosis for sickness, hospitalization, or for appointments, one family or household member per pet at the hospital, and willingness to participate in the study.

Research instrument and data collection

The structured question was developed for this study as the main instrument. Questionnaires were adapted from the previous relevant study of Jason W. Stull (18), another study regarding preventive measures against Japanese encephalitis, and according to CDC’s recommendations (19, 20). The questionnaire was first prepared in English language and translated into Thai language. Some parts of the questionnaires were updated, after validity IOC checking by 2 experts at Mahidol University, and pilot testing of 30 participants. Thai research assistants were trained to gain informed

consent, to provide questionnaires, and face-to-face interview support.

Data analysis

Survey questionnaires were verified, checked for completeness of answers, data input, cleansed in Excel, coded, and statistical analyses were conducted using IBM SPSS Version 25. The Chi-square test was performed, and 95% Confidence Interval (CI) was calculated to identify the potential associations between each factor and preventive measure levels, and a P-value ≤ 0.05 was considered statistically significant. Data was described in frequency, percentage, and cut-off points were determined with quartile deviations.

Ethical Consideration

Data was collected after approval from Mahidol University Social Science Independent Review Board (MUSSIRB), with Certificate of Approval number 2023/176.3010. The participant information sheets were distributed and explained in detail before obtaining consent from participation. The information collected was anonymized and archived for confidentiality data.

RESULTS

Sociodemographic characteristics

Table 1 presents the sociodemographic characteristics of the participants. 59.8% were females and 40.2% were males. Nearly 49% of participants were younger than 42 years old. Nearly two-thirds of participants have a bachelor’s degree or college level of education. Less than half of the participants had a monthly income of less than 50,000 THB. Nearly half of the participants were business owners. More than half of the participants were married or living with partners. Nearly 80% of the participants live in houses with compounds. More than half of the participants have more than or

equal to 4 household members and 70% of participants live in the nuclear family type. Nearly 50% of participants reported having

more than one high-risk health condition among household members.

Table 1 Characteristics of respondents (n=430)

Sociodemographic Variables	Frequency	Percentage (%)
Age (Years)		
<42 years	210	48.8
≥ 42 years	220	51.2
<i>Median= 42, QD= 10, Min=19, Max= 77</i>		
Gender		
Female	257	59.8
Male	173	40.2
Education		
Primary school	12	2.8
Secondary school	21	4.9
High school	66	15.3
Bachelor's degree or college	272	63.3
Post-graduate degree	59	13.7
Monthly Income		
< 50,000 THB	200	46.5
≥ 50,000 THB	230	53.5
<i>Median= 50,000, QD= 30,000, Min= 0, Max= 1,300,000</i>		
Occupation		
Unemployed	17	4.0
Civil servants	38	8.8
Personal business	196	45.6
Employed	128	29.8
Retire/Pensioner	21	4.8
Others (students, freelancers, etc.)	30	7.0
Marital Status		
Single	175	40.7
Married	189	44.0
Divorced/separated	7	1.6
Not married but living together	55	12.8
Widow	4	0.9
Household Type		
Condo	18	4.2
Apartment	12	2.8
Twin/townhouse	61	14.2
House with compound	337	78.4

Sociodemographic Variables	Frequency	Percentage (%)
Semi-detached house	2	0.6
Family type		
Nuclear	301	70.0
Extended	129	30.0
Condition of household members		
No condition	231	53.7
At least one condition	141	32.8
At least two conditions	48	11.2
At least three conditions	10	2.3
Number of household members		
<4 members	189	44.0
≥ 4 members	241	56.0

Median= 4, QD= 1, Min= 1, Max= 20

QD: Quartile Deviation

The cumulative knowledge score of more than or equal to 39 marks accounted for 50% of the participants and regarded as high. 48.5% of the participants had positive attitude regarding zoonotic disease and its preventive measures. Approximately one-third of pet owners reported being scratched or bitten by pets. 3.5% of participants reported having diseases transmitted from pets to human.

Online media or internet was the main source of information regarding zoonotic

diseases (84.7%). 50.5% of participants chose veterinary personnels and nearly one-fourth gained information from health facilities, schools or universities. Approximately two-thirds of pet owners gained health information regarding zoonotic disease from two or more sources. Regarding the type of information obtained, only around one-fourth of pet owners received information regarding meanings of zoonotic diseases and high-risk people respectively.

Table 2 Frequency and percentage distribution of psychosocial factors of respondents (n=430)

Characteristics	Frequency (n)	Percentage (%)
Predisposing factors		
Knowledge		
Poor (≤ 39)	215	50.0
Good (> 39)	215	50.0
<i>Median= 39.5, QD= 3.5, Min= 0, Max= 43</i>		
Attitude		
Negative (≤ 29)	221	51.4
Positive (> 29)	209	48.6
<i>Median= 29, QD= 2, Min= 16, Max= 37</i>		
Got scratched or bitten by a pet	275	64.0

Characteristics	Frequency (n)	Percentage (%)
Predisposing factors		
Transmitted disease from pet to human	15	3.5
Enabling Factors		
Source of information		
Online media/internet	364	84.7
Printed media	88	20.5
Healthcare facilities/schools or universities	111	25.8
Pet stores/pet breeders	23	5.3
Veterinary	217	50.5
Friends or family	100	23.3
Type of information (n= 384)		
Disease meaning	94	24.5
Disease names	285	74.3
Disease agent	174	45.4
Mode of transmission	172	44.8
High-risk behaviors	155	40.4
High-risk people	84	21.9
Knows preventive measures	214	55.8
Source of information level		
No or only one source of information	161	37.4
Two sources of information	132	30.7
Three sources of information above	137	31.9

Based on the cutoff point at 75 percentiles of the total scores (117 scores), 24.9% of participants were regarded to have high preventive measures. The majority of pet owners reported washing their hands with soap and water after handling pet waste. Feeding practice was also found to be good. In contrast, only 35.3% always used gloves when disposing pet waste, and a notable 28.1% admitted to never practicing pest control around the environment. Less than one-fifth of the pet owners reported never or

rarely washing paws and body parts of pets that were exposed to outdoor and soil, collecting pet feces from public places, and cleaning the pet items regularly respectively. Over 30% of participants reported never or rarely practiced disinfection or bleaching of pet items exposed to pet wastes and cleaning the pet items regularly. One-third of participants do risky behaviors such as sleeping on the same bed with pets, kissing the pets, and cuddling with pets respectively.

Table 3 Descriptive analysis of preventive behaviors of respondents (n=430)

Type of preventive measures	Level of Practice %				
	Never	Rarely	Some times	Often	Always
Hygiene and general preventive measures					
<i>Interaction with pets</i>					
Let pets lick	14.2%	32.1%	27.2%	17.4%	9.1%
Cuddle with pets	4.7%	14.4%	18.6%	29.1%	33.3%
Sleep on same bed	43.3%	15.6%	9.8%	7.2%	24.2%
Kiss the pets	22.8%	20.5%	14.4%	14.2%	28.1%
<i>Feeding practices</i>					
Pets eat from the same plate as people or lick plate	97.4%	2.3%	0%	0%	0.2%
Feed the pet raw egg, meat, or raw animal parts	93.3%	5.1%	0.7%	0%	0.9%
<i>Pet checkups</i>					
On regular and timely vaccination according to recommendation	4%	1.9%	9.3%	4.4%	80.5%
On regular treatment and check-up for intestinal worms	7.9%	3.5%	15.8%	7.7%	65.1%
On regular treatment and check-up for external parasites	8.4%	4%	13.5%	8.8%	65.3%
<i>Waste management</i>					
Pet feces are collected and disposed everyday	5.8%	5.1%	3.7%	11.9%	73.5%
Pet feces are disposed of in covered bin	8.1%	2.3%	3.7%	4.7%	81.2%
Use gloves when emptying the waste and containers of the wastes of pets	30.9%	15.3%	11.6%	6.7%	35.3%
<i>Hygiene</i>					
Wash the hands with soap and water after handling pet wastes	0.5%	2.1%	1.2%	3.3%	93%
Wash the hands with soap and water after touching or playing with pets	0.9%	11.6%	23.3%	9.1%	55.1%
Wash the hands with soap and water after feeding the pet	1.4%	2.8%	17.9%	8.4%	69.5%
Wash hands after handling pet items	1.2%	4%	10.9%	15.6%	68.4%
Environmental related measures					
<i>Environmental control</i>					
Pest control	28.1%	27.7%	22.6%	10%	11.6%
Pet and items out of kitchen or dining areas	4.9%	2.8%	3.7%	5.6%	83%
Keep house clean, has good ventilation, and exposed to sunlight	0%	2.1%	4.4%	12.1%	70.5%
<i>Waste management in environment</i>					
Keep areas around the house clear of pet feces	4%	4.2%	7.4%	14%	70.5%
Collect pet feces from public places	13%	2.6%	4.4%	5.8%	74.2%

Type of preventive measures	Level of Practice %				
	Never	Rarely	Some times	Often	Always
Wash paws/ body parts exposed to outdoor and soil	12.1%	8.1%	15.1%	17.2%	47.4%
Cleaning and disinfection					
Clean pet items regularly	1.4%	8.4%	17.4%	24.4%	48.4%
Disinfect or bleach pet items exposed to pet wastes	15.1%	19.1%	18.6%	11.6%	35.6%
Risky feeding practice in environment					
Let pets eat insects	72.1%	27.2%	0.5%	0%	0.2%
Let pets eat rodents or rats	87%	12.8%	0.2%	0%	0%
Let the pet drink unclean water or outdoor body of water	79.8%	17.2%	0.5%	1.6%	0.9%

Chi-square analysis in Table 4 revealed significant sociodemographic factors to preventive measures, such as age of ≥ 42 years old ($p=.002$), male gender ($p=.03$), having bachelor's degree or higher ($p=.001$), monthly income of $> 50,000$ Thai baht, married or living with a partner ($p= .004$),

and living in compound ($p= .002$). Regarding the psychosocial factors in Table 6, high knowledge score ($p=.014$), and positive attitude ($p=.034$) were found to be significantly associated with high preventive measure level.

Table 4 Associations between socio-demographic factors and preventive measure level of participants ($n=430$)

Variables	Number	Preventive Measures, N (%)		p-value
		Low	High	
Age				
<42 years	210	172 (81.9)	38 (18.1)	.002
≥ 42 years	220	151 (68.6)	69 (31.4)	
Gender				
Female	257	183 (71.2)	74 (28.8)	.0300
Male	173	140 (80.9)	33 (19.1)	
Education Status				
\leq High School	99	78 (78.8)	21 (21.2)	.001
Bachelor's degree	272	212 (77.9)	60 (22.1)	
Post-graduate degree	59	33 (55.9)	26 (44.1)	
Monthly Income				
$\leq 50,000$ THB	263	208 (79.1)	55 (20.9)	.023
$> 50,000$ THB	167	115 (68.9)	52 (31.1)	
Occupation status				

Variables	Number	Preventive Measures, N (%)		p-value
		Low	High	
Unemployed	68	48 (70.6)	20 (29.4)	.500
Employed	166	129 (77.7)	37 (22.3)	
Business	196	146 (74.5)	50 (25.5)	
Marital status				
Single or no partner	186	153 (82.3)	33 (17.7)	.004
Married or with a partner	244	170 (69.7)	74 (30.3)	
Family type				
Nuclear	301	219 (72.8)	82 (27.2)	.108
Extended	129	104 (80.6)	25 (19.4)	
Number of household members				
< 4 people	189	148 (78.3)	41 (21.7)	.214
≥ 4 people	241	175 (72.6)	66 (27.4)	
Condition of household members				
Healthy	231	175 (75.8)	56 (24.2)	.826
People with at least one condition	199	148 (74.4)	51 (25.6)	
Housing type				
Condo, apartment, semi-detached	93	82 (88.2)	11 (11.8)	.002
Compound	337	241 (71.5)	96 (28.5)	

Table 5 Associations between psychosocial factors, enabling factor, animal and environmental factors and preventive measure level of respondents (n=430)

Variable	Number	Preventive measures, N (%)		p-value
		Low	High	
Knowledge				
Low (≤ 39)	215	173 (80.5)	42 (19.5)	.014
High (>39)	215	150 (69.8)	65 (30.2)	
Attitude				
Negative (≤ 29)	221	176 (79.6)	45 (20.4)	.034
Positive (>29)	209	147 (70.3)	62 (29.7)	
Past experience				
No	154	109 (70.8)	45 (29.2)	.151
Yes	276	214 (77.5)	62 (22.5)	
Level of source of health information				
No or only one source	16	123 (76.4)	38 (23.6)	.867
Two sources	132	99 (75.0)	33 (25.0)	
≥ Three sources	137	101 (73.7)	36 (26.3)	
Type of health information				
< 3 types	225	173 (76.9)	52 (23.1)	.436

Variable	Number	Preventive measures, N (%)		p-value
		Low	High	
Three and above	205	150 (73.2)	55 (26.8)	

DISCUSSION

This study explored the detailed preventive measures against zoonotic diseases, practiced by the pet owners in Nakhon Pathom, Thailand. The findings revealed several significant factors regarding sociodemographic characteristics and psychosocial factors in relation to preventive measures, such as older age, female gender, higher income, higher education, and living in compound housing were all positively associated with higher level of practices.

The relatable studies in Thailand and Ethiopia, stated that age and gender were shown to link with protective behaviors including hygienic measures and vaccinations (21, 22). Public health programs targeting younger age groups and gender-sensitive campaigns can be considered. Similarly, papers from Pakistan, and Ethiopia, where married individuals were found to show better compliance in preventive protocols, proactivity in activity like vaccination, and hygienic practices (23). Family obligations and perceived responsibilities for household health possibly drive married pet owners to comply with vaccination and hygiene protocols. Moreover, A study in Thailand discussed how compound-style housing facilitated better pet management by providing more controlled spaces for pets (22). These findings suggest that older age, educational exposure, and financial resources increase both health literacy and behavioral compliance.

Psychosocial variables such as knowledge and attitude played a central role. This supports the behavioral constructs of the PRECEDE-PROCEED model, where

predisposing factors strongly influence health actions. Interestingly, enabling factors such as the number of information sources or prior experience with pet-transmitted disease did not significantly impact preventive behavior. This suggests that merely providing information is insufficient, it must be contextually relevant, motivating, and linked to behavior change strategies.

The study reinforces the importance of One Health frameworks that acknowledge how pet ownership, living environment, social determinants, and human behavior collectively influence zoonotic disease risk. With trends like pet humanization, such as co-sleeping, kissing pets, and sharing food, the Thai urban landscape presents unique challenges for disease prevention. Ultimately, these findings emphasize the need for culturally tailored interventions that bridge knowledge and action. Veterinary professionals, community health workers, and digital health platforms can serve as important conduits for translating awareness into sustainable behavior.

LIMITATIONS

Self-reporting preventive behaviors may introduce recall or social desirability bias, especially for behaviors like handwashing or pet feeding practices. The sample was drawn from a single animal hospital, potentially excluding lower-income or rural households who may not seek formal veterinary care.

CONCLUSIONS AND RECOMMENDATIONS

This study identifies gaps in preventive behaviors related to zoonotic disease risk among pet owners in an urbanizing region of Thailand. Providing knowledge and encouraging positive attitudes are important to improve preventive behavior.

Key recommendations include:

1. Health Communication: Launch culturally adapted, digital platforms and community-based, health facility and school-based campaigns that target significant groups. Public health programs targeting younger age groups and gender-sensitive campaigns can be considered.
2. Veterinary Integration: Use routine pet clinic visits to reinforce hygiene practices and zoonotic education.
3. One Health Education: Integrate zoonotic awareness into local school curricula and health volunteer training modules.
4. Municipal Policy Support: Support regulations on exotic pet ownership, pest control, and wider glove usage in animal waste handling.
5. Research and Evaluation: Encourage longitudinal studies to measure changes in behavior and monitor zoonotic disease trends.
6. These recommendations align with Thailand's national One Health strategy and contribute to Sustainable Development Goals, particularly SDG 3 (Health and Well-being) and SDG 6 (Clean Water and Sanitation).

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FACTORS ASSOCIATED WITH RABIES-RELATED BEHAVIORS AMONG MYANMAR MIGRANT WORKERS IN BANGKOK METROPOLITAN AREA

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ABSTRACT

Introduction: Rabies is a fatal but preventable viral disease that continues to be a public health concern in Thailand, particularly among vulnerable populations such as migrant workers. Myanmar migrant workers, who often reside in high-risk environments with limited access to healthcare and information, may face increased risk of rabies exposure due to animal bites and inadequate knowledge of prevention measures.

Objectives: This study aimed (1) to determine the proportion of potential rabies exposure in the past 12 months, (2) to assess levels of knowledge, attitudes, and practices (KAP) regarding rabies, and (3) to examine associations between socio-demographic factors, KAP, and exposure risk among Myanmar migrant workers in the Bangkok Metropolitan Area.

Methodology: A cross-sectional study was conducted among 184 Myanmar migrant workers recruited through hospitals and online platforms in BMA. Data were collected using structured questionnaires covering demographics, knowledge of rabies transmission and prevention, attitudes toward rabies risk and vaccination, practices following animal exposure, and self-reported exposure incidents. Descriptive statistics summarized the findings. Associations were analyzed using Pearson correlation and logistic regression.

Results: In total, 16.3% of participants reported at least one rabies exposure in the past 12 months (4.9% bitten, 11.4% scratched, 5.9% licked). Knowledge was moderate (mean score 4.89/11), with only 17.4% showing good knowledge. Misconceptions were common, such as underestimating risks from healthy-looking animals and non-bite exposures. Attitudes were poor to moderate, with only 30.4% demonstrating good attitudes. Practices were relatively better: 69.6% reported wound cleaning and 71.2% sought hospital care after bites. Logistic regression showed older age increased exposure risk (OR = 1.03, 95% CI 1.01–1.05), while higher education was protective (OR = 0.70, 95% CI 0.52–0.95). Knowledge and practice were strongly correlated ($r = 0.600$, $p < 0.001$).

Conclusion: Myanmar migrant workers in Bangkok remain at high risk of rabies exposure, with substantial gaps in knowledge and attitudes. These findings emphasize the need for culturally and linguistically appropriate health education, structural interventions to ensure affordable rabies vaccination and Post-Exposure Prophylaxis, and integrated One Health strategies to reduce rabies risk among migrant workers in Thailand.

Keywords: Rabies, Migrant Workers, One Health, Knowledge Attitudes Practices, Public Health

INTRODUCTION

Rabies remains a severe but preventable zoonotic viral disease, responsible for approximately 59,000 human deaths annually worldwide, with 95% occurring in Asia and Africa (1,2). It is transmitted predominantly through bites from infected animals, especially dogs, which account for up to 99% of all human

rabies cases (3). Despite the availability of effective post-exposure prophylaxis (PEP), rabies continues to cause significant mortality due to poor access to timely treatment and limited public awareness (1,4).

Thailand has been classified as rabies-endemic, with over one million dog bite cases

reported each year, of which only approximately half seek rabies vaccination (5,6,19). In 2018, the country recorded an outbreak with 18 human deaths, highlighting persistent gaps in rabies control despite mass dog vaccination and public education programs (7). In 2023 alone, Thailand reported five human rabies deaths, none of whom received PEP (7). Such fatalities underscore the need for targeted interventions, particularly among vulnerable populations. (23)

Migrant workers, especially those from Myanmar, are disproportionately affected. A study at the Sanitation 1 Medical Academic Center in Bangkok reports that 92% of foreigners seeking PEP in Bangkok are migrant workers, and they are five times more likely to experience animal bites compared to local Thai residents (8,9). As of January 2025, Thailand hosts approximately 5.2 million migrant workers, with around 1.7 million residing in Bangkok Metropolitan Area (BMA) (10,11). Approximately 70% of these are Myanmar nationals, engaged primarily in labor-intensive sectors such as construction, manufacturing, and services (12,13).

The migrant workforce plays a critical role in Thailand's economy, accounting for up to 10% of its labor force, but faces structural disadvantages, including legal barriers, language difficulties, lack of health insurance, and limited access to preventive healthcare (16,17). Many are undocumented, with studies indicating that undocumented migrants are less likely to access healthcare services, including PEP, due to fear of legal consequences and high out-of-pocket costs (17,18,22).

Previous studies on rabies exposure have focused largely on travelers (24,25,26), with limited research exploring rabies risk among migrant populations, particularly in urban megacities like Bangkok, where stray animals are common and healthcare systems are overburdened (9,12,20). This study addresses this gap by focusing on Myanmar migrant workers in the Bangkok Metropolitan Area, a population disproportionately affected by rabies. Specifically, the study aimed to (1) determine the proportion of potential rabies exposure within the past 12 months, (2) assess levels of knowledge, attitudes, and practices (KAP) regarding rabies, and (3) examine the associations between socio-

demographic factors, KAP outcomes, and rabies exposure risk. Findings are intended to inform One Health and public health interventions tailored to migrant populations, thereby reducing rabies morbidity and mortality in Thailand. (10,12,21).

METHODOLOGY

Study Design

This was a cross-sectional quantitative survey study designed to determine the proportion of potential rabies exposure and assess knowledge, attitudes, and practices (KAP) regarding rabies among Myanmar migrant workers. The cross-sectional design allowed rapid data collection to explore prevalence and associated factors within this vulnerable population.

Study Area

The study was conducted in Bangkok Metropolitan Area (BMA), which includes Bangkok, Samut Prakan, Nonthaburi, Pathum Thani, Nakhon Pathom, and Samut Sakhon. These areas are home to a significant proportion of Thailand's estimated 5.2 million migrant workers, with over 1.7 million residing in BMA alone (10,11). Approximately 70% of these are Myanmar nationals, reflecting the study's target population. The area's dense stray animal population, combined with socio-economic and legal barriers to healthcare access among migrants, increases rabies exposure risks, justifying its selection as the study site (20,21,22).

Sample Size and Sampling Method

Because most previous studies on rabies exposure and KAP were conducted among travelers, whose KAP has many times been shown to be higher than that of the general population, rather than immigrant workers, their estimates were not considered representative of our study population. Furthermore, no published study has reported rabies exposure incidence among Myanmar migrant workers in the Bangkok Metropolitan Area (BMA). We therefore based our calculation on regression requirements using Green's formula, the rules of thumb, (27) for multiple regression ($N \geq 50 +$

8m) to ensure adequate power for the planned multivariable analyses with 16 predictors. This yielded a minimum N of 178 ($50 + 8 \times 16$). Our final sample of 184 participants met and slightly exceeded this threshold, supporting stable estimation in the regression models.

Participants were recruited using convenience sampling from hospitals, clinics, community groups, and online platforms. For example, Samut Sakhon Hospital, which conducts migrant health check-up services every week, sees approximately 200 Myanmar migrant workers daily for these services.

Eligible participants met the following inclusion criteria: they were of Myanmar nationality, aged 18 years or older, currently residing or working in the Bangkok Metropolitan Area, able to communicate in either Burmese or English, and willing to participate by providing informed consent. Individuals who were unable to understand or complete the questionnaire, even with assistance, were excluded to ensure the accuracy and reliability of the collected data.

Measurement Tools and Instrument

Data were collected using a structured questionnaire, developed based on literature review and expert input, and validated by 3 public health specialists. The questionnaire was translated into Burmese and English to ensure clarity and accessibility for participants.

The final questionnaire consisted of five sections. The first section captured demographic information, including age, gender, educational attainment, income, migrant status, and access to healthcare services. The second section assessed participants' knowledge of rabies, covering topics such as transmission routes, clinical symptoms, animal reservoirs, and the availability and use of pre- and post-exposure prophylaxis (PrEP/PEP), as well as appropriate wound care practices. The third section focused on attitudes toward rabies, exploring perceived severity of the disease, the importance of vaccination, and barriers to accessing preventive services. The fourth section examined participants' practices related to rabies prevention and response, including wound cleaning after potential exposure, seeking medical attention, and vaccination behaviors. The final section addressed exposure history, capturing self-reported incidents of potential

rabies exposure such as bites, scratches, or licks from animals that could carry rabies within 1 year. Knowledge, attitudes, and practices (KAP) were scored using predefined cut-offs validated in prior studies and refined through expert consultation. For example, for knowledge, correct answers were scored +1 and incorrect answers -1, with total scores ranging from -6 to 11; scores <4 were classified as poor, 4-6 as moderate, and 7-11 as good.

Data Collection

Data collection was conducted using both paper-based and online formats (Google Forms) to maximize participant reach. Online links were shared at the data collection sites and via social media and migrant worker networks, but paper questionnaires were also available for those without digital connectivity. Informed consent was obtained from all participants prior to data collection.

Data Analysis

Data were analyzed using SPSS. Descriptive statistics summarized demographics, KAP levels, and exposure prevalence. Pearson correlation and logistic regression analyses examined associations between socio-demographic factors, KAP, and potential rabies exposure. A p-value <0.05 was considered statistically significant.

RESULTS

Descriptive statistics interpretation

The study population was predominantly male (53.3%) and documented (89.1%), with nearly half (47.8%) having completed secondary education. Most participants earned between 5,000-9,999 THB monthly, reflecting persistent economic vulnerability, while only 30.4% had healthcare access through insurance or employer support. Overall, knowledge scores were moderate, with only 17.4% showing good knowledge, particularly regarding non-bite exposures and animal reservoirs. Attitude scores were also low, indicating insufficient perceived risk or vaccination prioritization. However, practices were relatively better, with over two-thirds reporting proper wound cleaning and hospital visits after bites.

Table 1 Socio-demographic Characteristics (n=184)

Variable	Frequency (n)	Percentage (%)
Age (years, mean ± SD)	31.6 ± 8.4	—
Sex		
Male	98	53.3
Female	86	46.7
Migrant status		
Documented	164	89.1
Undocumented	20	10.9
Education		
No formal	16	8.7
Primary	31	16.8
Secondary	88	47.8
University+	49	26.7
Monthly income (THB)		
<5,000	32	17.4
5,000–9,999	84	45.7
10,000–14,999	48	26.1
≥15,000	20	10.9
Healthcare access		
Insurance/employer	56	30.4
Out-of-pocket	112	60.9
None/unsure	16	8.7

Table 2 Knowledge, Attitudes, and Practices (KAP) Scores

Domain	Mean ± SD	Range	Poor (%)	Moderate (%)	Good (%)
Knowledge (−6 to 11)	4.89 ± 2.75	−3 to 10	32.1	50.5	17.4
Attitude (0–3)	1.02 ± 0.92	0–3	36.4	33.2	30.4
Practice (−4 to 4)	2.30 ± 1.24	−1 to 4	12.0	52.2	35.8

Categorization: Poor, moderate, and good were defined using scoring cut-offs validated in prior studies and expert consultation (see methods)

Table 3 Potential Rabies Exposure in Past 12 Months

Exposure Type	Frequency (n)	Percentage (%)
Any exposure	30	16.3
Bitten	9	4.9
Scratched	21	11.4
Licked	11	5.9

Inferential statistics interpretation

Inferential analysis revealed older age was significantly associated with increased rabies exposure risk, suggesting cumulative occupational exposure effects. Higher education appeared protective, reducing exposure odds by 30%. Notably, knowledge and practice showed a strong positive correlation ($r=0.600$, $p<0.001$),

indicating that better knowledge predicts better preventive behavior. Attitude and practice also showed a moderate correlation, supporting the role of risk perception in behavioral outcomes. These results highlight the importance of education and knowledge-based interventions to improve rabies prevention among migrants.

Table 4 Significant Associations with Rabies Exposure and KAP

Predictor	Association	OR / r (95% CI)	p-value
Age	↑ Exposure risk	OR = 1.03 (1.01–1.05)	0.014
Education	↑ Education → ↓ Exposure	OR = 0.70 (0.52–0.95)	0.024
Knowledge–Practice correlation	Strong	r = 0.600	<0.001
Attitude–Practice correlation	Moderate	r = 0.320	<0.001

Note: Logistic regression included all socio-demographic predictors, but only significant results are displayed above. Correlation results are from separate Pearson analyses, not regression models.

DISCUSSION

This study revealed that 16.3% of Myanmar migrant workers in Bangkok experienced potential rabies exposure in the past 12 months, with 4.9% reporting bites, 11.4% scratches, and 5.9% licks. Compared with national estimates of ~1.4% annual bite incidence among Thai residents, the bite rate in this study population was more than three times higher, confirming that migrant workers face disproportionately greater exposure risks due to occupational and environmental factors such as outdoor work, crowded housing, and frequent contact with stray animals.

Knowledge scores were moderate (mean 4.89/11), but critical misconceptions persisted. Nearly half believed that healthy-looking dogs posed no risk, and fewer than one in five correctly identified all transmission routes. Misunderstandings about non-bite exposures and reservoir species (e.g., bats) highlight gaps in health communication strategies. Attitudes were poor to moderate, with only 30.4% reporting positive attitudes toward rabies prevention, often constrained by financial concerns, low perceived necessity of vaccination, and lack of pre-travel health preparation. Practices were relatively stronger: most respondents reported wound cleaning and seeking medical care after exposure, but inappropriate practices such as tying wounds and sucking out toxins persisted, reflecting residual traditional beliefs.

Multivariate analysis showed that older age was positively associated with exposure (OR = 1.03), possibly reflecting cumulative occupational hazards and longer duration of stay in Thailand. Conversely, higher education was

protective (OR = 0.70), consistent with evidence that literacy supports awareness and proactive preventive measures. Interestingly, sex, migrant status, and income were not significantly associated with exposure in this study, suggesting that exposure risk is largely behavioral and environmental, rather than structural. However, income and healthcare access were strongly associated with knowledge, attitudes, and practices, indicating that socio-economic factors still play an important role in shaping prevention capacity and treatment-seeking behavior.

The strong correlation between knowledge and practice (r = 0.600) suggests that interventions improving rabies literacy could directly translate into safer practices. Attitudes were also associated with practices (r = 0.320), although to a lesser degree, highlighting the importance of combining factual knowledge with strategies that address beliefs, perceptions, and barriers to vaccination uptake.

CONCLUSION

This study demonstrates that Myanmar migrant workers in Bangkok are at significantly higher risk of rabies exposure compared to the general Thai population. While basic protective practices are common, critical gaps in knowledge and attitudes remain, especially regarding non-bite exposures, healthy-looking animals, and the importance of vaccination protocols. These findings underscore the need for targeted, culturally appropriate health education, integration of rabies awareness into migrant worker orientation and workplace training, and removal of financial barriers to accessing rabies vaccination and Post-Exposure Prophylaxis.

Addressing these gaps through an integrated One Health approach will not only protect migrant workers—a vulnerable but essential population—but also contribute to Thailand’s broader goal of eliminating human rabies deaths by 2030.

RECOMMENDATION

1. Develop targeted, pictorial, and multilingual rabies education programs emphasizing non-bite exposure risks and PEP importance.

2. Implement structural interventions ensuring free or affordable rabies vaccination and PEP access for migrant workers.

3. Integrate rabies education into migrant worker orientation and occupational health programs in collaboration with employers and NGOs.

4. Strengthen One Health initiatives to address animal control in migrant communities to reduce environmental exposure risks.

ETHICAL DECLARATION

This study was reviewed and approved by The Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University (Approval Number: COA No. 181/68).

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MATERNAL RISK FACTORS FOR NEONATAL SEPSIS: A TIME-TO-EVENT ANALYSIS

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ABSTRACT

Introduction: Neonatal sepsis, a life-threatening immune response to infection in newborns, remains a major cause of neonatal mortality, especially in low- and middle-income countries (LMICs). In 2019, global neonatal sepsis cases increased by 12.79%, contributing to 25,692 newborn deaths annually in Pakistan.

Objective: This study examined perinatal and intranatal factors associated with neonatal sepsis and compared the timing of sepsis onset among newborns in two hospitals in Landhi-Korangi, Karachi.

Methodology: A hospital-based, cross-sectional study was conducted from October to December 2024 in two Karachi hospitals. A total of 384 neonates were recruited through convenience sampling. Neonatal clinical data were extracted from hospital records, while maternal socioeconomic and medical histories were collected via interviews during follow-up visits. Data were analyzed using SPSS. Chi-square tests assessed associations between neonatal sepsis and maternal or perinatal factors. Kaplan-Meier survival curves and Log-Rank tests were used for time-to-event analysis. A p-value < 0.05 and 95% confidence intervals indicated statistical significance.

Results: The prevalence of neonatal sepsis was 52%. Most mothers were aged 21–34 years (67%), had primary education (64.8%), and received WHO-recommended antenatal care (52.9%). Significant factors associated with neonatal sepsis included place of birth, financial adequacy, maternal anemia, urinary tract infections (UTIs), history of pre-labor rupture of membranes, and ANC frequency (p < 0.05). Survival analysis showed mothers who delivered in healthcare facilities, with UTIs and better financial status had neonates with significant shorter disease-free durations (p < 0.05).

Conclusion: Addressing maternal infections, promoting regular ANC visits, and improving infection control in healthcare settings are critical for reducing neonatal sepsis and mortality in resource-limited areas.

Keywords: Antenatal Care, Anemia, Neonatal Sepsis, Infection, Low-Resource Settings

INTRODUCTION

Neonatal sepsis (NS) remains a major contributor to neonatal morbidity and mortality worldwide, with an especially high burden in low- and middle-income countries (LMICs). Globally, the incidence of NS continues to rise, with a 12.79% increase in 2019 alone (1). In Pakistan, neonatal sepsis accounts for approximately 17.2% of all neonatal deaths, with 25,692 newborns dying annually due to the condition (2, 3).

NS is defined as a systemic inflammatory response to bloodstream infection in infants

under 28 days of age (4). It is commonly categorized into early-onset sepsis (EOS), with symptoms within 72 hours to 7 days, and late-onset sepsis (LOS), which occurs after this period (5). In Pakistan, studies have shown that up to 44% of NS cases are nosocomial, with 26% EOS and 43% LOS (6).

Key maternal and perinatal risk factors have been associated with NS, including low socioeconomic status, limited education, maternal anemia, urinary tract infections (UTIs), gestational diabetes mellitus (GDM), pre-labor rupture of membranes (PROM), and insufficient antenatal care (ANC) visits (7-12). However,

there is limited data from peri-urban districts like Landhi-Korangi in Karachi, where environmental exposure and healthcare access disparities may further shape neonatal outcomes.

Neonatal sepsis is a major cause of mortality in Pakistan, yet research in areas like Korangi, Karachi, is scarce. A review of studies (2000–2024) revealed only limited descriptive research on neonates under 28 days, with few analytical studies and none using the Health Belief Model. Key maternal and healthcare factors remain underexplored. This study aims to assess the prevalence and associated factors of neonatal sepsis in three rural hospitals of Korangi to support evidence-based prevention strategies, identifying associated perinatal and intranatal factors, and compare disease-free survival time among neonates admitted to two hospitals in

Landhi-Korangi, Karachi by following the framework in Figure 1. The conceptual framework illustrates that neonatal sepsis is influenced by four main domains: socio-economic characteristics, prenatal conditions, intra-natal and postnatal conditions, and healthcare accessibility. Socio-economic factors such as income and parental education affect health-seeking behavior and living conditions. Prenatal factors include maternal infections and antenatal care visits, while intra-natal and postnatal factors involve mode of delivery, place of birth, and early breastfeeding. Healthcare accessibility, including availability of skilled providers and timely treatment, also plays a critical role in preventing and managing neonatal sepsis.

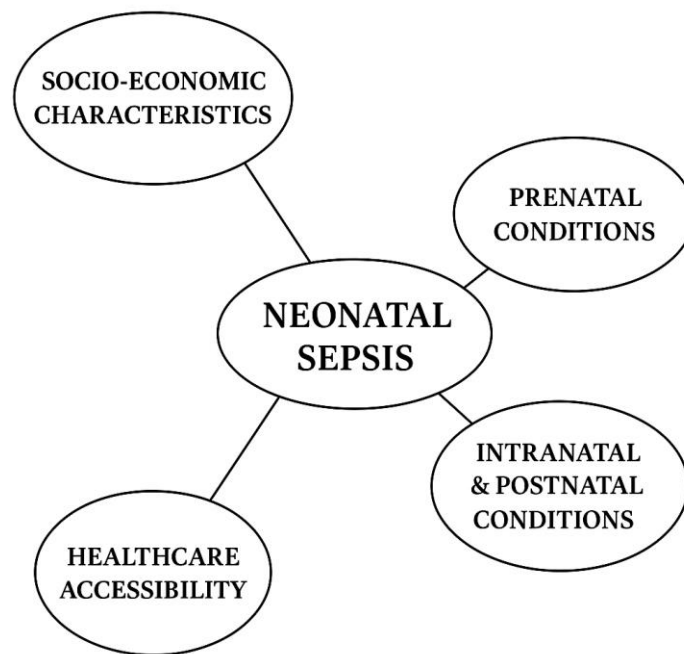


Figure 1 Study Framework

METHODOLOGY:

Study Design, Population, and Sampling

A hospital-based cross-sectional study with primary data collection and secondary data on medical records in the NICUs of two hospitals,

Sindh Employees Social Security Hospital (SESSI) and Sindh Institute of Child Health and Neonatology (SICHN), located in District Korangi, Karachi. The district was purposively selected due to its high burden of infectious diseases and poor environmental conditions.

A previous study reported that 89% of water samples from this area were unsafe for human consumption due to heavy microbial contamination (13). Neonates admitted between October and December 2024 were enrolled using convenience sampling.

Inclusion criteria the mothers of inpatient neonates at the study hospital, who provided informed consent, and with full medical records, were included in this study. The caretakers (except mothers) and mothers with readmitted neonates with sepsis were excluded.

The sample size was estimated with Cochran's formula with an error allowance of 0.05, and the sepsis prevalence of 50%. The outcome variable (neonatal sepsis) clinically diagnosed by the attending pediatrician based on hospital protocols. The outcome variable was neonatal sepsis, medically diagnosed and recorded by the pediatrician. Neonatal sepsis in this study was defined as the infection of newborns in their first 28 days, with increased leucocyte counts. Mothers served as primary respondents. Postpartum mothers were approached with sensitivity to minimize distress. Informed consent was obtained, and interviews were conducted privately after the stabilization of the newborn, by trained healthcare staff. Information collected through interviews included maternal socio-demographic characteristics, antenatal care history, and delivery details. Neonatal clinical data and laboratory findings were extracted from medical records. The phases of pregnancy are described accordingly with variables.

Data Collection and Instruments Data were collected through an interviewer-administered questionnaire and a medical record checklist. The questionnaire included open- and closed-ended items on maternal sociodemographic and economic characteristics, antenatal care history, delivery details, and maternal medical history not available in hospital records. The checklist was adapted from the Canadian Pediatric Surveillance Program tool the Canadian Pediatric Surveillance Program Tools, which were reviewed for local adaptation and validated by a neonatology consultant.

Data Management and Analysis

Questionnaires were verified, coded, and double-entered, then analyzed in SPSS v22 licensed to Chulalongkorn University. Descriptive statistics summarized maternal socioeconomic and medical factors; continuous variables are reported as medians with interquartile ranges, and categorical variables as frequencies and percentages. To identify the association between the independent variables and neonatal sepsis, the Pearson Chi-square test (For the variables with less than 5 cases, the Fisher Exact Test) with a significance level of p -value less than 0.05. Lastly, the survival analysis was performed for time-to-event analysis, using Kaplan-Meier curves and Log-Rank (Mantel-Cox) tests with significance set at $p < 0.05$ and 95% confidence intervals.

Prenatal period (Antenatal): The time from conception until onset of labor. Variables for this phase are maternal age at last delivery, fever in 3rd trimester, history of UTI & chorioamnionitis, PIH, GDM, ANC visits.

Intra natal period: The duration from onset of true labor to the completion of the delivery of the placental. Variables for this phase are mode of delivery, place of birth,

Post natal period: Time begins immediately after the birth of the baby and extends up to 6 weeks postpartum. Variables for this phase are breast feeding.

The following variables were collected through interviews and medical records. Variables were selected based on previous literature and expert input and were grouped for analysis as follows: Maternal age at last delivery (grouped as ≤ 20 , 21–35, ≥ 36 years), fever in the third trimester, history of urinary tract infection (UTI), pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), antenatal care (ANC) visit frequency (< 4 or ≥ 4 visits), and history of chorioamnionitis, mode of delivery (vaginal or cesarean), place of birth (home, public, or private facility), and chorioamnionitis. Variable definitions and groupings were guided by WHO guidelines (2014, 2016, 2018) and relevant literature.

Ethical Consideration

This study was approved by the Sindh Institute of Child Health and Neonatology Institutional Review Board (SICHN/IRB-006/2024).

RESULTS

Sociodemographic, Pre, Intra, and Post-natal Conditions

A total of 384 mothers were included in the study. As mentioned in Table 1A, the majority (67.2%) were aged between 21 and 34 years at the time of their last delivery, while 21.9% were 20 years or younger, and 10.9% were older than 34 years. The median maternal age was 26 years, with an interquartile range (IQR) of 22 to 32

years, and the minimum and maximum ages ranged from 16 to 40 years. In terms of ethnicity, 40.9% of the mothers were Sindhi, 30.7% were Pashto, 18.2% were Urdu-speaking, and 10.2% belonged to other ethnic backgrounds. Regarding prenatal conditions, 49.2% of the mothers reported a history of fever during the third trimester, while 50.8% did not. A history of urinary tract infection during pregnancy was present in 46.9% of the mothers. Furthermore, a large proportion (81.5%) had a history of gestational diabetes mellitus, whereas

18.5% did not. Although specific indicators of antenatal care utilization were not presented, the presence of these maternal complications provides insight into the prenatal health status of the population.

Table 1A Sociodemographic Characteristics and Prenatal Conditions (n=384)

Characteristics	Frequency	Percentage %
Socioeconomic Characteristics of Mothers		
Maternal age at last delivery ^a (years)		
20 years old and younger	84	21.9
21 to 34 years	258	67.2
Older than 34 years	42	10.9
	Median (26), IQR (22-32) Min -Max (16-40)	
Educational Status of Mother		
Illiterate	17	4.4
Primary education	249	64.8
Secondary education	98	25.5
Higher secondary & above	20	5.2
Ethnicity		
Sindhi	157	40.9
Pashto	118	30.7
Urdu	70	18.2
Others	39	10.2
Monthly Income (PKR^b)		
Less than 32000	168	43.7
32000 to 50000	142	37.0
More than 50000	74	19.3
	Median (40,000) IQR (30,000-50,000) Min -Max (150,00-100,000)	

Characteristics	Frequency	Percentage %
Prenatal Conditions		
History of Fever at 3rd Trimester		
Yes	189	49.2
No	195	50.8
History of Anemia		
Yes	181	47.1
No	203	52.9
History of Urinary Tract Infection		
Yes	180	46.9
No	204	53.1
History of Pregnancy Induced Hypertension		
Yes	302	78.6
No	82	21.4
History of Gestational Diabetes Mellitus		
Yes	313	81.5
No	71	18.5
ANC^c Frequency		
No Visit	21	5.5
1 – 3 Visits	175	45.5
4 and above visits	188	49.0

^a year's · ^b Pakistan Rupee, ^c Antenatal Care Visit, (1USD = 280.20PKR),

In Table 1 B, over half of the mothers (52.6%) had a history of pre-labor rupture of membranes. Nearly half (49.7%) delivered via normal spontaneous vaginal delivery, 7.6% had instrumental deliveries, and 42.7% underwent the cesarean section. Regarding healthcare access,

63.5% reported insufficient financial resources, while 36.5% sufficient. In terms of distance, 28.4% lived within 5 km of a health center, 31.0% lived 5–10 km away, and 40.6% lived more than 10 km away.

Table 1B Intra and Post-Prenatal Conditions (n=384)

Characteristics	Frequency	Percentage %
Intra-natal and Postnatal Characteristics		
History of Pre-labor Rupture of Membrane		
No	182	47.4
Yes	202	52.6
History of Chorioamnionitis		
No		
Yes		
Mode of Delivery		
NSVD ^a	191	49.7
Instrumental	029	7.6
LSCS ^b	164	42.7
History of Early Initiation of Breastfeeding		
No	260	67.7
Yes	124	32.3

Characteristics	Frequency	Percentage %
Access to Health		
Enough Money for Health Care Services		
Not Enough	244	63.5
Enough	140	36.5
Awareness about Nearest Healthcare Center		
Yes	80	20.8
No	304	79.2
Distance to Nearest Healthcare Center		
< 5 km ^c	109	28.4
5 – 10 km	119	31.0
> 10 km	156	40.6
Place of Birth		
Home Delivery	281	73.2
Healthcare Center	103	26.8

^aNormal Spontaneous Vaginal Delivery, ^bLower Segment Cesarean Section, ^cKilometer

Association between General Characteristics and Neonatal Sepsis

Pearson’s Chi-square analysis, as in Table 2, revealed several statistically significant associations between maternal and clinical characteristics and the occurrence of neonatal sepsis. Maternal age was significantly associated

with neonatal sepsis ($p = 0.003$), indicating that younger or older maternal age may influence neonatal infection risk. Maternal education status also showed a strong association ($p < 0.001$). A significant relationship was observed between maternal ethnicity and neonatal sepsis ($p = 0.043$).

Table 2 Associated factors of Neonatal Sepsis among Newborns in Landhi-Korangi (Karachi), Pakistan with Bivariate Analysis (n = 384)

General Characteristics	Neotal Sepsis		Chi-square	p-value
	Yes (n, %)	No (n, %)		
Socioeconomic Characteristics of Mothers				
Maternal Age at Last Delivery				
20 years and younger	41 (48.8%)	43 (51.2%)	0.76	0.84
21 to 34 years	137 (53.1%)	121 (46.9%)		
Older than 34 years	20 (47.6%)	22 (52.4%)		
Educational Status of Mother				
Illiterate	06 (35.3%)	11 64.7%)	2.38	0.49
Primary	129 (51.8%)	120 (8.2%)		
Secondary	51 (52%)	47 (48%)		

General Characteristics	Neotal Sepsis		Chi-square	p-value
	Yes (n, %)	No (n, %)		
Higher Secondary and above	12 (60%)	08 (40%)		
Ethnicity				
Sindhi	86 (54.8%)	71 (45.2%)	1.59	0.660
Pashto	56 (47.5%)	62 (52.5%)		
Urdu	35 (50.0%)	35 (50.0%)		
Others	21 (53.8%)	18 (46.2%)		
Monthly Income (PKR^a)				
< 32,000	76 (48.1%)	82 (51.9%)	1.28	2.56
≥ 32,000	122 (54.0%)	104 (46.0%)		
Prenatal Conditions				
History of Fever at 3rd Trimester				
Yes	96 (48.5%)	89 (47.8%)	0.016	0.901
No	102 (51.5%)	97 (52.2%)		
History of Anemia				
Yes	187 (92.1%)	16 (7.9%)	283.6	<0.001*
No	11 (6.1%)	170 (93.9%)		
History of Urinary Tract Infection				
Yes	191 (96.5%)	13 (7.0%)	308.329	<0.001*
No	7 (3.5%)	173 (93.0%)		
History of Pregnancy Induced Hypertension				
Yes	46 (56.1%)	36 (43.9%)	0.859	0.354
No	152 (50.3%)	150 (49.7%)		
History of Gestational Diabetes Mellitus				
Yes	46 (56.1%)	36 (43.9%)	0.859	0.354
No	152 (50.3%)	150 (49.7%)		
ANC^b Frequency				

General Characteristics	Neotal Sepsis		Chi-square	p-value
	Yes (n, %)	No (n, %)		
No Visit	20 (10.1%)	1 (0.5%)	301.025	<0.001*
1 – 3 Visits	166 (83.8%)	9 (4.8%)		
4 and above Visits	12 (6.1%)	176 (94.6%)		

^a Pakistan Rupee, ^b Antenatal Care Visit, * Significant at p-value < 0.001

Table 2 Associated factors of Neonatal Sepsis among Newborns in Landhi-Korangi (Karachi), Pakistan with Bivariate Analysis (n = 384) – Continued

General Characteristics	Neotal Sepsis		Chi-square	p-value
	Yes (n, %)	No (n, %)		
Intra-natal and Postnatal Characteristics				
History of Pre-labor Rupture of Membrane				
Yes	194 (98.0%)	8 (4.3%)	337.574	<0.001*
No	4 (2.0%)	178 (95.7%)		
History of Chorioamnionitis				
Yes	21 (10.6%)	23 (12.4%)	0.293	0.589
No	177 (89.4%)	163 (87.6%)		
Mode of Delivery				
NSVD ^a	101 (51.0%)	90 (48.4%)	1.219	0.544
Instrumental	17 (8.6%)	12 (6.5%)		
LSCS ^b	80 (40.4%)	84 (45.2%)		
History of Early Initiation of Breastfeeding				
Yes	62 (31.3%)	62 (33.3%)	0.179	0.672
No	136 (68.7%)	124 (66.7%)		

Access to Health

Enough Money for Health Care Services

Enough	190 (96.0%)	10 (5.4%)	315.324	<0.001*
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General Characteristics	Neotal Sepsis		Chi-square	p-value
	Yes (n, %)	No (n, %)		
Not enough	8 (4.0%)	176 (94.6%)		
Awareness about Nearest Healthcare Center				
Yes	150 (75.8%)	154 (82.8%)	2.880	0.090
No	48 (24.2%)	32 (17.2%)		
Distance to Nearest Healthcare Center				
< 5 km ^c	62 (31.3%)	47 (25.3%)	5.662	0.059
5 – 10 km	67 (33.8%)	52 (28.0%)		
> 10 km	69 (34.8%)	87 (46.8%)		
Place of Birth				
Home Delivery	24 (12.1%)	79 (42.5%)	45.013	<0.001*
Healthcare Center	174 (87.9%)	107 (57.5%)		

^a Normal Spontaneous Vaginal Delivery, ^b Lower Segment Ceseraen Section, ^c Kilometer, * Significant at p-value < 0.001

Among the clinical variables, a history of fever during the third trimester was significantly associated with neonatal sepsis ($p = 0.001$), as was a history of urinary tract infection ($p < 0.001$). Gestational diabetes mellitus was also found to be significantly related to neonatal sepsis ($p < 0.001$). Similarly, the history of pre-labor rupture of membranes (PROM) was significantly associated with neonatal sepsis ($p = 0.003$), along with mode of delivery ($p = 0.007$).

Furthermore, financial accessibility to healthcare services showed a significant association ($p = 0.002$), emphasizing the impact of economic factors on neonatal outcomes. In contrast, distance to the nearest healthcare facility was not statistically significant ($p = 0.118$), suggesting that physical access alone may not be a primary determinant when other supportive factors are present.

Survival Analysis comparing Sepsis-free time

Survival analysis revealed significant differences in neonatal survival time across various maternal and healthcare-related factors in Figure 2 and Table 3. Neonates born to mothers with enough money for healthcare had significantly higher survival estimates compared to those without (log-rank $p < 0.001$). The birth also showed a strong association, with healthcare center deliveries linked to better survival outcomes ($p < 0.001$). Similarly, the absence of maternal urinary tract infection ($p < 0.001$) and anemia ($p < 0.001$) were associated with longer neonatal survival. Antenatal care frequency significantly impacted survival, with neonates of mothers who had four or more ANC visits showing the highest survival estimates ($p < 0.001$). Moreover, the history of PROM was significantly associated with reduced neonatal survival ($p < 0.001$).

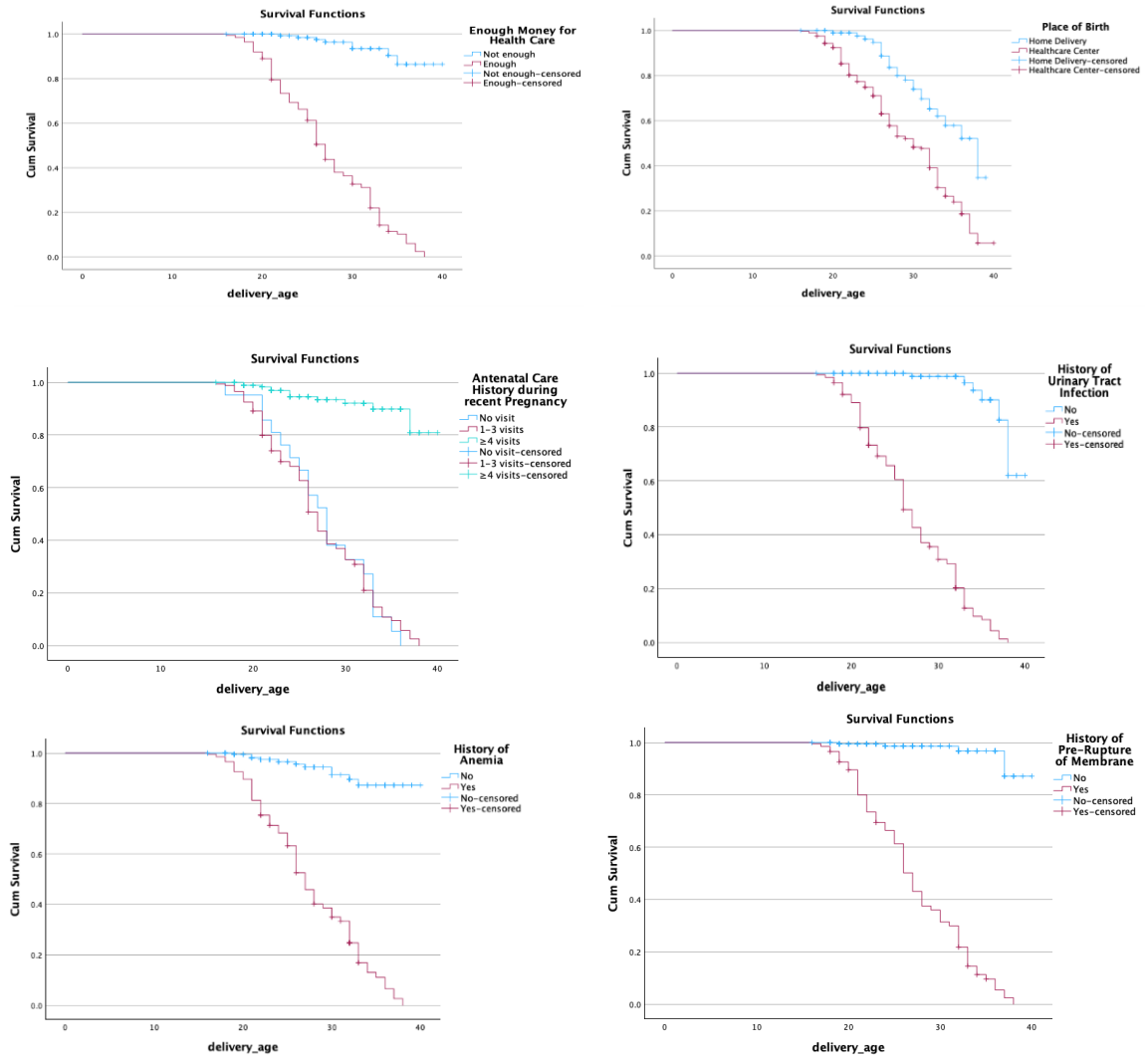


Figure 2 Kaplan-Meier survival curves comparing time to neonatal sepsis between groups based on Perinatal, Intra and Post-natal, and Access to Health (n = 384)

Table 3 Means for Survival Time in days comparing time to neonatal sepsis between groups based on Perinatal, Intra and Post-natal, and Access to Health with Log Rank (Mantel-Cox)

Characteristics	Estimate	95% CI*		Log Rank	
		Lower	Upper	X ²	p-value
Enough Money for Health Care Services					
Not Enough	38.788	37.980	39.595	170.351	<0.001
Enough	27.238	26.451	28.025		
Place of Birth					
Home Delivery	34.413	33.009	35.818	26.110	<0.001

Characteristics	Estimate	95% CI*		Log Rank	
		Lower	Upper	X ²	p-value
Healthcare Center	29.534	28.708	30.360		
History of Urinary Tract Infection					
Yes	38.702	37.879	39.525	193.519	<0.001
No	27.054	26.295	27.813		
History of Anemia					
Yes	27.568	26.777	28.358	145.156	<0.001
No	38.466	37.601	39.331		
ANC^a Frequency					
No Visit	27.673	25.421	29.926	163.380	<0.001
1 – 3 Visits	27.285	26.499	28.121		
4 and above Visits	38.328	37.399	39.256		
History of PROM^b					
Yes	27.203	26.428	27.978	181.926	<0.001
No	39.315	38.624	30.006		

^a Antenatal Care Visits, ^b Pre-labor Rupture of Membrane, * Confidence Interval

DISCUSSION

The prevalence of neonatal sepsis (NS) in this study was 51.6%, indicating a substantial burden among newborns in urban low-resource settings. This prevalence is consistent with previously reported figures in Pakistan, where estimates have ranged from 40% to 60% in similar healthcare environments (14, 15). The high rate underscores persistent gaps in infection prevention, early diagnosis, and access to quality neonatal care.

The average age of sepsis onset in this study was 9.5 days, suggesting a predominance of late onset sepsis (LOS), with a slight male predominance, consistent with previous findings in Pakistan (16). A slight male predominance was observed among sepsis cases, which aligns with existing literature suggesting biological susceptibility

among male neonates due to X-linked immune regulatory mechanisms and hormonal influences (17).

Socioeconomic vulnerability played a key role in our study. Neonates from financially insecure households had significantly higher sepsis rates and shorter disease-free survival. These findings are consistent with global evidence indicating poverty is a major risk factor for delayed care-seeking, poor maternal nutrition, inadequate antenatal follow up, and substandard delivery conditions, all of which increased risk of infections (18).

Maternal urinary tract infections (UTIs) and anemia emerged as the most prenatal risk factors, each present in over 90% of neonatal sepsis. These conditions significantly increased the risk of neonatal infection and were also

associated with reduced sepsis free survival time. These findings align with existing literature from Pakistan, where untreated maternal infections have been repeatedly linked to elevated risk of early and late onset neonatal sepsis (14). Maternal UTIs lead to vertical transmission of pathogens during labor, while anemia may compromise maternal and placental immunity, facilitating neonatal vulnerability (19). Conversely, studies from Bangladesh have reported no significant association between maternal infections and neonatal sepsis (20). However, these findings may reflect limitations such as smaller sample sizes, differences in clinical definitions, or underdiagnosis due to limited microbiological resources in some settings.

Antenatal care (ANC) attendance was another key determinant of neonatal sepsis. Mothers who received fewer than four ANC visits had significantly higher odds of having neonates with sepsis. This finding aligns with data from Ethiopia and India, where neonates born to mothers with ≤ 3 ANC visits had approximately 3–5 times greater odds of sepsis compared to those whose mothers attended ≥ 4 visits (21). These results suggest that inadequate ANC use significantly compromises opportunities for infection screening, maternal education, and preventive interventions crucial in reducing neonatal infection risk.

Premature rupture of membranes (PROM) was strongly linked to neonatal sepsis in our cohort. This is consistent with robust global evidence showing that PROM particularly when lasting more than 18 hours—increases the risk of sepsis by facilitating ascending bacterial infection from the birth canal into the amniotic sac (22).

Contrary to expectations, institutional deliveries were linked to shorter sepsis-free survival compared to home births. This may be due to poor infection control and overcrowding in healthcare facilities. Studies from LMICs report that hospital-born neonates face up to 20 times higher infection risk due to inadequate hygiene and sterilization practices, contributing to increased rates of nosocomial sepsis. This result was supported by another study in Pakistan (14).

Collectively, these findings emphasize the role of maternal infections, ANC quality, and perinatal care practices in determining neonatal outcomes.

CONCLUSION

This study reveals a high burden of neonatal sepsis (51.6%) in Korangi, Karachi, with key prenatal risk factors including maternal UTIs and anemia. Inadequate antenatal care (<4 visits) significantly increased sepsis risk, highlighting missed preventive opportunities. Perinatal factors like PROM were strongly linked to early-onset sepsis. Surprisingly, institutional deliveries had shorter sepsis-free survival than home births, likely due to poor infection control in overcrowded facilities. Socioeconomic disadvantage further worsened outcomes. Strengthening maternal care, improving facility-based infection control, and addressing social inequities are vital to reducing neonatal sepsis in similar settings.

LIMITATIONS

The study was conducted exclusively within neonatal intensive care unit (NICU) settings, which may have introduced selection bias, as cases of neonatal sepsis managed at the community or primary level care were not captured. Consequently, the finding may not be fully generalized to the broader neonatal population. Although time-to-event (survival) analysis was employed, the exact timing of sepsis onset may have been subject to misclassification due to variable clinical presentation and delayed recognition or referral. Furthermore, microbial culture reports were not consistently available for all neonates, particularly those admitted to the Sindh Employees' Social Security Institution hospital, limiting the ability to confirm pathogen-specific diagnosis and assess antimicrobial susceptibility.

RECOMMENDATION

To reduce the burden of neonatal sepsis, especially among facility-based deliveries, strengthened infection prevention and control (IPC) measures are urgently needed to prevent potential nosocomial transmission. Community-

based health education should be expanded to encourage antenatal care (ANC) attendance and early utilization of facility-based services. Efforts should also focus on minimizing vertical transmission through better maternal screening and improved perinatal hygiene practices. Finally, policies that ensure equitable access to healthcare, particularly for economically disadvantaged families, are essential to reduce delays in seeking care and to improve neonatal outcomes.

CONFLICT OF INTEREST

The author declared that there is no conflict of interest.

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SESSION 3: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience

UTILIZATION OF TELEHEALTH ANTENATAL CARE SERVICES AMONG PREGNANT WOMEN IN RURAL BALOCHISTAN, PAKISTAN: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction : Rural areas of Pakistan, especially the province of Balochistan, face substantial challenges in accessing quality maternal healthcare due to inadequate health infrastructure, low levels of female literacy, and widespread economic hardship. In response, telehealth services have emerged as a promising approach to improve access to antenatal care (ANC) and enhance the quality of maternal health services in underserved settings.

Objectives: To assess the knowledge, attitudes, and utilization of telehealth-based antenatal care services among pregnant women in rural Balochistan.

Methodology: A quantitative cross-sectional study was conducted at the Balochistan Research and Development Foundation (BRDF) Telehealth Center in Gandawa, located in Jhal Magsi District. Using purposive sampling, 379 pregnant women aged 18 years and above who were utilizing antenatal care services participated in the study. Data were collected through a structured, interviewer-administered questionnaire measuring sociodemographic characteristics, knowledge, attitudes, and utilization of telehealth ANC services. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were analyzed using SPSS version 26. The internal consistency of the knowledge and attitude subscales was confirmed using Cronbach's alpha (0.717 and 0.701, respectively).

Results: Despite low education levels (62.8% no formal education), 81.0% had previously used BRDF telehealth services, with 34.7% reporting three or more visits, indicating strong retention. Knowledge of ANC benefits was high (M = 2.85), but gaps existed in scheduling awareness (M = 1.24). Attitudes were generally positive, though some hesitation was noted toward video-based consultations (M = 1.53)

Conclusion: Community-based telehealth models like BRDF improve ANC access in rural areas. Scaling services, training workers, and boosting infrastructure are essential next steps to enhance continuity, reduce maternal risks, and promote equitable care delivery.

Keywords: Antenatal Care, Telehealth, Maternal health, Pakistan, Balochistan

INTRODUCTION

Maternal health is the cornerstone of public health, and access to quality care reflects how well the system works. It encompasses a continuum of care during pregnancy, childbirth, and the postpartum period (1). Maternal Mortality Ratio, “number of maternal deaths during a given period per 100,000 live births in the same period”, is a key indicator of maternal health (2).

Maternal mortality has declined by 34% between 2000 and 2020, but disparities remain stark. For high-income countries, the lifetime risk of maternal death is 1 in 5,300; on the other hand, for lower-income countries, it is 1 in 49 (3). In 2020, an estimated 95% of all maternal deaths occurred in low- and lower-middle-income countries (2).

In Pakistan, Balochistan is the largest and most impoverished province, faces the highest rates of maternal mortality, with national MMR

being 186 deaths per 100,000 live births and Balochistan with an MMR of 298 per 100,000 live births (4).

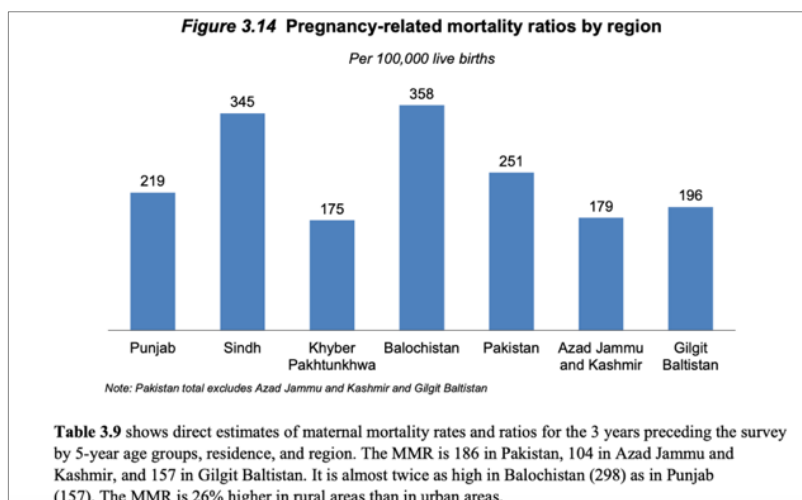


Figure 1 MMR by region (PMMS, 2019)

The data in Figure 1 illustrates the maternal mortality ratio (MMR) by region, indicating that rural areas experience a 26% higher MMR compared to urban areas. Additionally, Balochistan reports the highest MMR among all regions.

Over the past decade, maternal mortality in Balochistan has shown minimal improvement, indicating persistent challenges despite national and provincial interventions. Factors contributing to high maternal mortality in Balochistan are economic crisis, limited access to health care, socioeconomic barriers, lack of skilled professionals in rural areas of Balochistan, and lack of infrastructure, healthcare providers, and essential medical services in Balochistan (5). Although initiatives like the Maternal and Neonatal Child Health (MNCH) program and the Lady Health Worker (LHW) scheme aim to enhance service delivery, these efforts have not significantly reduced maternal deaths in remote areas (6).

Antenatal Care plays a critical role in reducing maternal mortality by enabling early detection of complications, timely referrals, and

management of coexisting conditions (7). The World Health Organization recommends at least four ANC visits for uncomplicated pregnancies, beginning in the first trimester (7).

In response to these challenges, telehealth-based antenatal care has emerged as a potential solution. *Telehealth-based antenatal care refers to the delivery of routine maternal health services during pregnancy through digital and telecommunications technologies.* It includes remote consultations, counseling, education, follow-up care, and monitoring by healthcare providers using tools such as mobile phones, video conferencing, or web-based platforms. Yet in rural Pakistan, adoption remains limited—only 36% of rural women own a mobile phone, and fewer than 20% have used the internet (8). These barriers highlight the digital divide and underscore the need for more accessible, facility-based telehealth models.

However, the use of telehealth via mobile phones is not widely adopted in rural regions of Pakistan due to barriers such as low literacy, poverty, and poor internet connectivity (9).

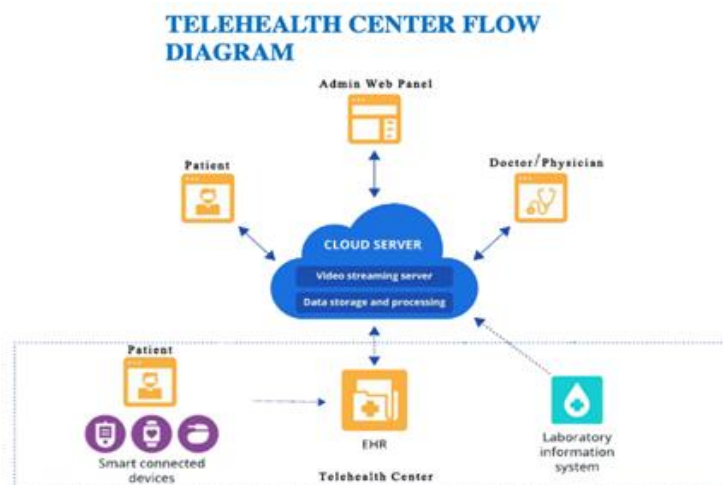


Figure 2 Telehealth center flow diagram

In this context, a more structured and facility-based approach is being piloted. The telehealth center in Jhal Magsi District, Balochistan provides maternal and child healthcare services by connecting rural women to specialists at Dr. Najma Ghaffar Hospital in Quetta via computer-based telecommunication. Through this system, pregnant women receive online consultations, delivery assistance, labor support, and pharmacy services. This model addresses two major challenges: limited access to quality healthcare and the shortage of skilled healthcare providers in rural Balochistan. To acquire deeper insights into this model, the present study focuses on the sociodemographic knowledge and attitudes profiles of pregnant women utilizing telehealth-based antenatal care services in rural Balochistan.

Despite increasing interest in telehealth, few studies have explored its use for ANC in rural Pakistan. Existing literature tends to focus on urban pilots or provider perspectives, lacking analysis of how rural women perceive, access, or repeatedly engage with telehealth. This study addresses that gap by examining the sociodemographic, knowledge, and attitude profiles of women using telehealth-based ANC in rural Balochistan. The findings will inform policy, improve service design, and support evidence-based scale-up of digital maternal health strategies in underserved areas.

METHODOLOGY

Study Design and Population

This cross-sectional study was conducted at the BRDF Telehealth Center in Jhal Magsi, Balochistan. The target population included pregnant women aged 18 years and above who accessed ANC services during any trimester. Women who never used the facility or sought non-pregnancy-related care were excluded. Both first-time and repeat users were eligible.

Measurement

Purposive sampling was used to select participants with direct experience using the telehealth center. Participants were approached post-consultation to avoid service disruption. While this method ensured relevance, it excludes non-users and limits generalizability to broader rural or national populations.

Knowledge (14 yes/no items) was scored 0–14 and categorized using Bloom’s cut-offs: high (12–14), moderate (9–11), and low (<9). Attitude (5 Likert items, scored 1–3) was grouped as positive (2.5–3.0), neutral (1.5–2.49), or negative (1.0–1.49).

Use was categorized as 1–2, 3–5, or >5 times based on typical ANC visit patterns. These groupings reflect local usage trends and align with WHO’s recommendation for multiple contacts during pregnancy.

Data Collection

A structured, interviewer-administered questionnaire was used, developed in English, translated into Urdu, and pilot-tested for clarity. It included 40 closed-ended items and took 15–20 minutes to complete, covering demographics, pregnancy-related factors, information sources, and knowledge and attitude toward telehealth. Knowledge (14 items, $\alpha = .717$) and attitude (5 items, $\alpha = .701$) scales were adapted from Ghaffar (2011) and refined with expert input. Utilization questions for ANC, delivery, and PNC were developed with maternal health experts. Interviews were conducted post-consultation. Data quality was ensured through daily supervisor checks and real-time review of responses. Incomplete or “don’t know” answers were addressed during data cleaning.

Validity and Reliability

Content validity was established through literature review and expert consultation to ensure coverage of key areas: knowledge, attitudes, and utilization of telehealth for maternal care. The questionnaire showed acceptable internal consistency: Cronbach’s

alpha was .717 for the knowledge subscale (14 items) and .701 for the attitude subscale (5 items).

Sample Size Calculation and Statistical Analysis

The sample size was calculated using Cochran’s formula with a 95% confidence level and 5% margin of error, yielding a target sample of 379 participants. Data were analyzed using SPSS version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the data.

RESULTS

Sociodemographic Characteristics

The study included 379 pregnant women who accessed antenatal care at the BRDF Telehealth Center in Gandawa, Jhal Magsi. Nearly half (48.8%) were aged 18–25, followed closely by those aged 26–35 (47.5%). A significant proportion had no formal education (62.8%) and were unemployed (62.8%). Regarding household income, 60.9% did not know their monthly earnings, 26.1% earned between PKR 15,000–30,000, and only 3.2% reported earnings above PKR 50,000 (Table 1).

Table 1 Sociodemographic Characteristics of BRDF Telehealth Center Users

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group	18–25 years	185	48.8%
	26–35 years	180	47.5%
	Above 35 years	14	3.7%
	Total	379	100.0%
Education Level	No formal education	238	62.8%
	Primary education	53	14.0%
	Secondary education	44	11.6%
	Higher secondary	44	11.6%
	Total	379	100.0%
Employment Status	Unemployed	238	62.8%
	Employed	119	31.4%
	Self-employed	22	5.8%
	Total	379	100.0%
Monthly Household Income	15,000–30,000 PKR	99	26.1%
	30,000–50,000 PKR	37	9.8%
	Above 50,000 PKR	12	3.2%
	Don't know	231	60.9%
	Total	379	100.0%

Health and Antenatal Characteristics of BRDF Telehealth Center Users

Health conditions were common among participants: 33.1% had hypertension, 24.5% had diabetes, and 10.4% had heart disease. Regarding antenatal history, 46.2% had experienced 1–2

pregnancies, 43.8% had 3–4 pregnancies, and 10% had five or more. Most participants were in their second trimester (46.7%), followed by the first (29.6%) and third trimester (22.4%) (Table 2)

Table 2 Health and Antenatal Characteristics of BRDF Telehealth Center Users

Characteristic	Frequency (n)	Percentage (%)
Health Condition of Pregnant women		
Hypertension	127	33.1
Diabetes	94	24.5
Heart disease	40	10.4
No pre-existing condition	123	32.0
Number of Pregnancies		
1–2	175	46.2
3–4	166	43.8
5 or more	38	10.0
Trimester of Current Pregnancy		
First trimester	112	29.6
Second trimester	177	46.7
Third trimester	85	22.4

Note: n = 379 indicates the total number of pregnant women who participated in the study

Prior Antenatal Care Utilization and Sources

Before visiting the BRDF Telehealth Center in Gandawa, 59.4% of participants had received antenatal care (ANC), while 40.6% had not accessed any services. Among those who sought prior ANC, private healthcare providers were the most commonly used source (27.7%), followed by Basic Health Units (14.8%), civil dispensaries (11.3%), and Lady Health Workers (6.1%), indicating relatively limited use of public sector services.

friends, while 20.8% were informed by local healthcare providers.

Source of Information about the BRDF Telehealth Center

Most participants (79.2%) learned about the BRDF Telehealth Center from family or

Prior Use and Frequency of Reutilization of BRDF Telehealth Services

Among the 379 pregnant women surveyed, 81.0% had previously used the BRDF Telehealth Center for maternal care, while 19.0% were first-time users. Of the repeat users (n = 311), the majority (65.3%) reported visiting the center 1–2 times, followed by 30.5% who had visited 3–5 times, and 4.2% who reported more than five visits, reflecting continued engagement with the telehealth service (Figure 3)

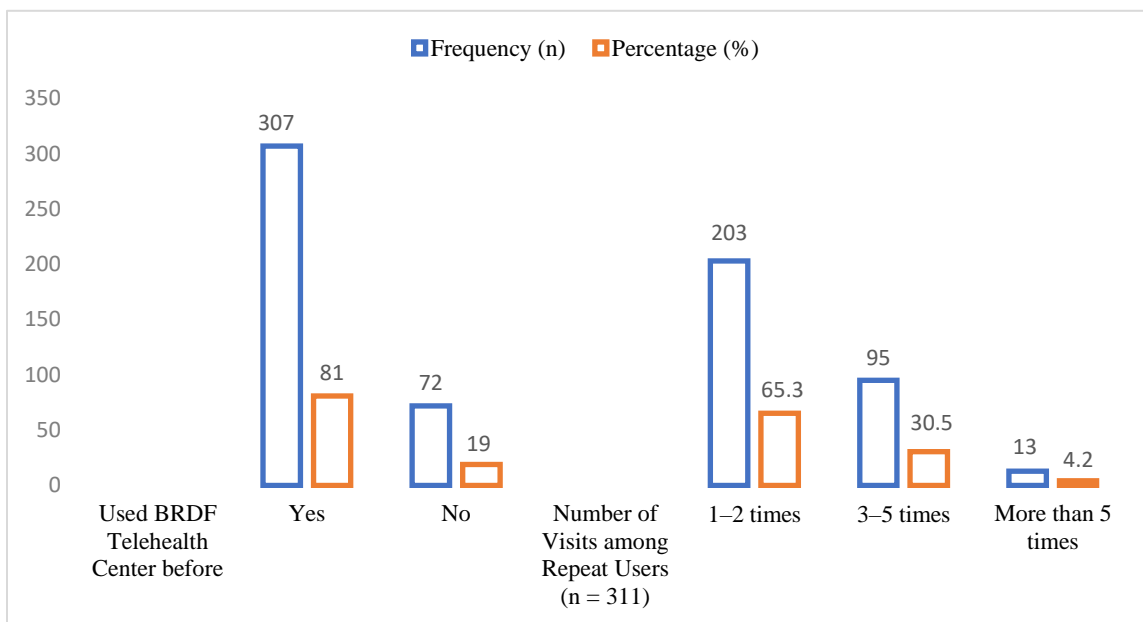


Figure 3 Prior Utilization and Frequency of Visits to the BRDF Telehealth Center, Gandawa (N = 379)
 Note: Based on participants’ self-reported past use of maternal care services at the BRDF Telehealth Center. Only participants who had previously used the BRDF Telehealth Center are included. Percentages are based on valid responses

Reasons for Choosing BRDF Telehealth Center Services

Nearly half of the participants (49.6%) selected the BRDF Telehealth Center for multiple reasons, including access, affordability, and service quality. Others cited specialist access (20.6%) and emergencies (17.2%), while fewer chose it for low cost (8.4%) or service quality alone (4.3%).

Knowledge and ANC Utilization at BRDF Telehealth

Participants showed strong awareness of antenatal care (ANC) benefits, with high mean scores for items like “ANC improves knowledge of fetal well-being” (M = 2.85) and “ANC helps prevent complications” (M = 2.83). However, specific knowledge regarding ANC scheduling was limited “Knows ANC includes 4 visits at BRDF” had the lowest mean (M = 1.24), and uncertainty was reflected in “First ANC within 3 months” (M = 1.74) (Table 3).

Table 3 Knowledge of Pregnant Women Regarding BRDF Telehealth Center Services in Gandawa: Mean Ratings and Interpretation

Knowledge Item	Mean	SD	Interpretation
Understands ANC is care during pregnancy	3.00	0.00	Yes
Knows ANC includes 4 visits at BRDF	1.24	0.62	No
First ANC at BRDF within 3 months	1.74	0.45	I don't know
Second ANC within 6 months at BRDF	2.65	0.76	Yes
ANC helps prevent complications	2.83	0.50	Yes
Received info on nutrition/exercise	2.00	0.91	I don't know
Received info on delivery/breastfeeding/family planning	2.59	0.72	Yes

Knowledge Item	Mean	SD	Interpretation
ANC helps learn about danger signs	2.81	0.55	Yes
ANC helps understand fetal well-being	2.87	0.45	Yes
ANC informs about labor, lactation, planning	2.75	0.61	Yes
ANC informs about danger signs	2.81	0.57	Yes
ANC improves knowledge of fetal well-being	2.85	0.50	Yes

Note: Items were rated on a 3-point Likert scale (1 = No, 2 = I don't know, 3 = Yes). Interpretations are based on mean score ranges

Attitude and ANC Utilization at BRDF Telehealth

Attitudes toward telehealth antenatal care were largely favorable. Most participants agreed that the BRDF Telehealth Center provided effective care (M = 2.71), useful information (M = 2.77), and a sense of safety and support (M =

2.70). The highest agreement was seen for ANC helping maintain good health (M = 2.83). However, participants were neutral about seeking care without complications (M = 1.98) and disagreed with feeling comfortable consulting via video (M = 1.53), indicating some hesitation toward remote communication (table 4)

Table 4 Attitude of Pregnant Women Toward BRDF Telehealth Center Services in Gandawa: Mean Ratings and Interpretation

Statement	Mean	SD	Interpretation
ANC helps maintain good health	2.83	0.41	Agree
Feel reassured visiting BRDF Telehealth Center	2.66	0.50	Agree
Info provided is useful/relevant	2.77	0.47	Agree
Feel safe and supported at BRDF Telehealth Center	2.70	0.51	Agree
Will visit even without complications	1.98	0.91	Neutral
Feel hesitant about consulting through a video screen talking via computer screen	1.53	0.82	Disagree
Telehealth is as effective as in-person care	2.71	0.56	Agree

Note: Items were rated on a 3-point Likert scale (1 = Disagree, 2 = Neutral, 3 = Agree). Interpretations are based on mean score ranges

Table 5 Overall Mean Scores and Interpretation of Attitude and Knowledge Toward Telehealth ANC Services (N = 379)

Category	Number of Items	Mean Score	Interpretation
Knowledge	12	2.51	Agree
Attitude	7	2.45	Positive

The overall mean attitude score was 2.45, interpreted as positive, and the knowledge score was 2.51, interpreted as agree, based on Pimentel's (2019) Likert scale classification.

DISCUSSION

This study explored the knowledge, attitudes, and utilization of telehealth maternal services at the BRDF Telehealth Center in Gandawa, Balochistan. It highlights the role of telehealth in addressing healthcare gaps resulting

from infrastructure, economic instability, and workforce shortages.

Most participants (96.8%) were aged 18–35, aligning with early childbearing patterns in Balochistan(10), Nearly half (48.8%) were aged 18–25, underlining the importance of early access

to maternal care. Education and employment levels were low—62.8% had no formal education and were unemployed, which are known barriers to traditional ANC utilization(10). The BRDF Center’s affordability and reach appear to address these inequities effectively (11).

Many women using the center had chronic conditions, 33.1% had hypertension, 24.5% diabetes, and 10.4% heart disease, demonstrating the center’s critical role in managing high-risk pregnancies through remote specialist care (12).

Utilization patterns showed that 59.4% had prior ANC experience, and 81.0% had used BRDF services before, with frequent repeat use suggesting trust and continuity of care. Compared to national figures, where only 20.5% of women receive adequate ANC (10), the BRDF model reflects improved engagement. In Jhal Magsi, where healthcare access is severely limited and outreach by Lady Health Workers remains weak (13), telehealth fills critical service gaps.

Quality in maternity care is not limited to clinical outcomes—it encompasses the presence of trained professionals, reliable infrastructure, essential supplies, and efficient service delivery, all contributing to a positive care experience and improved maternal outcomes (11). While access to specialist care is often restricted in rural areas due to referral systems or geographic isolation, telehealth mitigates these barriers by enabling real-time consultations between frontline providers and specialists. This enhances diagnostic accuracy and the overall quality of care women receive during pregnancy (14). The results reflect these advantages. Many participants cited easy access to specialists (20.6%) and emergency services (17.2%) as key reasons for choosing BRDF services. While fewer mentioned quality of care (4.3%), its presence still points to perceived improvements through telehealth.

Knowledge levels were similarly high. Women recognized ANC as important for preventing complications (M = 2.83), understanding fetal well-being (M = 2.87), and learning about danger signs (M = 2.81). However, gaps were found in knowledge about scheduling, particularly “knowing that ANC includes 4 visits at BRDF” (M = 1.24) and “first ANC within 3 months” (M = 1.74), both rated lower. These

knowledge and attitude items were measured using a 3-point Likert scale, a method supported for clarity and simplicity in health surveys (15).

Participants’ attitudes were largely positive. High mean scores were recorded for “ANC helps maintain good health” (M = 2.83), “telehealth is as effective as in-person care” (M = 2.71), and “feel safe and supported at BRDF” (M = 2.70), indicating broad satisfaction. However, some participants expressed neutral views about seeking care without complications (M = 1.98), and disagreed with comfort in video consultations (M = 1.53), showing hesitance toward virtual interaction.

LIMITATIONS

The cross-sectional design limits causal interpretations between knowledge, attitudes, and service use. Findings from this facility-based sample in rural Balochistan may not be generalizable to other regions. Selection bias, recall bias, and social desirability bias may have affected self-reported data. No inferential analysis was conducted to examine variable relationships.

CONCLUSION

This study offers key insights into the knowledge, attitudes, and utilization of maternal telehealth services in rural Balochistan, with the BRDF Telehealth Center in Gandawa serving as a trusted and accessible care model. Findings highlight high user trust, particularly in accessing specialists and emergency support, and demonstrate continuity of care, evidenced by over one-third of women making three or more visits. While general knowledge about telehealth was strong, critical gaps remain in awareness of ANC visit schedules, underscoring the need for focused health education. Notably, the center effectively reached women with limited education, financial barriers, and chronic conditions. This study contributes new evidence on maternal telehealth use in remote Pakistan and supports policy discourse on scaling equitable, community-integrated digital health services. Future inferential analysis will further inform targeted interventions and service design.

RECOMMENDATION

To improve maternal health in rural areas, stakeholders should prioritize early and repeated ANC through community-based telehealth platforms. Expanding models like BRDF can enhance access to remote consultations and reduce maternal risks.

Key actions include:

- Expanding Services: Scale up tele-ANC via Community Telehealth.
- Training Workforce: Equip Lady Health Workers and midwives with telehealth skills and retention incentives.
- Improving Infrastructure: Invest in mobile connectivity and telemedicine tools for remote areas.
- Raising Awareness: Promote early ANC through locally tailored campaigns and mobile reminders.
- Monitoring Impact: Track telehealth use and outcomes to guide improvements and set maternal health targets.

These strategies can support local health departments and policymakers in making maternal care more accessible, responsive, and equitable.

ETHICAL DECLARATION

Ethical approval was obtained from Chulalongkorn University (No. 680100) and Dr. Najma Ghaffar Hospital (Ref: DNGH/25/014) for data collection at the BRDF Telehealth Center, Gandawa.

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HOUSEHOLD WATER SECURITY AMONG MYANMAR MIGRANTS IN MAE SOT DISTRICT, THAILAND: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Water security has emerged as a global concern, increasingly exacerbated by climate change, industrialization, urbanization, population growth, and migration. In 2023, 72% of the global population experienced water insecurity, while over 75% of Asia's population was affected. This ongoing global continues to threaten human health and well-being, undermining progress toward SDG 3, which aims to ensure healthy lives and promote well-being. Addressing water security holistically is essential to achieving SDG 6, which aims to ensure availability and sustainable management of water and sanitation for all by 2030. The political instability and conflict in Myanmar have triggered a mass exodus to Thailand. Inadequate water supply and sanitation services are prevalent in migrant and refugee communities along the Thailand-Myanmar border.

Objectives: This study aimed to assess household water security status among Myanmar migrants and identify factors associated with their water security status in Mae Sot District, Thailand.

Methodology: A cross-sectional study was conducted among 250 Myanmar migrant households living along the Thailand-Myanmar border. Simple random sampling was used to select the communities, followed by voluntary response sampling to recruit households. Data were collected through face-to-face interview with household representative using structured questionnaires. The data were cleaned and analyzed using descriptive statistics and Chi-square tests.

Results: Of the 250 households surveyed, 72% of the households were water secure, and 28% experienced water insecurity. Factors significantly associated with household water security ($p < 0.05$) included household size, number of under-five children, housing type, household income, water location, water storage facility, water scarcity during dry season, types of water used, and access to sanitation and hygiene services.

Conclusion: Water insecurity remains a significant concern among Myanmar migrants in Mae Sot District, driven by overcrowded living conditions, limited access to services, and socioeconomic inequalities. To reduce the risks associated with household water insecurity and its related health impacts, the study highlights the need for targeted interventions. These include improving water, sanitation, and hygiene services, promoting rainwater harvesting as a coping strategy, and implementing climate-resilient water supply systems.

Keywords: Household Water Security, Myanmar Migrants, SDG 6, Thailand-Myanmar Border

INTRODUCTION

Water security has emerged as a global concern, increasingly exacerbated by climate change, industrialization, urbanization, population growth, and migration (1, 2). In 2023, 72% of the global population experienced water insecurity, while over 75% of Asia's population was affected. This ongoing global continues to

threaten human health and well-being (3). Addressing water security holistically is essential to achieving Sustainable Development Goal (SDG) 6, which aims to ensure availability and sustainable management of water and sanitation for all by 2030. Achieving universal and equitable access to safe and affordable drinking water for all will require a comprehensive approach and a

deeper understanding of the multidimensional factors influencing water security as a complex global concern.

In the 2023 Global Water Stress Index, Thailand ranked 35th among 164 countries experiencing high water stress (4). Moreover, Thailand also faces water insecurity, with the national water security score reported as 53 out of 100, indicating moderate water insecurity. Despite improvement in economic growth and water infrastructure, Thailand continues to grapple with ADB's five dimensions of national water security including household water security (5). Inadequate water supply and sanitation services are prevalent in migrant and refugee communities enduring overcrowded conditions along the Thailand-Myanmar border. Water insecurity is strongly associated with the occurrence of waterborne diseases (6). In 2022, diarrhoea morbidity was the highest among diseases under surveillance in Thailand, with 1,001 cases per 100,000 population (7).

Mae Sot District, located on Thailand's western border with Myanmar, has a vast population of Myanmar migrants and serves as a key corridor for migrants. The ongoing political instability and conflict in Myanmar have led to a mass exodus of people fleeing to Thailand (8). Migrants are among the poorest people and live in overcrowded housing with limited access to clean tap water, sanitation services, and poor waste management system (9). These conditions could contribute to household water insecurity, which can negatively impact their health and well-being (10). In December 2024, the Myanmar Health Cluster reported a suspected cholera outbreak in a border town of Myanmar, resulting in two deaths and approximately 700 cases of acute watery diarrhoea (11). Moreover, a 2022 survey by Ethnic Health Organizations (EHOs) reported that only 55% of households had access to basic drinking water services, and none had safely managed water services (12). These findings underscore that there could be water insecurity and highlight the need for further studies to better understand and address this issue.

Although numerous studies have examined water security in Thailand, those studies could not reflect the household water security status of Myanmar migrants. Most

existing research focuses on national trends, overlooking the specific challenges faced by migrant communities. Therefore, this study aimed to explore the household water security status and identify its associated factors among Myanmar migrants in Thailand.

METHODOLOGY

Study design, study population, and sample size

A cross-sectional study was conducted in rural areas of three sub-districts within Mae Sot District, Thailand, located along the Thailand-Myanmar border, an area with a high density of Myanmar migrants displaced by political instability. There are 10 sub-districts under Mae Sot district. From these, three sub-districts (Mae Tao, Mae Pa and Tha Sai Luat) were initially selected through simple random sampling. The participants from these sub-districts were recruited through voluntary response sampling with Myanmar household representatives aged 18 years or older and residing in the area for at least six consecutive months. Regarding the exclusion criteria, the participants who were unavailable during the data collection period were excluded.

The sample size was calculated using Cochran's formula for an infinite population, assuming a 95% confidence level and a precision of 0.05. A total of 427 samples were initially targeted for the study. Data collection was conducted between June and July 2025, during which 59% of the target sample was completed. Thus, a total of 250 completed datasets were used for preliminary analysis in this study.

Research instrument

The questionnaire consists of seven sections: socio-demographic characteristics, socioeconomic status, access to water supply, access to sanitation, health related factors, affordability, and Household Water Insecurity Experience Scale (HWISE). The Household Water Insecurity Experience Scale (HWISE) is a validated tool developed by the HWISE Research Coordination Network and has been used by over 100 organizations, including UNICEF, the World Bank, and FAO, in more than 55 countries. The tool includes twelve occurrence questions assessing the severity of water insecurity, each followed by a frequency-of-occurrence question to determine how often the condition occurred in

the past four weeks. Response options were coded as: ‘never’ (0 times scored as 0), ‘rarely’ (1-2 times scored as 1), ‘sometimes’ (3-10 times scored as 3), or ‘often and always’ (more than 10 times scored as 3). Total scores range from 0 to 36. Based on the total score, water security status was categorized into four levels: water secure (0-2 scores), low water insecurity (3-11 scores), moderate water insecurity (12-23 scores), and high water insecurity (24-36 scores) (13, 14).

The study included the following variables: age groups (1 = ≤39 years, 2 = >39 years), sex (1 = male, 2 = female), length of stay in Thailand (1 = 6 month and 2 years, 2 = 3-14 years, 3 = ≥15 years), household size (0 = ≤ 4 members, 1 = 5-8 members, 2 = ≥ 9 members), number of under five children (0 = none, 1 = one child, 2 = two or more children), education (0 = below secondary school, 1 = secondary school and above), occupation (1 = agriculture, 2 = construction, 3 = other), monthly family income (0 = ≤ 4000 THB, 1 = >4100 to 8000 THB, 2 = >8000 THB), housing type (1 = owned, 2 = rented, 3 = shelter, 4 = farmhouse), and debt payment status (0= no, 1= yes). Water-related variables were categorized according to the WHO/UNICEF Joint Monitoring Program (JMP) definitions. Basic drinking water was classified as drinking water from an improved source with a collection time of no more than 30 minutes per round trip, including queuing (15). The level of water services was coded as: (1 = basic, 2 = limited, 3 = unimproved, 4 = surface), water source location (1 = outside premises, 2 = within premises), water fetching time (1 = within 30 minutes, 2 = above 30 minutes) and water treatment method (0= no, 1= yes). Rainwater harvesting, identified as a coping strategy, involves the collection and storage of rainwater to meet household water supply need (16). Households were coded based on rainwater harvesting practices as 0 = no, 1 = yes. Water storage facility was coded as 1= proper, 2 = improper. Proper storage mean households have an outside water container (sealed water tank, drum, bucket) which had a lid/cover and no larvae; Improper storage: Households have an outside water container which don’t comply with at least one criterion, water scarcity during the dry season (0= no, 1= yes). Basic sanitation was defined as practicing the improved sanitation

facilities which are not shared with other families. Basic hygiene was defined as the availability of a handwashing facility on premises with soap and water (15). Sanitation service levels were coded as follows: (1= safely managed, 2 = basic, 3 = limited, 4 = open defecation), hygiene service level (1 = basic, 2 = limited, 3 = no facility). The knowledge section included 10 items assessing knowledge regarding water sanitation and hygiene. The respondents were asked to respond “yes” “no” or “don’t know” in each statement, and the response were coded as “1” if the participants answered “Yes” and “0” if “no/don’t know”. The overall score was calculated for each participant, and a median cutoff point was used to differentiate between "poor" and "good" levels of knowledge. Diarrhoea status was assessed by asking whether any family member had experienced diarrhea in the past four weeks, with responses coded as 1 = yes and 0 = no (6). Water affordability was measured based on whether the household spent more than 3% of its income on water, with responses coded as 0 = unaffordable and 1 = affordable (17).

Data collection procedures

The data collection was performed after the protocol was approved by the Mahidol University – Central Institutional Review Board (MUCIRB). The questionnaire was pre-tested and revised based on the results of a pilot test with 30 Myanmar migrant households in Mae Sot district. Reliability was assessed using Cronbach’s alpha, resulting in 0.79 for the knowledge section and 0.77 for the Household Water Insecurity Experience Scale. The community leaders in selected migrant clusters were informed about the purpose and procedures of the study, and the researcher sought permission to collect data. Two research assistants were recruited and trained for data collection. Data were collected through face-to-face interviews with household representatives using structured questionnaires through Kobo Toolbox, which is an open-source and user-friendly platform on any device, including mobile phones. Respondents were asked to provide informed consent before the interview. Data collection was conducted in June and July 2025.

Statistical analysis

A total of 250 participants were used in the data analysis. The data was cleaned and coded in Microsoft Excel and then imported into IBM SPSS Statistics version 27 for analysis. Descriptive statistics were used to summarize the socio-demographic characteristics and other independent variables. Additionally, the Chi-square test was applied to examine the association between the independent variables and household water security status of Myanmar migrants. A p-value less than 0.05 was considered statistically significant.

Ethical considerations

Ethical approval for this study was obtained from the Mahidol University Central Institutional Review Board (MU-CIRB) in May 2025 (Certificate of Approval No. 2025/155.0805). Informed consent was obtained

from all participants, and strict measures were taken to ensure confidentiality and data privacy throughout the study.

RESULTS

Table 1 describes the socio-demographic and household characteristics of the Myanmar migrants. The average age of household heads was 39.5 years (SD = 13.6), with a median age of 37 years and a range of 60 years. The sex distribution was approximately balanced, with 52.8% female and 47.2% male. Nearly half of the households had resided in Thailand for 3-14 years, and approximately two-thirds (64.4%) of households had four or fewer family members. The majority of households (58.8%) had no under-five children, 32.0% had one, and 9.2% had two or more. More than two-thirds (81.6%) had an education level below secondary school and over half (60.1%) were employed as casual workers.

Table 1 Socio-demographic characteristics of respondents (n= 250)

Variables	Number	Percent (%)
Age group		
≤ 39	143	57.2
> 39	107	42.8
Mean= 39.5, Median= 37, SD= 13.6, Min= 18, Max= 78		
Sex of household head		
Female	132	52.8
Male	118	47.2
Length of stay in Thailand		
≤ 2 years	64	25.6
3-14 years	118	47.2
≥ 15 years	68	27.2
(median= 6, QD= 6.5, min= 0, max= 34)		
Household size		
≤ 4	161	64.4
5-8	80	32.0
≥ 9	9	3.6
Median= 4, QD= 0, Min= 1, Max= 14		
Number of under-five children		
0	147	58.8
1	80	32.0
≥ 2	23	9.2
Median= 4., QD= 0, Min= 1, Max= 4		
Education level		

Variables	Number	Percent (%)
Below secondary school	204	81.6
Secondary school and above	46	18.4
Occupation		
Agriculture	42	16.8
Construction	57	22.8
Other	151	60.4
Household monthly income		
≤ 4000 THB	63	25.2
> 4100 - 8000 THB	144	57.6
> 8000 THB	43	17.2
Mean= 6498.8, median= 6000, SD= 4274.7, Min= 500, Max= 5500		
Housing type		
Farmhouse	121	48.4
Owned house	1	4
Rented house	98	39.2
Shelter	30	12.0
Paying debt		
Yes	168	67.2
No	82	32.8

Table 2 displays access to water supply, access to sanitation, health related factors, and affordability among respondents. Among 250 households, 70% used basic water services, 12.4% limited, 9.2% surface water, and 8.4% unimproved sources. Most (86.8%) accessed water within their premises. The average round-trip water-fetching time was 18.7 minutes, with 94% fetching water within 30 minutes. Rainwater harvesting was reported by 42.8%, and 51.2% treated their water. Only 23.6% had proper water

storage. Water scarcity during the dry season affected 34% of households. For sanitation, 33.2% had basic services, 34.8% limited, 23.6% safely managed, and 8.4% practiced open defecation. Hygiene facilities were basic in 80.8%, limited in 14%, and no facility in 5.2%. Diarrhoea was reported by 32% of households in the past 4 weeks. WASH knowledge was good in 84.8%, and 77.2% found water affordable (water expense <3% of their income).

Table 2 Number and percentage distribution of access to water supply, access to sanitation, health related factors and affordability among respondents (n= 250)

Variables	Number	Percent (%)
Water service level		
Basic	175	70.0
Limited	31	12.4
Surface	23	9.2
Unimproved	21	8.4
Water source location		
Within premises	217	86.8
Outside premises	33	13.2
Water fetching time		
Within 30 minutes	235	94.0
Above 30 minutes	15	6.0
Mean= 18.7, Median= 15, SD= 11.9, Min= 3, Max= 35		
Rainwater harvesting		

Variables	Number	Percent (%)
Yes	107	42.8
No	143	57.2
water treatment		
Yes	128	51.2
No	122	48.8
Water storage		
Proper	59	23.6
Improper	191	76.4
water scarcity during dry season		
Yes	85	34.0
No	165	66.0
Sanitation service level		
Basic	83	33.2
Limited	87	34.8
Open defecation	21	8.4
Safely managed	59	23.6
Hygiene service level		
No facility	13	5.2
Basic	202	80.8
Limited	35	14.0
Diarrhoea status (past 4 weeks)		
No	170	68.0
Yes	80	32.0
WASH knowledge		
Poor knowledge (≤ 9)	38	15.2
Good knowledge (> 9)	212	84.8
Water affordability		
Unaffordable	57	22.8
Affordable	193	77.2

Table 3 describe the household water security experience scale category of Myanmar migrants. More than two-thirds (72%) of the households were water secure. A total of 28% of

of the households experienced water insecurity, with 26.4% facing low water insecurity, 1.2% experiencing moderate water insecurity, and another 0.4% being high water insecure.

Table 3 Household water insecurity experiences scale (HWISE) (n= 250)

HWISE Category	Number	Percent (%)
Water security	180	72.0
Low water insecurity	66	26.4
Moderate water insecurity	3	1.2
High water insecurity	1	0.4

Table 4 shows associated factors with household water security status among Myanmar migrants (n= 250), analyzed using Pearson's Chi-square test. Household water security was categorized into two groups: water secure and water insecure. Statistically significant

associations were observed between household water security and the following variables: household size (p= 0.027), number of under-five children (p= 0.025), household income (p=0.001), housing type (p= 0.007), paying debt (p= 0.037), water service level (p< 0.001), water

source location ($p < 0.001$), water fetching time ($p < 0.001$), rainwater harvesting ($p = 0.002$), water storage facility $p < 0.001$, water scarcity during the dry season ($p < 0.001$), sanitation service level ($p < 0.001$), hygiene service level ($p <$

0.001), diarrhoea status ($p = 0.046$), and water affordability ($p < 0.001$). Age, sex, length of stay, education, occupation and household water treatment methods were not significantly associated with water security.

Table 4 Associated factors with household water security (n = 250)

Variables	Number	Household water secure	Household water insecure	P-value*
		N (%)	N (%)	
Age group				0.561
≤ 39	143	105 (42.0)	38 (15.2)	
> 39	107	75 (30.0)	32 (12.8)	
Sex				0.254
Male	118	89 (35.6)	29 (11.6)	
Female	132	91 (36.4)	41 (16.4)	
Length of stay in Thailand				0.217
≤ 2 years	64	51 (20.4)	13 (5.2)	
3-14 years	118	84 (33.6)	34 (13.6)	
≥ 15 years	68	45 (18.0)	23 (9.2)	
Household size				0.027
≤ 4	161	120 (48.0)	41 (16.4)	
5-8	80	57 (22.8)	23 (9.2)	
≥ 9	9	3 (1.2)	6 (2.4)	
Number of under-five children				0.025
0	147	110 (44.0)	37 (14.8)	
1	80	59 (23.6)	21 (8.4)	
≥ 2	23	11 (4.4)	12 (4.8)	
Education level				0.158
Below secondary school	204	143 (57.2)	61 (24.4)	
Secondary school and above	46	37 (14.8)	9 (3.6)	
Occupation				0.526
Agriculture	42	31 (12.4)	11 (4.4)	
Construction	57	44 (17.6)	13 (5.2)	
Other	151	105 (42.0)	46 (18.4)	
Household income THB				0.001
≤ 4000 THB	63	35 (14.0)	28 (11.2)	
> 4100-8000 THB	144	107 (42.8)	37 (14.8)	
> 8000 THB	43	38 (15.2)	5 (2.0)	
Housing type				0.007
Farmhouse	121	75 (30.0)	46 (18.4)	
Owned	1	1 (0.4)	0 (0.0)	

Variables	Number	Household water secure	Household water insecure	<i>P</i> -value*
		N (%)	N (%)	
Rented Shelter	98	81 (32.4)	17 (6.8)	
	30	23 (9.2)	7 (2.8)	
Paying debt				0.037
Yes	168	114 (45.6)	54 (21.6)	
No	82	66 (26.4)	16 (6.4)	
Water service level				< 0.001
Basic	175	142 (56.8)	33 (13.2)	
Limited	31	9 (3.6)	22 (8.8)	
Surface	23	13 (5.2)	10 (4.0)	
Unimproved	21	16 (6.4)	5 (2.0)	
Water source location				< 0.001
Within premises	217	168 (67.2)	49 (19.6)	
Outside premises	33	12 (4.8)	21 (8.4)	
Water fetching time				< 0.001
Within 30 minutes	235	176 (70.4)	59 (23.6)	
Above 30 minutes	15	4 (1.6)	11 (4.4)	
Rainwater harvesting				0.002
Yes	107	66 (26.4)	41 (16.4)	
No	143	114 (45.6)	29 (11.6)	
Water treatment				0.173
Yes	128	97 (38.8)	31 (12.4)	
No	122	83 (33.2)	39 (15.6)	
Water storage				< 0.001
Proper	59	54 (21.6)	5 (2.0)	
Improper	191	126 (50.4)	65 (26.0)	
Water scarcity during dry season				< 0.001
Yes	85	32 (12.8)	53 (21.2)	
No	165	148 (59.2)	17 (6.8)	
Sanitation service level				< 0.001
Basic	83	70 (28.0)	13 (5.2)	
Limited	87	53 (21.2)	34 (13.6)	
Open defecation	21	5 (2.0)	16 (6.4)	
Safely managed	59	52 (20.8)	7 (2.8)	
Hygiene service level				< 0.001
No facility	13	1 (0.4)	12 (4.8)	
Basic	202	163 (65.2)	39 (15.6)	
Limited	35	16 (6.4)	19 (7.6)	

Variables	Number	Household water secure	Household water insecure	<i>P</i> -value*
		N (%)	N (%)	
Diarrhoea status (past 4 weeks)				0.046
No	170	129 (51.6)	41 (16.4)	
Yes	80	51 (20.4)	29 (11.6)	
WASH knowledge				0.888
Poor knowledge (≤ 9)	38	27 (10.8)	11 (4.4)	
Good knowledge (> 9)	212	153 (61.2)	59 (27.8)	
Water affordability				0.008
Unaffordable	57	49 (19.6)	8 (3.2)	
Affordable	193	132 (52.4)	62 (24.8)	

*Pearson Chi-square test

DISCUSSION

In this study, household water security refers to the ability to access and benefit from affordable, adequate, reliable and safe water to sustain well-being and a healthy life (14). The study found that 28% of the Myanmar migrant households were water insecure, a figure that is comparable to the 28.9% prevalence reported in the vulnerable populations. Water insecurity disproportionately affects socially marginalized populations and is associated with negative physical and mental health outcomes (18). Moreover, the prevalence of water insecurity in this study was higher compared to another study, which reported that 3% of Myanmar migrant households in Tak province, Thailand, did not have enough water for drinking, cooking, bathing, and washing. In that study, water scarcity was primarily attributed to the distance from water sources and poor water quality (9). Another study conducted in Ghana and Mexico reported that 32% and 57% of the studied households had water insecurity (16, 19). The high prevalence of household water insecurity may be attributed to the type of housing among Myanmar migrants. Many live in farmhouses on agricultural worksites that often lack basic infrastructure, with distant water sources and poor storage facilities limiting access to safe and sufficient water.

Household size, family income, and debt payment were associated with household water insecurity. A similar finding was reported, indicating that respondents who have larger

household members, low family income, and debt were more likely to experience water insecurity compared to those without such socioeconomic hardships (19). These challenges increase household vulnerability to water insecurity, underscoring the importance of integrating water access interventions with broader social protection strategies.

This study found that households with water sources located outside the premises and requiring more than 30 minutes to fetch water were more prone to water insecurity compared to those with on-premises sources and shorter collection times. These findings align with previous research reported that proximity to water source and travel time for water are key factors contributing to water insecurity, particularly among rural households (20). To improve water security, it is essential to understand how a lack of rainwater harvesting, improper water storage, and seasonal water scarcity can lead to water insecurity. This study found that these factors were significantly associated with increased levels of water insecurity.

This study measured water, sanitation, and hygiene (WASH) service levels using the core questions for household survey developed by the WHO/UNICEF Joint Monitoring Program (JMP). Drinking water service levels were categorized into four types: basic, limited, unimproved, and surface water. Sanitation services were classified as safely managed, basic, limited, unimproved, and open defecation.

Hygiene service levels included basic, limited, and no facility (15). The drinking water service levels were statistically associated with household water security. This finding was consistent with the result of a study that indicated that the source of drinking water supply could contribute to household water insecurity. Households relying on limited, surface, or unimproved water sources had significantly higher level of water insecurity compared to those accessing basic water services (21). Poor sanitation and hygiene conditions were also associated with water insecurity. Households that practiced open defecation or lacked handwashing facilities faced a higher risk of water insecurity. A study conducted in Vietnam found an inverse relationship between sanitation and hygiene services, indicating better WASH services are associated with improved water security (22). Therefore, ensuring adequate sanitation and hygiene services at the household level is crucial to improve household water security.

The observed correlation between diarrheal illness, inadequate WASH conditions, and water insecurity underscores the critical importance of public health interventions and education in preventing waterborne diseases. Moreover, health related issues should be considered in water security studies (6, 16). This study revealed a statistically association between water affordability and household water security status ($p=0.008$). Similarly, previous research found that water affordability was associated with household water security (17). Affordability alone may not guarantee household water security, as other factors such as accessibility, reliability, and quality. Nevertheless, ensuring water affordability remains a critical component in achieving household water security.

CONCLUSION

This study highlighted the high prevalence of household water insecurity among Myanmar migrants living along the Thailand-Myanmar border. Approximately one-fourth (28%) of the total households experienced water insecurity. These results revealed that water insecurity is shaped by a complex interplay of demographic, environmental, and socioeconomic factors. Factors significantly associated with household water security ($p < 0.05$) included

household size, number of under-five children, housing type, household income, water location, water storage facility, rainwater harvesting, diarrhoea experience, water scarcity during the dry season, water affordability, types of water used, and access to sanitation and hygiene services.

These findings underscore the urgent need for integrated water, sanitation, and hygiene (WASH) interventions tailored to the basic needs of migrant communities. Addressing these factors holistically will contribute to improved water security, reduce health risks, and support broader goals of health equity and sustainable development in the border areas.

RECOMMENDATION

To reduce the risks associated with household water insecurity and its related health impacts, the study highlights the need for targeted interventions. These include improving water, sanitation, and hygiene services; promoting rainwater harvesting as a coping strategy; and implementing climate-resilient water supply systems. It is also recommended that policy strengthening to improve water security by integrating WASH interventions with broader social protection strategies. Further research on household water security should consider broader determinants, including water quality, as water security is a multidimensional issue.

LIMITATIONS

Due to the nature of the study sample, the findings can only reflect Myanmar migrant communities with similar living and working conditions in Thailand and may not be generalizable to populations in different contexts. Additionally, this study did not include water quality testing, which is a critical dimension of water security, and this limits the comprehensiveness of the findings.

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HEALTH RISK ASSESSMENT OF DERMAL CONTACT WITH HEAVY METALS CONTAMINATED SOIL AMONG WORKERS IN BLOOD COCKLE FARMS, THAILAND

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ABSTRACT

Introduction: Heavy metals such as arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), lead (Pb), and zinc (Zn) are persistent environmental pollutants with high toxicity and bioaccumulative potential. In Samut Sakhon, Thailand, blood cockle farming near industrial zones raises concerns about chronic occupational exposure through dermal contact with contaminated soil. While prior studies emphasized dietary exposure, dermal pathways remain underexplored. Prolonged skin contact with contaminated soil can contribute to systemic absorption of toxic metals, potentially leading to long-term health effects including carcinogenesis, which is supported by toxicological findings and reflected in international guidelines such as those by ATSDR toxicological profiles and acknowledged in WHO health risk frameworks.

Objective: This study aims to assess non-cancer and cancer risk associated with dermal exposure to heavy metals in soil among workers at open-system blood cockle farms.

Methodology: Soil samples were collected from five representative cockle farms. Heavy metal concentrations were measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The average daily intake (ADI), hazard quotients (HQ), hazard index (HI), and lifetime cancer risk (LCR) were assessed through dermal exposure route.

Results: The concentration of As, Cd, Cr, Pb, Hg, Zn in soil were found all lower than standard. Non-cancer risk was not found in all studied heavy metals, as mean HI values of male participants was 0.042 and 0.043 for females (HI < 1). However, LCR values for As and Cr exceeded the acceptable risk threshold (1×10^{-6}), with total lifetime cancer risk (TLCR) reaching 5.423×10^{-6} for males and 5.485×10^{-6} for females.

Conclusion: Although the heavy metals contaminated in soil found low concentration, but long-term dermal exposure to As and Cr in soil by cockle farm activities may cause cancer risk. Implementation of PPE use, environmental monitoring, and biomonitoring is recommended.

Keywords: Heavy metals, Soil contamination, Dermal exposure, Cancer risk, Occupational health

INTRODUCTION

Heavy metals such as arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg), lead (Pb), and zinc (Zn) are toxic and persistent environmental pollutants (1. that pose serious health risks via ingestion, inhalation, and dermal contact (2. -4) In Samut Sakhon Province, Thailand, industrial (5-7) and agricultural runoff have elevated metal levels in

sediments and coastal waters (8-11). Open-system blood cockle (*Anadara granosa*) farms in this region depend on tidal exchange, increasing vulnerability to contamination (11-12). As filter feeders, cockles bioaccumulate metals, raising health concerns for consumers and aquaculture workers (10,13). Workers often handle soil and water without protection, increasing dermal exposure potential (14). Although ingestion risks have been extensively

studied, dermal pathways remain comparatively less explored in aquaculture contexts(15-17)

However, several studies in related occupations—such as rice farming, tanning, and mining—have reported systemic absorption of metals like As and Cr through prolonged skin contact, resulting in elevated biomarker levels and potential carcinogenic risk(18-20) In such cases, lifetime cancer risk (LCR) values have ranged between 1×10^{-6} and 1×10^{-4} , while non-cancer hazard index (HI) values in highly exposed populations have approached or exceeded the acceptable threshold ($HI \geq 1$)(21).

Compared to ingestion, dermal absorption is typically lower, with bioavailability ranging from 0.01–0.06% depending on metal form, skin condition, and exposure duration(22). Nevertheless, chronic dermal exposure—especially under conditions of damaged skin or high humidity—may significantly increase systemic uptake(23). Metal speciation, skin integrity, and contact frequency are all known to influence percutaneous absorption(24).

This study evaluates both non-carcinogenic and carcinogenic risks from dermal contact with contaminated soil using the U.S. EPA risk assessment model.

METHODS

Study design

This cross-sectional study assessed dermal exposure to heavy metals in soil among adult blood cockle farmworkers (aged ≥ 20 years) in Samut Sakhon Province, Thailand. Eligible participants had lived and worked in the study area for at least 12 consecutive months. Farms were purposively selected based on open-system operations, consistency of farming activities, and likelihood of direct soil contact(18). Health risk assessment followed the U.S. EPA framework for evaluating both non-carcinogenic and carcinogenic risks from dermal exposure to environmental contaminants(19-21).

Relevant demographic and occupational data of workers (e.g., age, body weight, duration and frequency of soil contact) used for exposure estimation were derived from a previously published study with a similar population in the same geographic region. These secondary data were selected based on their methodological

compatibility with the current risk assessment framework(21, 36,37).

Place and duration of study

The study was conducted in Samut Sakhon Province, a key aquaculture hub on Thailand's central coast, known for intensive blood cockle (*A. granosa*) farming(8). Due to ongoing industrial and agricultural runoff, the region presents a relevant case for contamination studies(10,22). Soil sampling took place in December 2024, during the peak farming season when worker–soil contact is highest(23). Samples were collected during low tide and dry weather to ensure consistency and minimize dilution from surface runoff.

Inclusion and exclusion criteria

Farms were selected using purposive sampling to align with the study objectives and minimize variability in exposure conditions. Inclusion criteria required: (1) open-system operation without water recirculation, (2) continuous activity for ≥ 12 months, and (3) routine worker contact with soil. Preference was given to farms within 10 km of the Tha Chin River estuary due to potential riverine contamination. Farms were excluded if they used closed systems, were inactive during sampling, or relied solely on mechanized processes with minimal human-soil contact(18).

Sample Size and sampling

Five open-system blood cockle farms in Samut Sakhon Province were purposively selected based on dermal exposure relevance. Each farm was divided into three strips, with six sampling points per farm. At each point, 3–5 subsamples (0–10 cm depth) were collected using a stainless-steel trowel and composited into one representative sample per strip, resulting in three composite samples per farm. Sampling tools were pre-cleaned with 10% nitric acid and rinsed with deionized water(24). Samples were stored in acid-washed polyethylene bags, transported on ice, air-dried (48–72 h), sieved (2 mm), and digested with 21 ml of concentrated HNO_3 at $115^\circ C$ for 2 hour (25).

Digested samples were filtered, diluted to 100 ml, and analyzed for As, Cd, Cr, Hg, Pb, and Zn using ICP-MS(26). Quality assurance and

control measures included the use of certified reference materials, blank samples, and evaluation of detection limits (LOD), quantification limits (LOQ), and relative standard

deviation (RSD) (27), all maintained within the U.S EPA-accepted threshold of <15% (28). The geographic locations of the five sampling sites are shown in Figure 1.

Figure 1 Geographic locations of the five sampling sites in blood cockle farms located in Samut Sakhon Province, Thailand.



Data analysis

Descriptive statistics were calculated using Microsoft Excel. Risk characterization metrics including Average Daily Intake (ADI), Hazard Quotient (HQ), Hazard Index (HI), and Lifetime Cancer Risk (LCR) were computed using U.S. EPA health risk assessment equations and published slope factors (15,18,20,29).

Health risk assessment overview

The health risk assessment in this study was performed to evaluate dermal exposure to heavy metals from soil among workers at open-system blood cockle farms in Samut Sakhon, Thailand. Following the U.S EPA guidance and the methodology, the risk assessment process consisted of four key steps: hazard identification, dose–response assessment, exposure assessment, and risk characterization(19,30).

(1) Hazard identification

This step identifies heavy metals in soil that may cause adverse health effects through dermal contact. In this study, six heavy metals—arsenic (As), cadmium (Cd), chromium (Cr) mercury (Hg), lead (Pb), and zinc (Zn) —were selected based on previous reports of

contamination in coastal aquaculture regions and the known toxicological relevance of these metals(31).

(2) Dose-Response assessment

The dose–response assessment examines how varying levels of chemical exposure relate to potential adverse health effects. In this study, reference doses (RfDs) for non-carcinogenic dermal exposure and cancer slope factors (CSFs) for carcinogenic assessment were adopted from the U.S. EPA’s IRIS and other international sources. These values informed the calculation of hazard quotients (HQs) and lifetime cancer risks (LCRs) in exposed individuals(15,32).

(3) Exposure assessment

Exposure assessment evaluates health risks from dermal contact with contaminants. This study quantified dermal exposure to soil heavy metals among blood cockle farmworkers in Samut Sakhon, Thailand, following the U.S. EPA framework, which considers exposure type, frequency, and duration. The average daily intake (ADI dermal, mg/kg-day) was calculated using the standard equation(20,33).

$$ADI_{\text{dermal}} = \frac{(Cs \times CF \times SA \times AF \times ABS \times EF \times ED)}{(BW \times AT)}$$

Where C_s is the metal concentration in soil (mg/kg); CF is the unit conversion factor (10^{-6} kg/mg); SA is the skin surface area available for contact (cm^2); AF is the soil adherence factor (mg/ cm^2); ABS is the dermal absorption factor (unitless); EF is the exposure frequency (days/year); ED is the exposure duration (years);

BW is the body weight (kg); and AT is the averaging time (days) (14, 21).

To estimate skin surface area (SA), total surface area (TSA) was calculated based on the height and weight of Thai farmworkers using the established allometric equation(21).

$$\ln(\text{TSA}) = \ln(a_0) + a_1 \ln(H) + a_2 \ln(W)$$

Where TSA is the total body surface area in square meters, H is the height in centimetres, and W is the weight in kilograms. The coefficients used were $a_0 = 0.007184$, $a_1 = 0.725$, and $a_2 = 0.425$.

This method allows personalized estimation of exposed skin surface area based on height and weight data derived from the Thai population, using nationally representative averages from public databases(35) and standard weight parameters from the U.S EPA Exposure Factors Handbook(21). These values were considered appropriate for dermal exposure estimation in aquaculture contexts where region-specific surface area data are limited.

In Thailand, cockle farming generally

follows a four-phase cycle: site preparation, seed stocking, maintenance, and harvesting—each involving specific tasks such as land levelling, mesh setup, and sediment management(36,37). This stage-based structure corresponds with small-scale aquaculture practices in other Southeast Asian countries, where similar sequences of preparation, stocking, daily care, and harvesting are employed(38) and is supported by global aquaculture models, particularly for open systems(39). These references collectively justify the classification of work stages applied in this study for exposure assessment. The total $\text{ADI}_{\text{dermal}}$ for each individual was aggregated across all stages using a weighted formula recommended by ATSDR and U.S EPA:

$$\text{ADI total} = [(\text{ADI}_1 \times \text{EF}_1) + (\text{ADI}_2 \times \text{EF}_2) + \dots + (\text{ADI}_n \times \text{EF}_n)] / (\text{EF}_1 + \text{EF}_2 + \dots + \text{EF}_n)$$

This approach captures seasonal and task-specific variations in dermal exposure, improving the accuracy of annual ADI estimates. Each stage involves different exposure durations, frequencies (EF), and affected body regions. For instance, harvesting requires greater use of the lower torso, legs, and feet, resulting in higher surface area exposure to soil contaminants.

To enhance accuracy, body region-specific surface area percentages were matched with stage-based EF to calculate refined daily SA values differentiated by gender—e.g., 16,020.87 cm^2/day for males and 14,534.05 cm^2/day for females during the harvesting stage. These estimations were based on anatomical surface area distributions from established exposure factor references(40) and

$$\text{HQ} = \text{ADI} / \text{RfD}$$

Where ADI is the average daily intake via dermal exposure (mg/kg-day), and RfD is the reference dose (mg/kg-day). The sum of

adjusted using Thai-specific anthropometric data(35). The resulting SA values were directly incorporated into the $\text{ADI}_{\text{dermal}}$ calculations.

(4) Risk characterization

Risk characterization, the final step in the health risk assessment framework, integrates hazard identification, dose–response, and exposure data to estimate adverse health effects. In this study, both non-carcinogenic and carcinogenic risks from dermal exposure to heavy metals in soil were quantified among blood cockle farmworkers in Samut Sakhon Province, following U.S. EPA guidelines (20,41). Non-carcinogenic risk was assessed by calculating the hazard quotient (HQ) for each metal of concern using the following equation:

individual HQs for multiple metals results in the hazard index (HI):

$$\text{HI} = \sum \text{HQ}_i$$

If HI exceeds 1, it indicates a potential for

adverse systemic health effects due to cumulative exposure. Conversely, an HI value equal to or below 1 suggests that non-carcinogenic effects are unlikely to occur.

Carcinogenic risk was assessed only for contaminants with established cancer slope factors (CSFs). In this study, arsenic (As), hexavalent chromium (Cr VI), and lead (Pb) were identified as carcinogenic substances with available CSF values. Individual cancer risk (CR) was calculated using the equation:

$$CR = ADI \times CSF$$

where CR represents the estimated probability of developing cancer over a lifetime due to dermal exposure. The U.S EPA defines an acceptable lifetime cancer risk range between 1×10^{-6} and 1×10^{-4} . Risks above (32,41). Risks above this range are considered potentially significant and may warrant management interventions.

To estimate the combined cancer risk from simultaneous exposure to multiple carcinogens, the Total Lifetime Cancer Risk (TLCR) was computed as follows:

$$TLCR = \sum (ADI_i \times CSF_i)$$

where ADI_i is the average daily intake of

carcinogen i (mg/kg/day) via dermal contact, and CSF_i is its corresponding cancer slope factor (mg/kg/day)⁻¹. TLCR is a unitless value reflecting the aggregate lifetime cancer risk across multiple substances.

All calculations were performed following the U.S EPA's Risk Assessment Guidance for Superfund (RAGS) (32,41), Volume I and the Integrated Risk Information System (IRIS) protocols(32).

RESULTS

Heavy metals concentration in soil

Soil samples were collected from five open-system blood cockle farms in Samut Sakhon Province. The concentrations of arsenic (As), cadmium (Cd), lead (Pb), and zinc (Zn) in the composite soil samples are presented in Table 1. Among the metals analyzed, Zn exhibited the highest mean concentration (85.35 ± 12.18 mg/kg), followed by Cr (31.96 ± 1.78 mg/kg), Pb (6.49 ± 0.12 mg/kg), As (2.79 ± 0.59 mg/kg), and Cd ($<0.30 \pm 0.00$ mg/kg), Hg ($<0.30 \pm 0.00$ mg/kg). The concentration of As in certain farms exceeded residential soil screening level (RSL) established by the U.S. EPA. (34).

Table 1 Concentrations of heavy metals in soil from five blood cockle farms in Samut Sakhon, Thailand (in mg/kg dry weight)

Farm No.	Sample_ID	As (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)
1	SP01-02/FN1	2.303	<0.300	32.682	6.2	<0.300	77.532
	SP03-04/FN1	3.982	<0.300	33.407	6.487	<0.300	92.179
	SP05-06/FN1	3.484	<0.300	32.448	6.475	<0.300	100.903
2	SP01-02/FN2	2.481	<0.300	30.395	6.511	<0.300	71.771
	SP03-04/FN2	2.484	<0.300	30.672	6.486	<0.300	67.004
	SP05-06/FN2	2.914	<0.300	30.443	6.525	<0.300	66.864
3	SP01-02/FN3	2.450	<0.300	30.347	6.419	<0.300	85.078
	SP03-04/FN3	2.793	<0.300	33.125	6.461	<0.300	96.824
	SP05-06/FN3	3.403	<0.300	34.182	6.565	<0.300	98.751

Farm No.	Sample_ID	As (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Zn (mg/kg)
	06/FN3						
4	SP01-02/FN4	3.281	<0.300	35.797	6.364	<0.300	95.23
	SP03-04/FN4	2.316	<0.300	32.766	6.558	<0.300	101.658
	SP05-06/FN4	1.894	<0.300	32.762	6.471	<0.300	90.299
5	SP01-02/FN5	2.261	<0.300	29.444	6.566	<0.300	83.377
	SP03-04/FN5	3.462	<0.300	30.919	6.471	<0.300	77.09
	SP05-06/FN5	2.408	<0.300	30.239	6.765	<0.300	75.752
Mean ± SD		2.794 ± 0.596	<0.300 ± 0.000	31.975 ± 1.784	6.488 ± 0.120	<0.300 ± 0.000	85.354 ± 12.177
SSLs Standard		0.39	71	120,000	400	23	23,000

Note: Arsenic (As) concentrations in bold exceed the soil screening level (SSL) used in this study.

Soil pH

The pH values of soil samples from the five studied farms ranged from 6.83 to 8.14, with a mean of 7.65 ± 0.22 , indicating slightly acidic to slightly alkaline soil conditions. Soil pH plays a crucial role in controlling the mobility and bioavailability of heavy metals within the soil matrix. The near-neutral to mildly alkaline conditions observed may influence the solubility and potential dermal exposure to heavy metals present in these environments.

Estimated dermal exposure dose (ADI)

The Average Daily Intake (ADI) through dermal contact was calculated separately for cancer and non-cancer risks using U.S EPA-recommended parameters. Zn showed the highest ADI values in both scenarios. For cancer risk (Table 2), the mean dermal ADIs of Zn were 2.30×10^{-5} mg/kg/day (males) and 2.32×10^{-5} mg/kg/day (females), followed by Cr (8.59×10^{-6} and 8.60×10^{-6} mg/kg/day) and Pb (1.67×10^{-6} and 1.76×10^{-6} mg/kg/day). Hg consistently showed the lowest values (8.08×10^{-8} and 8.14×10^{-8} mg/kg/day).

Table 2 Estimated Average Daily Intake (ADI) of Heavy Metals via Dermal Exposure from Farm Soils: Carcinogenic Risk Assessment (mg/kg-day)

Farm No.	Sample_ID	As (ADI)		Cd (ADI)		Cr (ADI)		Pb (ADI)		Hg (ADI)		Zn (ADI)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	SP01-02/FN1	6.20×10^{-7}	6.25×10^{-7}	8.08×10^{-8}	8.14×10^{-8}	8.81×10^{-6}	8.87×10^{-6}	5.43×10^{-7}	1.63×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	2.09×10^{-5}	2.10×10^{-5}
	SP03-04/FN1	1.07×10^{-6}	1.08×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	9.00×10^{-6}	9.07×10^{-6}	1.75×10^{-6}	1.76×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	2.48×10^{-5}	2.50×10^{-5}
	SP05-06/FN1	9.39×10^{-7}	9.46×10^{-7}	8.08×10^{-8}	8.14×10^{-8}	8.74×10^{-6}	8.81×10^{-6}	1.74×10^{-6}	1.76×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	2.72×10^{-5}	2.74×10^{-5}
2	SP01-02/FN2	6.68×10^{-7}	6.74×10^{-7}	8.08×10^{-8}	8.14×10^{-8}	8.19×10^{-6}	8.25×10^{-6}	1.75×10^{-6}	1.77×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	1.93×10^{-5}	1.95×10^{-5}
	SP03-04/FN2	6.69×10^{-7}	6.74×10^{-7}	8.08×10^{-8}	8.14×10^{-8}	8.26×10^{-6}	8.33×10^{-6}	1.75×10^{-6}	1.76×10^{-6}	8.08×10^{-8}	8.14×10^{-8}	1.81×10^{-5}	1.82×10^{-5}

Farm No.	Sample ID	As (ADI)		Cd (ADI)		Cr (ADI)		Pb (ADI)		Hg (ADI)		Zn (ADI)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
3	SP05-06/FN2	7.85×10 ⁻⁷	7.91×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.2×10 ⁻⁶	8.26×10 ⁻⁶	1.76×10 ⁻⁶	1.77×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	1.80×10 ⁻⁵	1.82×10 ⁻⁵
	SP01-02/FN3	6.6×10 ⁻⁷	6.65×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.18×10 ⁻⁶	8.24×10 ⁻⁶	1.73×10 ⁻⁶	1.74×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.29×10 ⁻⁵	2.31×10 ⁻⁵
	SP03-04/FN3	7.52×10 ⁻⁷	7.58×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.92×10 ⁻⁶	8.99×10 ⁻⁶	1.74×10 ⁻⁶	1.75×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.61×10 ⁻⁵	2.63×10 ⁻⁵
4	SP05-06/FN3	9.17×10 ⁻⁷	9.24×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	9.21×10 ⁻⁶	9.28×10 ⁻⁶	1.77×10 ⁻⁶	1.78×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.66×10 ⁻⁵	2.68×10 ⁻⁵
	SP01-02/FN4	8.84×10 ⁻⁷	8.91×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	9.21×10 ⁻⁶	9.72×10 ⁻⁶	1.71×10 ⁻⁶	1.73×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.57×10 ⁻⁵	2.59×10 ⁻⁵
	SP03-04/FN4	6.24×10 ⁻⁷	6.29×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.83×10 ⁻⁶	8.9×10 ⁻⁶	1.77×10 ⁻⁶	1.78×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.74×10 ⁻⁵	2.76×10 ⁻⁵
5	SP05-06/FN4	5.1×10 ⁻⁷	5.14×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.83×10 ⁻⁶	8.89×10 ⁻⁶	1.74×10 ⁻⁶	1.76×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.43×10 ⁻⁵	2.45×10 ⁻⁵
	SP01-02/FN5	6.09×10 ⁻⁷	6.14×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	7.93×10 ⁻⁶	7.99×10 ⁻⁶	1.77×10 ⁻⁶	1.78×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.25×10 ⁻⁵	2.26×10 ⁻⁵
	SP03-04/FN5	9.33×10 ⁻⁷	9.4×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.33×10 ⁻⁶	8.39×10 ⁻⁶	1.74×10 ⁻⁶	1.76×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.08×10 ⁻⁵	2.09×10 ⁻⁵
Mean ± SD	SP05-06/FN5	6.49×10 ⁻⁷	6.54×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.15×10 ⁻⁶	8.21×10 ⁻⁶	1.82×10 ⁻⁶	1.84×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.04×10 ⁻⁵	2.06×10 ⁻⁵
		7.53×10 ⁻⁷ ± 1.61×10 ⁻⁷	7.59×10 ⁻⁷ ± 1.62×10 ⁻⁷	8.08×10 ⁻⁸ ± 1.45×10 ⁻¹⁰	8.15×10 ⁻⁸ ± 1.50×10 ⁻²	8.59×10 ⁻⁶ ± 4.24×10 ⁻⁷	8.68×10 ⁻⁶ ± 4.84×10 ⁻⁷	1.67×10 ⁻⁶ ± 3.14×10 ⁻⁷	1.76×10 ⁻⁶ ± 4.29×10 ⁻⁸	8.08×10 ⁻⁸ ± 2.74×10 ⁻²³	8.15×10 ⁻⁸ ± 1.37×10 ⁻²	2.30×10 ⁻⁵ ± 3.28×10 ⁻⁶	2.32×10 ⁻⁵ ± 3.31×10 ⁻⁶
Average		7.53×10 ⁻⁷	7.59×10 ⁻⁷	8.08×10 ⁻⁸	8.14×10 ⁻⁸	8.59×10 ⁻⁶	8.68×10 ⁻⁶	1.67×10 ⁻⁶	1.76×10 ⁻⁶	8.08×10 ⁻⁸	8.14×10 ⁻⁸	2.30×10 ⁻⁵	2.32×10 ⁻⁵

Note: Estimated average daily intake (ADI) values were calculated based on assumed sample size of 55 males and 45 females across five farms (total n = 100).

In the non-cancer risk assessment (Table 3), Zn again showed the highest values (1.61×10⁻⁴ and 1.62×10⁻⁴ mg/kg/day), followed by Cr (6.01×10⁻⁵ and 6.05×10⁻⁵ mg/kg/day). Hg remained the lowest (5.66×10⁻⁷ and 5.70×10⁻⁷ mg/kg/day). Standard deviations were generally low, though Zn and Pb exhibited slightly higher variability across sites.

Overall, Zn, Cr, and Pb were the primary contributors to dermal exposure, with females showing marginally higher ADI values—likely due to sex-specific differences in surface area estimates.

Table 3 Estimated Average Daily Intake (ADI) of Heavy Metals via Dermal Exposure from Farm Soils: Non-Carcinogenic Risk Assessment (mg/kg-day)

Farm No.	Sample ID	As (ADI)		Cd (ADI)		Cr (ADI)		Pb (ADI)		Hg (ADI)		Zn (ADI)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	SP01-02/FN1	4.34×10 ⁻⁶	4.38×10 ⁻⁶	5.62×10 ⁻⁷	5.70×10 ⁻⁷	6.16×10 ⁻⁵	6.21×10 ⁻⁵	3.80×10 ⁻⁶	1.14×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.46×10 ⁻⁴	1.47×10 ⁻⁴
	SP03-04/FN1	7.51×10 ⁻⁶	7.57×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.30×10 ⁻⁵	6.35×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.74×10 ⁻⁴	1.75×10 ⁻⁴
	SP05-06/FN1	6.57×10 ⁻⁶	6.62×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.12×10 ⁻⁵	6.17×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.90×10 ⁻⁴	1.92×10 ⁻⁴
2	SP01-02/FN2	4.68×10 ⁻⁶	4.71×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.73×10 ⁻⁵	5.78×10 ⁻⁵	1.23×10 ⁻⁵	1.24×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.35×10 ⁻⁴	1.36×10 ⁻⁴
	SP03-04/FN2	4.68×10 ⁻⁶	4.72×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.78×10 ⁻⁵	5.83×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.26×10 ⁻⁴	1.27×10 ⁻⁴
	SP05-06/FN2	5.50×10 ⁻⁶	5.54×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.74×10 ⁻⁵	5.79×10 ⁻⁵	1.23×10 ⁻⁵	1.24×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.26×10 ⁻⁴	1.27×10 ⁻⁴
3	SP01-02/FN3	4.62×10 ⁻⁶	4.66×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.72×10 ⁻⁵	5.77×10 ⁻⁵	1.21×10 ⁻⁵	1.22×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.60×10 ⁻⁴	1.62×10 ⁻⁴
	SP03-04/FN3	5.27×10 ⁻⁶	5.31×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.25×10 ⁻⁵	6.30×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.83×10 ⁻⁴	1.84×10 ⁻⁴
	SP05-06/FN3	6.42×10 ⁻⁶	6.47×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.45×10 ⁻⁵	6.50×10 ⁻⁵	1.24×10 ⁻⁵	1.25×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.86×10 ⁻⁴	1.88×10 ⁻⁴
4	SP01-02/FN4	6.19×10 ⁻⁶	6.24×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.45×10 ⁻⁵	6.80×10 ⁻⁵	1.20×10 ⁻⁵	1.21×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.80×10 ⁻⁴	1.81×10 ⁻⁴
	SP03-	4.37×10 ⁻⁶	4.40×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.18×10 ⁻⁵	6.23×10 ⁻⁵	1.24×10 ⁻⁵	1.25×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.92×10 ⁻⁴	1.93×10 ⁻⁴

04/FN4													
5	SP05-06/FN4	3.57×10 ⁻⁶	3.60×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	6.18×10 ⁻⁵	6.23×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.70×10 ⁻⁴	1.72×10 ⁻⁴
	SP01-02/FN5	4.26×10 ⁻⁶	4.30×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.55×10 ⁻⁵	5.60×10 ⁻⁵	1.24×10 ⁻⁵	1.25×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.57×10 ⁻⁴	1.58×10 ⁻⁴
	SP03-04/FN5	6.53×10 ⁻⁶	6.58×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.83×10 ⁻⁵	5.88×10 ⁻⁵	1.22×10 ⁻⁵	1.23×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.45×10 ⁻⁴	1.47×10 ⁻⁴
	SP05-06/FN5	4.54×10 ⁻⁶	4.58×10 ⁻⁶	5.66×10 ⁻⁷	5.70×10 ⁻⁷	5.70×10 ⁻⁵	5.75×10 ⁻⁵	1.28×10 ⁻⁵	1.29×10 ⁻⁵	5.66×10 ⁻⁷	5.70×10 ⁻⁷	1.43×10 ⁻⁴	1.44×10 ⁻⁴
Mean ± SD		5.27×10 ⁻⁶ ± 1.13×10 ⁻⁶	5.31×10 ⁻⁶ ± 1.13×10 ⁻⁶	5.65×10 ⁻⁷ ± 1.02×10 ⁻⁹	5.70×10 ⁻⁷ ± 1.06×10 ⁻²²	6.01×10 ⁻⁵ ± 2.97×10 ⁻⁶	6.08×10 ⁻⁵ ± 3.39×10 ⁻⁶	1.17×10 ⁻⁵ ± 2.20×10 ⁻⁶	1.23×10 ⁻⁵ ± 3.00×10 ⁻⁷	5.66×10 ⁻⁷ ± 1.10×10 ⁻²²	5.70×10 ⁻⁷ ± 0.00×10 ⁰	1.61×10 ⁻⁴ ± 2.39×10 ⁻⁵	1.62×10 ⁻⁴ ± 2.31×10 ⁻⁵
Average		5.27×10 ⁻⁶ ₆	5.31×10 ⁻⁶ ₆	5.66×10 ⁻⁷ ₇	5.70×10 ⁻⁷ ₇	6.01×10 ⁻⁵ ₅	6.08×10 ⁻⁵ ₅	1.17×10 ⁻⁵ ₅	1.23×10 ⁻⁵ ₅	5.66×10 ⁻⁷ ₇	5.70×10 ⁻⁷ ₇	1.61×10 ⁻⁴ ₇	1.62×10 ⁻⁴ ₇

Note: Estimated average daily intake (ADI) values were calculated based on assumed sample size of 55 males and 45 females across five farms (total n = 100).

Non-carcinogenic risk (HQ AND HI)

Non-carcinogenic risks from dermal exposure were assessed using Hazard Quotients (HQs) and the Hazard Index (HI), following U.S. EPA methodology. HQs were derived from the ratio of ADI to the reference dose (RfD), while HI represented the sum of HQs across all metals.

As presented in Table 4, all HQs for individual metals (As, Cd, Cr, Pb, Hg, and Zn) were below the safety threshold of 1.0, indicating no significant non-carcinogenic risk from any single metal. Among these, Zn showed the highest average HQ (0.001), followed by Cr (0.002), Pb (0.001), and As (0.018), with low standard deviations across sites.

As shown in Table 4, all HQs for individual metals (As, Cd, Cr, Pb, Hg, and Zn) were below the critical safety threshold of 1.0, indicating no significant non-carcinogenic risk

from individual metals. Among these, arsenic (As) showed the highest average HQ (1.80×10⁻²), followed by chromium (Cr, 2.00×10⁻²), lead (Pb, 3.00×10⁻³), and zinc (Zn, 1.00×10⁻³), all with minimal variation across sites.

However, cumulative HI values exceeded 1.00×10⁻² in several farms, particularly SP03-04/FN3 and SP05-06/FN3. The highest HI was recorded at SP03-04/FN3: 4.78×10⁻² (males) and 4.82×10⁻² (females). Overall, mean HI values were 4.20×10⁻² ± 4.00×10⁻³ (males) and 4.30×10⁻² ± 4.00×10⁻³ (females).

Although individual HQs remained within acceptable limits, elevated HI values suggest potential cumulative non-carcinogenic effects under prolonged exposure. This highlights the need for ongoing monitoring and integrated risk management in open-system cockle farming.

Table 4 Hazard Quotients (HQ) and Hazard Index (HI)

Farm No.	Site	HQ - As		HQ - Cd		HQ - Cr		HQ - Pb		HQ -Hg		HQ - Zn		HI (ΣHQ)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	SP01-02/FN1	1.45×10 ⁻²	1.46×10 ⁻²	8.03×10 ⁻⁵	8.14×10 ⁻⁵	2.05×10 ⁻²	2.07×10 ⁻²	1.06×10 ⁻³	3.17×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.87×10 ⁻⁴	4.91×10 ⁻⁴	3.75×10 ⁻²	3.98×10 ⁻²
	SP03-04/FN1	2.50×10 ⁻²	2.52×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.10×10 ⁻²	2.12×10 ⁻²	3.40×10 ⁻³	3.42×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	5.79×10 ⁻⁴	5.84×10 ⁻⁴	5.09×10 ⁻²	5.13×10 ⁻²
	SP05-06/FN1	2.19×10 ⁻²	2.21×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.04×10 ⁻²	2.06×10 ⁻²	3.39×10 ⁻³	3.42×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	6.34×10 ⁻⁴	6.39×10 ⁻⁴	4.72×10 ⁻²	4.76×10 ⁻²
2	SP01-02/FN2	1.56×10 ⁻²	1.57×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.91×10 ⁻²	1.93×10 ⁻²	3.41×10 ⁻³	3.44×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.51×10 ⁻⁴	4.55×10 ⁻⁴	3.95×10 ⁻²	3.98×10 ⁻²
	SP03-04/FN2	1.56×10 ⁻²	1.57×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.93×10 ⁻²	1.94×10 ⁻²	3.40×10 ⁻³	3.42×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.21×10 ⁻⁴	4.24×10 ⁻⁴	3.96×10 ⁻²	3.99×10 ⁻²
	SP05-06/FN2	1.83×10 ⁻²	1.85×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.91×10 ⁻²	1.93×10 ⁻²	3.42×10 ⁻³	3.44×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.20×10 ⁻⁴	4.24×10 ⁻⁴	4.22×10 ⁻²	4.25×10 ⁻²
3	SP01-02/FN3	1.54×10 ⁻²	1.55×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.91×10 ⁻²	1.92×10 ⁻²	3.36×10 ⁻³	3.39×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	5.35×10 ⁻⁴	5.39×10 ⁻⁴	3.93×10 ⁻²	3.96×10 ⁻²
	SP03-04/FN3	1.76×10 ⁻²	1.77×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.08×10 ⁻²	2.10×10 ⁻²	3.38×10 ⁻³	3.41×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	6.09×10 ⁻⁴	6.13×10 ⁻⁴	4.33×10 ⁻²	4.36×10 ⁻²
	SP05-06/FN3	2.14×10 ⁻²	2.16×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.15×10 ⁻²	2.17×10 ⁻²	3.44×10 ⁻³	3.47×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	6.21×10 ⁻⁴	6.26×10 ⁻⁴	4.78×10 ⁻²	4.82×10 ⁻²

Farm No.	Site	HQ - As		HQ - Cd		HQ - Cr		HQ - Pb		HQ -Hg		HQ - Zn		HI (ΣHQ)	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
4	SP01-02/FN4	2.06×10 ⁻²	2.08×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.15×10 ⁻²	2.27×10 ⁻²	3.33×10 ⁻³	3.36×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	5.99×10 ⁻⁴	6.03×10 ⁻⁴	4.69×10 ⁻²	4.83×10 ⁻²
	SP03-04/FN4	1.46×10 ⁻²	1.47×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.06×10 ⁻²	2.08×10 ⁻²	3.44×10 ⁻³	3.46×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	6.39×10 ⁻⁴	6.44×10 ⁻⁴	4.01×10 ⁻²	4.04×10 ⁻²
	SP05-06/FN4	1.19×10 ⁻²	1.20×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	2.06×10 ⁻²	2.08×10 ⁻²	3.39×10 ⁻³	3.42×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	5.68×10 ⁻⁴	5.72×10 ⁻⁴	3.73×10 ⁻²	3.76×10 ⁻²
5	SP01-02/FN5	1.42×10 ⁻²	1.43×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.85×10 ⁻²	1.87×10 ⁻²	3.44×10 ⁻³	3.47×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	5.24×10 ⁻⁴	5.28×10 ⁻⁴	3.76×10 ⁻²	3.79×10 ⁻²
	SP03-04/FN5	2.18×10 ⁻²	2.19×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.94×10 ⁻²	1.96×10 ⁻²	3.39×10 ⁻³	3.42×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.85×10 ⁻⁴	4.88×10 ⁻⁴	4.60×10 ⁻²	4.63×10 ⁻²
	SP05-06/FN5	1.51×10 ⁻²	1.53×10 ⁻²	8.08×10 ⁻⁵	8.14×10 ⁻⁵	1.90×10 ⁻²	1.92×10 ⁻²	3.54×10 ⁻³	3.57×10 ⁻³	8.08×10 ⁻⁴	8.14×10 ⁻⁴	4.76×10 ⁻⁴	4.80×10 ⁻⁴	3.91×10 ⁻²	3.94×10 ⁻²
Mean ± SD		1.80×10 ⁻² ± 4.00×10 ⁻³	1.80×10 ⁻² ± 4.00×10 ⁻³	0.00×10 ⁰ ± 0.00×10 ⁰	0.00×10 ⁰ ± 0.00×10 ⁰	2.00×10 ⁻² ± 1.00×10 ⁻³	2.00×10 ⁻² ± 1.00×10 ⁻³	3.00×10 ⁻² ± 1.00×10 ⁻³	3.00×10 ⁻² ± 0.00×10 ⁰	0.00×10 ⁰ ± 0.00×10 ⁰	0.00×10 ⁰ ± 0.00×10 ⁰	1.00×10 ⁻² ± 0.00×10 ⁰	1.00×10 ⁻² ± 0.00×10 ⁰	4.20×10 ⁻² ± 4.00×10 ⁻³	4.30×10 ⁻² ± 4.00×10 ⁻³

Note: All calculated Hazard Index (HI) values were below the acceptable risk threshold (HI < 1)

Carcinogenic risk (CR)

Carcinogenic risks from dermal exposure to arsenic (As), chromium (Cr), and lead (Pb) were estimated using U.S. EPA slope factors. Lifetime Cancer Risk (LCR) values were computed separately for males and females across five sites.

As shown in Table 5, arsenic posed the highest risk, with mean LCRs of 1.13×10⁻⁶ (males) and 1.14×10⁻⁶ (females), exceeding the 1.0×10⁻⁶ benchmark in some cases—particularly at SP05-06/FN2 and SP03-04/FN1. Chromium also showed elevated risks (mean: 4.29×10⁻⁶ for

males; 4.34×10⁻⁶ for females), consistently above the threshold, especially among females. Lead exhibited significantly lower LCRs (6.02×10⁻⁹ for males; 6.33×10⁻⁹ for females), indicating minimal cancer risk via dermal contact. The Total Lifetime Cancer Risk (TLCR) values were 5.43×10⁻⁶ (males) and 5.49×10⁻⁶ (females), exceeding the U.S. EPA’s acceptable risk level. While not indicative of direct health outcomes, these findings suggest potential long-term carcinogenic risks warranting continued surveillance and risk management in open-system aquaculture environments.

Table 5 Lifetime Cancer Risk (LCR) for As, Cr and Pb

Farm No.	Site	LCR - As		LCR - Cr		LCR - Pb		TLCR	
		Male	Female	Male	Female	Male	Female	Male	Female
1	SP01-02/FN1	9.31×10 ⁻⁷	9.38×10 ⁻⁷	4.40×10 ⁻⁶	4.44×10 ⁻⁶	1.95×10 ⁻⁹	5.87×10 ⁻⁹	5.43×10 ⁻⁶	5.49×10 ⁻⁶
	SP03-04/FN1	1.61×10 ⁻⁶	1.62×10 ⁻⁶	4.50×10 ⁻⁶	4.54×10 ⁻⁶	6.30×10 ⁻⁹	6.34×10 ⁻⁹		
	SP05-06/FN1	1.41×10 ⁻⁶	1.42×10 ⁻⁶	4.37×10 ⁻⁶	4.41×10 ⁻⁶	6.28×10 ⁻⁹	6.33×10 ⁻⁹		
2	SP01-02/FN2	1.00×10 ⁻⁶	1.01×10 ⁻⁶	4.09×10 ⁻⁶	4.13×10 ⁻⁶	6.32×10 ⁻⁹	6.36×10 ⁻⁹		
	SP03-04/FN2	1.00×10 ⁻⁶	1.01×10 ⁻⁶	4.13×10 ⁻⁶	4.16×10 ⁻⁶	6.30×10 ⁻⁹	6.34×10 ⁻⁹		
	SP05-06/FN2	1.18×10 ⁻⁶	1.19×10 ⁻⁶	4.10×10 ⁻⁶	4.13×10 ⁻⁶	6.33×10 ⁻⁹	6.38×10 ⁻⁹		
3	SP01-02/FN3	9.90×10 ⁻⁷	9.98×10 ⁻⁷	4.09×10 ⁻⁶	4.12×10 ⁻⁶	6.23×10 ⁻⁹	6.27×10 ⁻⁹		
	SP03-04/FN3	1.13×10 ⁻⁶	1.14×10 ⁻⁶	4.46×10 ⁻⁶	4.50×10 ⁻⁶	6.27×10 ⁻⁹	6.32×10 ⁻⁹		
	SP05-06/FN3	1.38×10 ⁻⁶	1.39×10 ⁻⁶	4.61×10 ⁻⁶	4.64×10 ⁻⁶	6.37×10 ⁻⁹	6.42×10 ⁻⁹		
4	SP01-02/FN4	1.33×10 ⁻⁶	1.34×10 ⁻⁶	4.61×10 ⁻⁶	4.86×10 ⁻⁶	6.17×10 ⁻⁹	6.22×10 ⁻⁹		
	SP03-04/FN4	9.36×10 ⁻⁷	9.43×10 ⁻⁷	4.41×10 ⁻⁶	4.45×10 ⁻⁶	6.36×10 ⁻⁹	6.41×10 ⁻⁹		
	SP05-06/FN4	7.65×10 ⁻⁷	7.71×10 ⁻⁷	4.41×10 ⁻⁶	4.45×10 ⁻⁶	6.28×10 ⁻⁹	6.33×10 ⁻⁹		
5	SP01-02/FN5	9.14×10 ⁻⁷	9.21×10 ⁻⁷	3.97×10 ⁻⁶	3.99×10 ⁻⁶	6.37×10 ⁻⁹	6.42×10 ⁻⁹		

Farm No.	Site	LCR - As		LCR - Cr		LCR - Pb		TLCR	
		Male	Female	Male	Female	Male	Female	Male	Female
	SP03-04/FN5	1.40×10^{-6}	1.41×10^{-6}	4.17×10^{-6}	4.20×10^{-6}	6.28×10^{-9}	6.33×10^{-9}		
	SP05-06/FN5	9.73×10^{-7}	9.81×10^{-7}	4.07×10^{-6}	4.11×10^{-6}	6.56×10^{-9}	6.61×10^{-9}		
	Mean ± SD	$1.13 \times 10^{-6} \pm 2.41 \times 10^{-7}$	$1.14 \times 10^{-6} \pm 2.43 \times 10^{-7}$	$4.29 \times 10^{-6} \pm 2.12 \times 10^{-7}$	$4.34 \times 10^{-6} \pm 2.42 \times 10^{-7}$	$6.02 \times 10^{-9} \pm 1.13 \times 10^{-9}$	$6.33 \times 10^{-9} \pm 1.54 \times 10^{-10}$		

DISCUSSION

This study assessed dermal exposure to heavy metals among workers at open-system blood cockle farms in Samut Sakhon, Thailand. The main findings revealed that arsenic (As), chromium (Cr), and lead (Pb) were the most prominent contaminants, with As and Cr posing carcinogenic risks above the U.S EPA acceptable level of 1×10^{-6} .

While non-carcinogenic risks were negligible ($HI < 1.0$ for all participants), the Total Lifetime Cancer Risk (TLCR) exceeded regulatory thresholds in both sexes— 5.47×10^{-6} for males and 5.68×10^{-6} for females—highlighting potential chronic health concerns. These results underscore the importance of long-term exposure monitoring in informal aquaculture settings.

Heavy metal concentration and exposure trends

Zinc (Zn) was detected at the highest concentrations, followed by Cr, Pb, and As. Cadmium (Cd) and mercury (Hg) were below quantifiable levels. Notably, As levels in some locations exceeded U.S EPA residential soil screening levels, suggesting chronic exposure concerns. The elevated presence of Cr and As may reflect industrial or legacy contamination, calling for targeted source investigations.

Non-carcinogenic risk

Hazard Quotients (HQs) for all metals were below 1.0, indicating no immediate risk from individual elements. However, Hazard Index (HI) values exceeded 0.01 at several sites—particularly SP03-04/FN1—pointing to potential additive effects. Mean HI values were $4.20 \times 10^{-2} \pm 4.00 \times 10^{-3}$ (males) and $4.30 \times 10^{-2} \pm$

common and warrants ongoing monitoring. A

4.00×10^{-3} (females). While below critical thresholds, these findings underscore the importance of long-term monitoring and consideration of unmodeled co-exposures (e.g., UV, pathogens, or chemical interactions).

Carcinogenic risk analysis

Lifetime Cancer Risk (LCR) from dermal exposure to arsenic (As), chromium (Cr), and lead (Pb) was assessed. Arsenic and chromium contributed most significantly, with mean LCRs exceeding the U.S EPA threshold of 1×10^{-6} in both sexes. Lead posed minimal carcinogenic risk. The aggregated Total Lifetime Cancer Risk (TLCR) reached 5.42×10^{-6} (males) and 5.49×10^{-6} (females), consistently surpassing the regulatory limit. These findings highlight potential long-term carcinogenic hazards in open-system cockle farms and support the need for routine dermal exposure surveillance within national health monitoring frameworks.

These elevated risks likely stem from the known toxicity of As and Cr. Arsenic accumulates in tissues and disrupts DNA repair, while hexavalent chromium (Cr^{6+}) can penetrate the skin, produce reactive oxygen species, and induce mutations even at low exposure levels.(40, 42.

Similar findings were reported by Wongsasuluk et al. (2021) (31). in Ubon Ratchathani, where dermal exposure to arsenic in agricultural soils posed a comparable lifetime cancer risk. Likewise, Raknuzzaman et al. (2016)(13) also identified high As levels in coastal aquaculture farms in Bangladesh, suggesting potential long-term health impacts. These regional and international studies support that chronic dermal exposure to arsenic and other metals in aquatic or agricultural settings is

similar trend was observed in Phitsanulok

province(34). while Li et al. (2015) (43). reported comparable chromium-related risks in Chinese farming communities.

CONCLUSION

This study demonstrates that blood cockle farm workers in Samut Sakhon Province may be at risk of dermal exposure to hazardous levels of arsenic and chromium, both linked to elevated carcinogenic potential. While individual non-carcinogenic risks were below critical thresholds, cumulative effects—as indicated by the Hazard Index (HI) and Total Lifetime Cancer Risk (TLCR)—suggest long-term health concerns.

To mitigate these risks, the following policy interventions are recommended:

- Promotion and enforcement of Personal Protective Equipment (PPE) use during high-contact farming tasks;
- Routine environmental monitoring of heavy metals in soil;
- Long-term biomonitoring to validate exposure models and support occupational health efforts.

These findings provide essential baseline data for environmental health management in coastal aquaculture zones and underscore the need for integrated regulatory strategies. They also reinforce the importance of revisiting soil quality guidelines in agricultural areas adjacent to industrial zones

RECOMMENDATION

This study has certain limitations, including a small number of purposively selected farms and the use of international exposure parameters. These factors may affect the generalizability and precision of the risk estimates. Therefore, future studies are recommended to expand sample coverage, adopt locally derived exposure data, and conduct long-term biomonitoring of exposed populations to validate model estimates and support policy decisions.

ETHICAL DECLARATION

This study has been approved by the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University, with Certificate of Approval—COA No. 008/68.

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MANAGING MENSTRUATION IN CRISIS: CHALLENGES, RESPONSES, AND HUMANITARIAN SOLUTIONS IN DISPLACED CAMPS, SOUTHERN SHAN STATE, MYANMAR

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ABSTRACT

Introduction: Menstrual Hygiene Management (MHM) has been extensively studied in many contexts. However, menstrual health is not prioritized among displaced women, especially in areas marked by conflict. In 2019, nearly 250,000 people in Myanmar became internally displaced, and one-third of women struggled to access MHM sources.

Objectives: This qualitative study explored the challenges of displaced women and girls, their MHM, due to lack of menstrual support in humanitarian assistance.

Methodology: Our study area is located in Southern Shan State where women living in six camps face difficulties accessing sanitary and hygiene products. Secondary data from three Focus Group Discussions (FGDs) among 19 women and girls are used to reveal challenges and responses to MHM among displaced camp women and girls.

Results: Respondents reported feeling embarrassed and inconvenienced in a male vendor's shop. Besides, economic problems and social aspects presented challenges for women who were forced to change their MHM. In their hometown, more than half of the women could afford feminine wash, and in remote areas, women had access to clean water and traditional antiseptic soap to meet their hygiene needs. Furthermore, females expressed frustration that it was uncomfortable to use reusable or washable pads at their camps due to the inadequate area to dry, and several interviewees elaborated on their pain in the lower abdomen and back, mood swings, and tender breasts during their menstrual cycle.

Conclusion: In conclusion, women in displacement are unable to afford these necessities and change their menstrual practices due to economic problems, social aspects, and physical and psychological challenges. Community-based evidence from this study provides potential recommendations for SRH policy refinement by highlighting a pressing immediate need for humanitarian organizations to include disposable pads, hygiene materials, and painkillers in the standard packages provided to displaced women.

Keywords: Displaced women and girls, Health disparities, Migrants, Menstrual hygiene management, Poverty

INTRODUCTION

Menstrual hygiene management (MHM) has been defined by the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO). Effective menstrual hygiene management (MHM) is guaranteed by free access to clean, affordable menstrual products and hygienic, private facilities for disposal and use, as well as the availability of clean water (1). Studies in low- and middle-

income countries such as India, Rajasthan, Mansoura, and Nigeria have determined that more than 50% of girls have inadequate access to MHM facilities (2). Period poverty has also been further compounded in humanitarian situations. In Lebanese refugee camps, a 2021 study revealed that the menstrual health of women is not provided for. Due to the economic crisis, many women and girls cannot afford sanitary

products. The inflation renders them unaffordable. The women are, therefore, forced into period poverty, limiting their access to essential menstrual products (3).

In Myanmar, political conflict and violence have led to severe displacement, further exacerbating menstrual hygiene challenges. In 2019, nearly 250,000 people were internally displaced, with one-third of vulnerable women and girls struggling to access MHM resources. In Kutkai, Northern Shan State, many displaced women and girls live in cramped conditions, with rooms as small as 10 by 15 feet, providing inadequate privacy for changing sanitary pads (4).

Contextual Background of Camps in Taunggyi and Nyaung Shwe

Research primarily focuses on displaced women and girls living in camps within the Taunggyi and Nyaung Shwe districts of Southern Shan State, Myanmar. The women and girls were relocated originally from conflict-affected regions of Kayah State and Northern Shan State. Those areas have experienced prolonged armed conflicts regarding ethnic armed organizations and the Myanmar military. In Kayah State, intense conflict contributed to the displacement of over 170,000 citizens and many sought refuge in Southern Shan State. In that area, the majority of ethnic groups are the Karenni (Kayah) and Shan communities (5).

Southern Shan State is one of the three administrative zones of Shan State adjacent to the north of Thailand and Laos. Taunggyi, Kalaw, Nyaung Shwe, and Pindaya are the main cities in Southern Shan State. The study areas are located in southern Shan State, especially in Taunggyi and Nyaung Shwe. In Nyaung Shwe, there are seven camps: (1) Teit Nan Pagoda, (2) Yangon Kyaung, (3) Mine Li, (4) Phaung Daw Thi, (5) Paung Daw Side Pagoda, (6) Mahar Yan Aung, (7) Law Ka Mar Ya Zein Pagoda, and one camp in Taunggyi – (1) Bhu-ya Kone.

When displaced, there were no specific IDP camps in Nyaung Shwe, but a small camp was established in Taunggyi. The Taunggyi camps are in hard-to-reach areas and menstruating women face limitations in accessing materials, mainly, and financial barriers. Displaced women rely on the neighborhood

shops which have limited materials, brands, and types due to geographical distance. The establishment designs in household settlement give provide displaced families with adequate private spaces, allowing menstruating females to manage their hygiene properly. Nevertheless, two to three households share toilets which are covered by wood and waterproof canvas, and some toilets use zinc sheets for covering. All the restrooms are located in public areas, and there are a few dustbins around the camps, but most people use woven-rice bags to manage their waste.

Displaced women from Nyaung Shwe lived in a religious building, a monastery because there was a large number of displaced families relocating to Nyaung Shwe, where they did not have a specific area for establishment. Therefore, many displaced families have crowded into monasteries, where women have difficulties finding private space, covered by water-proof canvases and blankets. In the buildings, all families share their electricity bills, water expenses, food, and use common bathrooms, restrooms, and a kitchen. Among camps, a little girl has access to gender segregated toilets, but few females deal their hygiene in common toilets. Despite that, the camps are situated near the markets and neighbourhood shops, so they do not have specific challenges, except for logical barriers and material shortages.

Along with providing evidence, the research relied on secondary data to fill the gap and offered guidance on MHM in humanitarian assistance. A qualitative approach was conducted in two diverse humanitarian response settings in Taunggyi and Nyaung Shwe. Unlike the other reviews, the secondary source had a strong strength in revealing the challenges faced by women and girls during the conflict period. The observations highlighted that displaced women had been experiencing difficulties and barriers in managing their menstruation due to the logistical crisis and inadequate space. Key questions guiding the review included: What are the challenges to accessing menstrual products in displacement camps, and how do women in the IDP camps respond to those challenges? The primary objective is to investigate the challenges that affect women's and girls' MHM, including economic and sociocultural challenges.

Theoretical framework

This study is grounded in the Socio-Ecological Framework (SEF) which helps identify the challenges women and girls face and analyze the insightful findings at each level that impact MHM. The framework assesses five key factors: individual (intrapersonal), interpersonal, community, organizational, and policy/enabling environment in alignment with the UNFPA's menstrual health approach. By applying this framework, the study can help address the challenges in menstrual support for displaced women in crisis settings. The study also considers access, dignity, and rights as key dimensions that influence menstrual health support. The research highlights community-based evidence of the barriers and potential gender-transformative solutions in humanitarian assistance. Hence, this content analysis examines the challenges of MHM by identifying barriers, coping strategies, and social stigma, for displaced women and girls.

METHODOLOGY

This study employed a qualitative research method approach using secondary data from focus group discussions collected by Doh Eain Organization to find menstrual hygiene management (MHM) in internally displaced persons (IDP) camps. Doh Eain Organization is a Yangon-based social enterprise in Myanmar with the purpose of urban regeneration, heritage conservation, and community development. The secondary goal is to explore how women respond to MHM situations in displaced camps, and to provide recommendations for humanitarian aid in displaced camps based on evidence findings. The data sources are supportive revealing challenges women face in accessing menstrual hygiene support, which become more prominent during the pandemic and in certain political situations. Additionally, research about Myanmar displaced women is limited, and if the events are not reported in the research, formulating the menstrual policies would be difficult in the future, and all displaced women would be underrepresented soon.

In 2021, an online survey in Yangon revealed that most women and girls purchased

menstrual hygiene products from grocery stores, spending an average of 2,000 – 3,000 mmk monthly. Based on findings, the Sanitary Voucher Pilot Assistance (SVPA) project was launched in peri-urban areas in Yangon funded by the UNFPA Myanmar in 2022 to assess the effectiveness of a voucher system during the crisis.

With funding from UNFPA Myanmar, the Sanitary Voucher Assistance (SVA) Pilot was designed to last for 4 months from September 2024 to January 2025. Two community-based associations – the Taunggyi Education Learning Hub and Shwe Nyaung Pin Rescue, a rescue organization operating in Nyaung Shwe after being originally operated in Loikaw, were selected to collaborate as regional partners (RP) based on youth leadership and previous experience distributing hygiene products in camps.

Additionally, focus group discussions were conducted to achieve a deeper understanding of the use of menstrual hygiene products among beneficiaries at the camps. The focus group discussions involved 19 participants, divided into three groups of 6 to 7 participants each. Project members and regional organization members in Bayargone Village, Nyomee Village Tract, Taunggyi carried out the first group. The other two groups were conducted at Law Ka Mar Ya Zein Pagoda in Nyaung Shwe. In the selection process for FGDs, regional partners assisted in identifying participants based on specific criteria, including women aged between 15 and 49. Typically, Southeast Asia women experience menopause around 51 years old; however, women in interviews are up to 50 years old and they reported that they still have menstruation. On the other hand, older women's involvement in interviews was greater than that of teenagers because adolescents had few braves to answer the questions. In contrast, the women were bold enough to speak out about their menstrual management. However, empirical evidence from Asia populations is limited due to differences in ethnicity, and the findings from Western populations may not apply to Asian population (6).

Doh Eain Organization approved the request to use the secondary data on February 20, 2025. The data was allowed to access FGDs without participants' identification. During the

interviews, the participants were asked to record their consents and handwrite their responses. Regional partners informed each woman and girls about the purpose of the data, which would be expressed in the report.

The researcher utilized content analysis to explain general relationships between predetermined keywords, categories, and variables. To ensure the reflection of codes and themes on reality, the researcher independently examined the data.

The Institutional Review Board of the Institute for Population and Social Research (IPSR-IRB) at Mahidol University approved (COA: IPSR-IRB-2025-031 issued on May 29, 2025) for ethical clearance for this study. The researcher also assured that data analysis, interpretation, presentation, and storage procedures adhered to IPSR-IRB ethical standards.

RESULTS

Challenges to MHM Access

1. The Economic Impact in Menstrual Access

The unemployment conditions and increasing price of products were significant consequences in accessing the menstrual materials and supplies in remote areas. The donations provided strong menstrual support for displaced women and girls in the camps.

A woman said,

"There is no difficulty for me when I relocated here for the first time because residents came to donate each woman one pack. But now, no one is donating to us anymore. If I have the money, there's no problem. When I run out of money, it becomes difficult." P 06 (55 years), from Nyaung Shwe camp, P 08 (50 years old) and above, and P 11 (40-49 years), from Nyaung Shwe camps, also highlighted the same response.

While others were comparing the price difference before and after the condition, one participant from Nyaung Shwe camp pointed out that the geographical distance was a main reason for pricing being double.

"Now the products are expensive in shops. I think it's because of the transportation costs. And home shops do not sell a full category of products."

Personally, I do not want to borrow from others, that is why I use the products donated by public hospitals, but the quality is poor." (P 13, 30-39 years, Nyaung Shwe camps)

Despite the prices of materials increasing at shops, all participants reported that there were no budget constraints, and household expenses were shared and saved for purchasing the materials.

"Even though the materials are expensive, I still have to buy for myself." (P 01, 40-49 years, and 02, 40-49 years, Taunggyi camp)

"I manage expenses on my own. I do not set a fixed amount on those supplies. I buy them, even though prices are higher." (P 18, 40-49 years, Nyaung Shwe camps)

2. Materials Constraints and Quality of Materials

In the meantime, material shortage was an additional challenge in accessing affordable items in camps. Displaced women had limitations regarding product consumption during their menstrual cycle due to a lack of menstrual products lack in home shops.

A woman, from Nyaung Shwe camps, (40-49 years) said her difficulty, *"Here, I have to find the materials everywhere, but most shops sold out. Because not every store sells menstrual products. I have a heavy flow, so daytime pads don't last, and night-use pads work for me only. Those products are not available at the home shop, so I have to go to the market."*

More than half of the women reported using the modern method – disposable pads – to manage their menses at their homes. However, one participant said that *"I do not use any materials while staying at home, I stay in my pants only."* (P 01, 40-49 years, Taunggyi camp)

Menstruators preferred to use disposable pads during their menstruation because they were effective. They answered that their preferences for modern materials included longer-lasting, longer length, thickness, adhesion, and they felt insecure while using them. Generally, daytime-use sanitary pad packs contain 10 pieces per pack, and

nighttime-use packs include either 4 or 8 pieces per pack. However, the quantity may vary depending on the brand.

One individual said, the quality and availability of the materials, "*Some fray a bit, but these materials stay in place. As I cannot afford them, and sometimes shops run out, I switch to others, but the quality is poor, and they are not as good as the preferred brands.*" (P 01, 40-49 years, Taunggyi camp)

Another woman also mentioned a traditional method using cloth pads – that is often employed while staying at home. A significant number of women clearly expressed frustration about using cloth pads due to quality of cloth and space constraints.

"I like sanitary pads. I have tried washable pads before, but they are not good for me, when I ride a motorbike. I like at a monastery; we don't have space to hang up our undergarments. Moreover, they are fabric, and it is a bit rough; that is why I do not use them anymore." (P 12, 30-39 years, Nyaung Shwe camps)

All women bought the materials ahead of time before their menses to get prepared. Some bought one pack while others bought three packs in advance. However, the products were available when women needed them in an urgent situation. Women mentioned, "*I rush to buy the items from the home shop in an urgent situation, but I cannot get the products I like.*" (P 13, 30-39 years, Nyaung Shwe camps)

Women's Responses to MHM in Displacement Settings

1. Purchasing Patterns and Sanitary Protection Materials of Menstrual Items

Menstruation is stigmatized. Many respondents expressed their purchasing patterns which varied from one to another. More than half of the respondents could explicitly describe what they wanted at shops, whereas some pointed out the products because they felt embarrassed. Other participants applied a discrete word "Bread" to depict their needs at shops.

"When buying the sanitary pads, I ask the shopkeepers...can I have monthly pads or

women's product?" (P 14, 20-29 years, Nyaung Shwe camps)

Each woman's menstrual cycle is divergent from time to time. Many individuals spend a minimum of 3 to maximum of 4 pieces per day and a minimum of 1 to a maximum of 4 packs per cycle. When participants were asked about their household dynamics, nearly all respondents confidently described making the decision-making process themselves. At the same time, the adolescents allowed their parents to manage their MH.

"I do not use only one item; I use whatever my mother buys me." (P03, 14-19 years, Taunggyi camp)

"I use what my mother buys me, because she gets exactly what I need." (P05, 14-19 years, from Taunggyi camp)

When asked about their purchasing habits, five participants answered that they bought materials near their homes because of geographical distance. Women told their difficulty, "*I buy the materials at the home shop as I cannot travel far to get to the big shops.*" (P 01, 40-49 years, from Taunggyi camp)

"I can only buy it from home shops. I cannot go to the market because I do not have a motorbike. In our camp, street vendors sell vegetables from a cart; we rely on them for daily groceries." (P 02, 40-49 years, Taunggyi camp)

Many women had access to materials at the market because home shops and the market had different prices.

"I always buy my own supplies at the market because home shops charge a little bit than the market. Even if the price difference is 100 or 50 mmk, I go to the market. Logically, it is a 200 or 300 mmk difference between the market and home shops. Luckily, it is not too far from our camps, so I just walk there to get what I want." (P 07, 40-49 years, Nyaung Shwe camps)

Participants commonly depicted that a shop selling only women's and children's products was their preferred shop type. In the

meantime, some expressed interest in the home shops because they thought there would not be fewer people around and it would be easy to get there.

"There will not be lots of people around, and I think I can get there easily." (P 13, 30-39 years)

"I can get everything that I need in one store. It seems like a complete set because I can buy both children's and women's products altogether." (P 06, 50 years and above, Nyaung Shwe camps)

Many individuals feel comfortable buying menstrual products at female vendors' shops because it is convenient to speak out about what materials are required.

"When I buy them, I get from female vendors' shops. If a man is selling or sitting around, I could not ask about the items, and I pick up another item instead." (P 13, 30-39 years, Nyaung Shwe camps)

The majority of women avoid male vendors when purchasing materials because they feel embarrassed about revealing their needs. One participant said,

"I feel shy. I have an inner conflict and uncertainty whether I should speak up or not. Even at regular shop, I walk away if there is a man selling, and then I come back when there is a woman." (P 10, 40-49 years, from Nyaung Shwe camps)

All menstruators feel insecure about seeing their menstrual materials when they carry them from the shops, therefore, many ask the shopkeepers to pack them in a black, single-use plastic bag. One individual expressed,

"Female vendors understand well. They discreetly pack them in a bag. Some have no experience, and use transparent bags, so it feels so awkward to hold." (P 02, 40-49 years, Taunggyi camp)

2. Discarded System of Used Menstrual Materials

A general of participants is that menstrual health management is adequately addressed during their camps. The overall situation for women is that disposal facilities for used disposable pads were woven rice bags placed in the bathrooms.

"I prefer disposable pads, and I do not like cloth pads. As there is nowhere to dry them, and this is not my home, it is too crowded. When I throw them away, I wrap my used sanitary pads in black, single-use plastic bags, then I put them into woven rice bags, which are placed in the bathroom. There is no bin inside the toilet because it is dirty. The woven rice bags are placed for those who dispose of them in a pit latrine. The garbage truck picks up the trash bags every Tuesday, so we discard them at that time." (P 16, 40-49 years, Nyaung Shwe camps)

3. Menstruation-related Hygiene Habits

Displaced women had access to clean water with some charges in the camps; however, a traditional antiseptic soap, named Carbolic soap, was used as an external topical wash for menstrual hygiene.

"When I get intense vaginal itching, I use feminine wash - PH care, in my hometown as I can get it at any time. But now, I mostly use body soap but not all the time." (P 02, 40-49 years, from Taunggyi camp)

"I have to buy clean water for use. The water from the artesian well costs 3,000 mmk per unit, and the seller pumps it using a generator." (P 03, 14-19 years, Taunggyi camp)

"I use carbolic soap because it is antiseptic, and body soap is too expensive." (P 04, 50 years and above, from Taunggyi camp)

Although beliefs are part of the restrictions in MH, no such restrictions exist in Buddhism. However, all females agreed with one participant's answer about not taking shower very often and not washing hair during menstruation. One of the females energetically mentioned that

"I have one friend who has no bleeding for six months. When the physician advised her,

she started taking blood-regulating medicine. That is why I told her not to take a shower very often, and not to wash her hair during menses." (P 07, 40-49 years, Nyaung Shwe camps)

4. Certain Menstruation-related Health Conditions: Psychologically and Physically

A large number of interviewees spoke significantly about awareness of their mental and physical pain during menstruation. They felt small, impatient, easily frustrated, insecure, and mentally uncomfortable. Others expressed their physical pains such as backaches, abdominal pain, breast tenderness and cramps before their menses.

"I feel impatient at that time. When I do household chores, I get exhausted and feel uncomfortable." (P 02, 40-49 years, Taunggyi camp)

"I have pelvic inflammation, my body muscles are sore, and my breasts are tender, so I know my period is coming soon." (P 18, 40-49 years, Nyaung Shwe camps)

Relying on traditional remedies is common among Burmese women for curing their pain and regulating-blood flow, especially in menstrual health management. The majority of women rely on traditional medicine and homemade remedies to heal their menstrual pains.

"If I have abdominal pain, I mix turmeric powder with salt." (P 13, 30-39 years, Nyaung Shwe camps)

"Before I relocated here, I could afford iron supplements, E-posoft, but now I cannot. If I have lumbar pain, I take iron tonic, Ferrovit. If I cannot afford that, I drink turmeric powder in hot water. The adolescents refuse to take this; they cannot stand the taste." (P 18, 40-49 years, Nyaung Shwe camps)

One of them sadly expressed her feelings,

"My daughter has pains such as dizziness and abdominal pain, so I make her take traditional medicine called "Maha Phay Say"

and watch her closely. Because my husband passed away suddenly death to suffering from abdominal pain, which terrifies me for my children's safety. Also, the clinic is far from here." (P 16, 40-49 years, Nyaung Shwe camps)

"Sanitary pads and pants are essential for me. I take a traditional remedy known as "Ke-thi-pan", when I have period." (P 04, 50 years and above, Taunggyi camp)

DISCUSSION

This research represents a new approach to defining inclusive menstrual support in crisis settings and to developing humanitarian assistance policies that address the specific menstrual needs of displaced women and girls in Myanmar, specifically in Taunggyi, and Nyaung Shwe, Southern Shan State. Displaced women and girls have logistical challenges, material constraints, inappropriate hygiene habits, physical and psychological pains, and non-verifiable medical information. At present, materials costs, and constraints pose challenges to menstrual support, while hygiene habits and menstrual-related remedies limit women's ability to manage their menstrual health, making it difficult to afford the menstrual supplies and materials.

Extraordinary, women and girls could manage their MH with their capabilities at their camps. Nonetheless, their coping strategies were not verifiable to ensure their menstrual hygiene safety. Then, these became additional risks to maintaining good hygiene habits during their menstruation due to the lack of menstrual health education. In the literature, the researchers pointed out that women experience the menstrual health during the period and pre-menstruation time with different symptom and unstable mental issues. A woman living with those symptoms possess the high risk of such as sexually transmitted infection during menstruation (7).

Additionally, menstruators concerned about other females' menstrual health, and their responses were spread generously without verifying with physicians. These practices increase the potential risk of infection. Further investigations should explore the menstrual needs

of displaced women and girls in depth for humanitarian assistance.

At both the intrapersonal and interpersonal levels, the main challenge is financial limitations; however, material constraints and hygiene habits were additional challenges at the intrapersonal level. The issue is also an economic and material burden on all females and their households in high-income countries, where period poverty was not considered a priority in countries' policies (8).

At the community level, the shops of male vendors hindered women's access to materials. Due to cultural constraints, menstruators claimed black single-use plastic bags to wrap their purchased pads to carry on their way back home. This is because in Myanmar, it is a habitual thing for people to stare at women if the sanitary packs are held and carried in front of them. Therefore, women want to avoid the eye-catching behaviors. In contrast, many residents believe that menstrual blood is dirty, and women also see their used pads as miserable, that which is why they apply a black single-use plastic to wrap them before placing them into the trash bins. The misperception is more prominent in low-resource countries than in high-resource ones, that menstruation is the body of impurity (9). Menstruation is an impurity or uncleanness and the major religions' views about menstruation are striking. These taboos exist across religions and cultures, and some include isolation, separation from religious services, and restraint from sexual intercourse. Even though there is no evidence to provide about impurity, every major religion regards menstruating women as impure (10).

Despite Buddhism being dominant in most of Southeast Asia such as Myanmar, Cambodia, Laos, Sri Lanka, and Thailand, the Buddha does not endorse restrictions on menstruating women (9). Nevertheless, cultural beliefs shape the expectation that women should hide their garments, especially in front of men. In Myanmar, a traditional cloth worn around the lower body, the longyi, is associated with the lower part of the body, and it can diminish men's power (pon), which is a spiritual power or dignity. At the organizational level, donated products often had poor quality and did not align with local cultural beliefs; therefore, it is necessary to

consider the camp's condition and facilities when aiming to be a gender-transformative intervention. Although clothing pads are sustainable and beneficial in protecting the environment from their impacts, the barriers for displaced women include limited infrastructure, such as access to private washing and drying facilities for clothes. The clothing pads became incorrect sanitary materials, which women were unfamiliar with and uncomfortable using.

The study highlighted a variety of perceptions of coping strategies in MHM. However, the last case information of the study is understood as being constrained by material factors, including geographical distance and poor economic status, as well as issues with sanitary protection, disposal of menstrual supplies, non-verification of hygiene habits, and access to medical remedies, which can exacerbate physical and psychological pains – factors that contribute to their, limited menstrual knowledge.

CONCLUSION

This research investigated the significant challenges to menstrual support accessibility for displaced women and girls in Myanmar, specifically in Taunggyi and Nyaung Shwe, Southern Shan State. The challenges involved logistical and materials constraints, the involvement of male vendors, and physical and psychological strains.

RECOMMENDATION

The research provides support for formulating menstrual support policies in humanitarian assistance for this vulnerable population, regardless of their economic status and material constraints. In the next stage, these challenges will be a possible direction to address, and existing humanitarian support will be outperformed. It should consider the human-centered design (HCD) approach, an innovative idea for problem-solving (11). In addition, the HCD model aims to accelerate the process by which people handling the issue seek solutions through techniques that encourage participation, communication, and empathy (12). Eventually, the menstrual support system in humanitarian settings can be upgraded to include underwear, sanitary pads, reusable bags for storing and carrying pads, unused paper for disposal, mild

painkillers, feminine wash, and detergent in each humanitarian assistance package as a basic need, with consideration for end-users and their preferences. Overall, menstrual support policies can be formulated as a basic need in each humanitarian assistance for displaced women and girls.

LIMITATIONS

Whilst the findings are unique, there were limitations. Firstly, the secondary source relied on a purposeful sampling process because the FGDs were conducted directly with the confirmed participants. Additionally, as the secondary data were limited, the observations were also limited due to the focus on specific geographic areas within Southern Shan State. Therefore, the findings would differ for different socio-demographic characteristics. In contrast, the majority of the participants were more than 50 years old due to the constrained evidence regarding the menopause age of Myanmar women, and the responses of the younger generation could not be covered because of their shame.

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EFFECTS OF HEALTH-RELATED FACTORS, NEIGHBORHOOD ENVIRONMENT, AND SOCIO-ECONOMIC CHALLENGES ON SUBJECTIVE WELL-BEING AMONG MYANMAR MIGRANT WORKERS IN TAK PROVINCE, THAILAND

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ABSTRACT

Introduction: Over 4.2 million Myanmar migrants are estimated to reside in Thailand. Migrants have become one of the major health issues because of their unmet needs for living and limited support. The prevalence of mental health disorders is higher among the migrant population. A previous study among Myanmar migrant workers in Thailand showed that approximately 50% had depressive symptoms. Subjective well-being (SWB) is recognized to predict and decrease the onset of depression and suicide. It consists of two distinct components: cognitive well-being (life satisfaction) and affective or emotional well-being. Therefore, studying SWB and its influencing factors offers valuable insight into migrant's quality of life. While most studies have focused on the mental health disorders among migrants, a few have explored their SWB conditions and the associated factors. Therefore, this study aimed to assess SWB among Myanmar migrant workers in Mae-Sot District and to evaluate its association with socio-economic challenges, neighborhood environments, and health-related factors.

Objectives: The study aimed to assess SWB among Myanmar migrant workers in Mae-Sot District and to identify its associated socio-economic challenges, neighborhood environments, and health-related factors.

Methodology: A descriptive cross-sectional study was conducted among 265 participants aged 18 years and older who resided in Mae-Sot for at least 6 months. A face-to-face interview was conducted using structured questionnaires adapted from validated standard questionnaires. Descriptive analysis and Chi-square test were performed using SPSS version 27. Finally, Multiple logistic regression analyses were performed to evaluate the determinants of SWB.

Results: A total of 265 Myanmar migrant workers participated in this study. Among them, 130 (49.1%) were male and 135 (50.9%) were female. Nearly half of the participants (49.4%) were highly satisfied with their lives, and 66.4% of participants had a positive emotional balance. In regression analysis, income inequality, income instability, and income growth opportunity were significant predictors of both life satisfaction and affect balance. Participants' self-reported health status and accessibility to healthcare services were positively associated with life satisfaction, while their stress level was inversely associated with positive emotions.

Conclusion: The study proved that the SWB of Myanmar migrant workers in Mae-Sot is influenced by various socio-economic factors such as income inequality, income instability, income development opportunity, social support, and social discrimination. The results point out the need for interventions to improve economic conditions, social environment, and a fair workplace to promote their well-being. Future studies should consider a longitudinal method to explore the causal relationships or a mixed method to get in-depth details of their challenges.

Keywords: Subjective well-being, Health-related factors, Neighborhood-environment, Socio-economic challenges, Myanmar migrants

INTRODUCTION

People leave their home country for job opportunities better future, security reasons, education, and forced displacement (1). According to the United Nations (UN) data in 2020, approximately 3.6 percent of the global population was living outside their home countries (2). In 2022, international migrants made up to 4.7% of the total global labor force, playing an important role in the global economy (3).

According to the International Organization for Migration (IOM) in 2024, Thailand is one of the top three host countries for international migrants in the Southeast Asia Region, with 5.3 million non-Thai individuals in the country (4). As of March 2024, 2.3 million Myanmar nationals are working as registered workers in Thailand, representing 70% of total registered migrants (5).

While people migrate to find better opportunities and improvement in living conditions, in post-migration, migrants usually face various socio-economic stressors like unfairness, low wages, a dirty and dangerous working environment, job insecurity, and language difficulties. Furthermore, ignoring foreign credentials, facing discrimination, and lacking social and professional networks in the host country can hinder the process of securing employment (6,7). Living in overcrowded areas with poor air quality, hygiene, and sanitary services increases the risk of infectious diseases, including respiratory infections. Exposure to social and environmental risk factors, changes in lifestyle, and improper behavioral risk factors also increase the prevalence of common non-communicable diseases (8). Furthermore, Health is a fundamental right for all human beings, but accessibility to equitable healthcare is doubtful among the migrant population. Even with a legal status, many informal barriers limit accessibility to necessary healthcare (9).

Migration and health are closely related, as residential and working environments have a significant impact on both physical and psychological well-being (10). The lack of basic living necessities and limited support has turned migration into a health concern (1). According to the World Health Organization (WHO), 1 in every 8 people around the world is living with

mental health disorders, where anxiety and depressive disorders are the most common. Adverse life events like unemployment, loss of close relatives, and traumatic events are usually associated with depression (11). In addition, more than 720,000 people die by suicide every year (12). Meanwhile, the prevalence of depression and anxiety is higher among refugees and migrants (8). A study conducted among migrants in the UK stated that new migrants experienced a high prevalence of poor emotional well-being. Unemployment, living in poor conditions, inadequate social support, poor language ability, and being victims of discrimination are associated factors for worse emotional health (13). In addition, a study conducted among Myanmar migrant workers in Malaysia showed that 79.2% of participants had poor mental well-being, and duration of stay in Malaysia and not getting financial aid when sick were associated with poor mental well-being (10).

Well-being is through the hedonic and eudemonic distinction. The hedonic well-being refers to the pleasure and positive feelings, whereas eudemonic well-being refers to a sense of meaning, purpose, and fulfillment in life (14). Principally, hedonic well-being typically includes measures of positive emotions, negative emotions, and life satisfaction (14).

Subjective well-being (SWB) refers to a person's perception of their life as desirable, pleasant, and good, regardless of how other people see it. The key characteristics of SWB are that it is inherently subjective and merely requires objective conditions like health, wealth, comfort, and virtue. It includes positive indicators and is not only defined by the lack of negative factors (15). Positive and negative emotions define the affective well-being component, while life satisfaction defines the cognitive or evaluative well-being component (14).

The relationship between SWB and health is an important area of study, and psychologists have focused on the relationship between SWB and mental health. It is found that SWB levels are more significantly associated with mental health than other objective measures (16). Therefore, studying SWB can provide new information about social, economic, and health conditions of the population for policy-making decisions.

In Thailand, suicide rates have increased by 32% between 2017 and 2022, with a reported 31,402 suicide attempts in 2023 (17). In a study among patients with major depressive disorder, the prevalence of suicidality was 64.0% (18). Furthermore, in a study among Myanmar migrant workers in southern Thailand, the prevalence of depressive symptoms was 53.03% of the participants, and was significantly associated with their living and working conditions (19).

Mae Sot district hosts the highest number of non-Thai individuals along the Thai-Myanmar border (20). The majority of migrant workers there do not have a working contract, and there is also a high level of irregular workers who are poorly paid (21). While numerous studies have focused on the mental health disorders among migrants, a few have explored their SWB conditions and the associated factors. Therefore, this study aimed to assess SWB among Myanmar migrant workers in Mae-Sot District and to identify its associated socio-economic challenges, neighborhood environments, and health-related factors.

METHODOLOGY

Study Design

It is a cross-sectional design conducted in Mae Sot District, Tak Province, Thailand. In Tak province, the Mae-Sot district was selected purposively based on the high population of Myanmar migrant workers there. Then, in the Mae-Sot district, Mae-Pa, Mae-Tao, and Mae-Sot subdistricts were selected randomly. Inclusion Criteria were Myanmar migrant workers aged 18 years and above who have been residing in Mae-Sot district for at least 6 months consecutively. Participants who met the criteria and were willing to participate in the study were selected by the Voluntary Sampling method. Data collection was performed between 1st of June and June 30th, and the 265 participants were included for the preliminary analysis of the study.

Data Collection Procedures

After getting approval from the Ethical Committee for Research Ethics (MU-CIRB), with COA No. MU-CIRB 2025/184.2905. The participants were informed about the nature and purpose of the study, and written consent was taken. A face-to-face interview was conducted

using structured questionnaires in the Myanmar language. The researcher filled in the participants' responses in electronic form using the KOBO toolbox. No personal data of the participants was recorded, and the collected data were checked and monitored daily by the researcher to control the quality of the data.

Research Instrument

The structured questionnaire set was used as the measuring instrument of the research. It was developed and adapted from questionnaires and standard measurement tools. In health-related factors, perceived stress levels were measured using the Perceived Stress Scale (22), while in social factors, social discrimination and cultural difference were measured using the Everyday Discrimination Scale (23) and the Cultural Distance Index (24), respectively. In addition, participants' perception of job insecurity was measured by the Job Insecurity Scale (25). In addition, Subjective well-being was measured by using the Satisfaction with Life Scale (26) and the 10-item Positive Affect and Negative Affect Schedule (PANAS) short-form in this study (27). Item-objective congruence (IOC) was calculated based on the evaluation by the three experts. Based on the results, the questionnaires were modified for content validity before they were translated into the Myanmar language. After that, a pilot study was done among 30 Myanmar migrant workers in Nakhon Pathom for the reliability test. Cronbach's alpha value was calculated for each variable, and a value of ≥ 0.7 was accepted, while irrelevant items were removed, and the questionnaire set was finalized.

Data Analysis

The study included 265 participants in the data analysis process. Data analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) software version 27. Firstly, descriptive analyses were employed before Chi-square analyses were performed to find the possible association between the variables. Then, multiple logistic regression (MLR) was performed to identify the independent predictors of both life satisfaction and affect balance. Variables with a p-value ≤ 0.25 in bivariate analysis were included in the initial regression model. A stepwise backward

approach was used to remove non-significant variables systematically. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated, and the variables with p-values less than 0.05 were considered statistically significant.

Ethical Consideration

In the context of research on humans, ethical approval was obtained from the Central Institutional Review Board (CIRB) of Mahidol University with the approval number MU-CIRB 2025/184.2905. The nature, objectives, and purposes of the study were explained to the participants. For those who were willing to participate in the research, written consent was requested. During the interview, no personal information was recorded. All the information acknowledged during the survey is kept

confidential and can only be accessed by the researchers.

RESULTS

A total of 265 Myanmar migrant workers participated in this study. Among them, 130 (49.1%) were male and 135 (50.9%) were female. SWB was evaluated based on its two distinct components: evaluative well-being (life satisfaction) and emotional well-being (affect balance). According to the SWLS scores, nearly half of the participants (49.4%) were categorized as having high life satisfaction (median = 19, QD = 6, Min = 5, Max = 35). In the affective well-being, 33.6% of the participants had a negative affect balance, while 66.4% of participants had a positive affect balance (Median = 4, QD = 4.5, Min = -16, Max = 18).

Table 1 Frequency of Life satisfaction (SWLS) and Affect Balance

Characteristics	Category	Number (n)	Percentage (%)
Life satisfaction	Low satisfaction	134	50.6%
	High satisfaction (Median = 19, QD = 6, Min = 5, Max = 35)	131	49.4%
Affect Balance	Negative Affect	89	33.6%
	Positive Affect (Median = 4, QD = 4.5, Min = -16, Max = 18)	176	66.4%

Table 2 Socio-Demographic Characteristics of the participants (n=265)

Individual Characteristics	Category	Number (n)	Percentage (%)
Sex	Male	130	49.1%
	Female	135	50.9%
Age	18-29	79	29%
	30-39	87	32.8%
	40-49	66	24.9%
	≥ 50	33	12.5%
	(Median = 35, QD = 7.5, Min = 18, Max = 61)		
Marriage	Married	210	79.2%

Individual Characteristics	Category	Number (n)	Percentage (%)
Education	Single	48	18.1%
	Divorced/ Separated	2	0.8%
	Widow	5	1.9%
	No formal Education	16	6.0%
	Primary School	91	34.3%
	Secondary School	79	29.8%
	High School	56	21.1%
	College or higher	23	8.7%
Thai Language skill	Bad skill	198	74.7%
	Good skill	67	25.3%
Occupation	(Median = 6 , QD = 1.5, Min =1, Max = 11)		
	Agriculture	56	21.1%
	Construction	83	31.3%
	Factory	27	10.2%
	Domestic workers	7	2.6%
	Others	92	34.7%
Household Income	Low Income	149	56.2%
	High Income	116	43.8%
Household Number	(Median = 9000, QD = 3,500, Min = 1,500, Max = 48,000)		
	Small Household	213	80.4%
	Large Household	52	19.6%
Registration Status	(Median = 4, QD = 1, Min = 1, Max = 11)		
	Documented	138	52.1%
	Not documented	100	37.7%
	Don't want to mention	27	10.2%

In Table 3, Chi-square analyses showed only income, occupation, and registration status were significantly associated factors among socio-demographic factors, while other factors such as age, sex, marital status, language skill, and household number had no association with life satisfaction. All health-related factors are significantly associated with life satisfaction. In social challenges, perceived social discrimination

and income inequality had an association with life satisfaction, while crime experience and cultural difference did not. In economic challenges, apart from the employment status of the participants, other factors had a significant association with life satisfaction. In the context of the neighboring environment, accessibility to green spaces and facing environmental hazards had no association with satisfaction with life. (Table 2.)

Table 3 Association Between Independent Variables and SWLS

Independent Factors	Category	SWLS Level		Chi-square	
		Low n (%)	High n (%)	X ²	p-value
Sex	Male	68 (52.3%)	62 (47.7%)	0.310	0.578
	Female	66 (48.9%)	69 (51.1%)		
Age	Young adult	85 (51.2%)	81 (48.8%)	0.073	0.788
	Old adult	49 (49.5)	50 (50.5%)		
Marital Status	Married	105 (50%)	105 (50%)	0.130	0.719
	Single or other	29 (52.7%)	26 (47.3%)		
Education	Secondary school or less	92 (49.5%)	94 (50.5%)	0.304	0.581
	High school or above	42 (53.2%)	37 (46.8%)		
Language Skill	Low skill	104 (52.5%)	94 (47.5%)	1.203	0.273
	High skill	30 (44.8%)	37 (55.2%)		
Income	Low Income	93 (62.4%)	56 (37.6%)	19.122	<0.001***
	High Income	41 (35.3%)	75 (64.7%)		
Household Number	Small Household	108 (50.7%)	105 (49.3%)	0.008	0.927
	Large Household	26 (50%)	26 (50%)		
Occupation	Industrial job	45 (40.9%)	65 (59.1%)	7.016	0.008**
	Non-industrial job	89 (57.4%)	66 (42.6%)		
Register Status	Documented	58 (42.0%)	80 (58.0%)	8.396	0.004**
	Not Documented	76 (59.8%)	51 (40.2%)		
Self-reported Health Status	Poor	91 (59.1%)	63 (40.9%)	10.689	0.001**
	Good	43 (38.7%)	68 (61.3%)		
Perceived Stress Level	Low Stress	45 (36.3%)	79 (63.7%)	19.000	<0.001***
	High Stress	89 (63.1%)	52 (36.9%)		

Independent Factors	Category	SWLS Level		Chi-square	
		Low n (%)	High n (%)	X ²	p-value
Perceived Social Support	Low Social Support	80 (60.2%)	53 (39.8%)	9.812	0.002**
	High Social Support	54 (40.9%)	78 (59.1%)		
Perceived Social Discrimination	Low Discrimination	64 (44.1%)	81 (55.9%)	5.293	0.021*
	High Discrimination	70 (58.3%)	50 (41.7%)		
Income Inequality	Low Inequality	60 (41.7%)	84 (58.3%)	9.992	0.002**
	High Inequality	74 (61.2%)	47 (38.8%)		
Crime Experience	Absence	90 (50.8%)	87 (49.2%)	0.017	0.897
	Presence	44 (50.0%)	44 (50.0%)		
Cultural Difference	Low Difference	71 (49.3%)	73 (50.7%)	0.200	0.654
	High Difference	63 (52.1%)	58 (47.9%)		
Employment Status	Part-time or other	84 (49.7%)	85 (50.3%)	0.139	0.710
	Full-time	50 (52.1%)	46 (47.9%)		
Job insecurity	Low job insecurity	69 (44.2%)	87 (55.8%)	6.090	0.014*
	High job insecurity	65 (59.6%)	44 (40.4%)		
Income Instability	Low Instability	42 (31.1%)	93 (68.9%)	41.669	<0.001***
	High Instability	92 (70.8%)	38 (29.2%)		
Income Growth Opportunity	Low Opportunity	95 (68.3%)	44 (31.7%)	36.969	<0.001***
	High Opportunity	39 (31.0%)	87 (69.0%)		
Accessibility to Health Care	Low accessibility	91 (61.1%)	58 (38.9%)	15.035	<0.001***
	High accessibility	43 (37.1%)	73 (62.9%)		
Perceived quality of physical environment	Low quality	83 (58.5%)	59 (41.5%)	7.609	0.006**
	High quality	51 (41.5%)	72 (58.5%)		
Accessibility to green spaces	Low accessibility	71 (52.6%)	64 (47.4%)	0.452	0.501

Independent Factors	Category	SWLS Level		Chi-square	
		Low n (%)	High n (%)	X ²	p-value
Facing environmental hazards like flooding and landslides	High accessibility	63 (48.5%)	67 (51.5%)	0.290	0.591
	Not experienced	126 (51.0%)	121 (49.0%)		
	Experienced	8 (44.4%)	10 (49.4%)		

Note. Young adult - ≤ 39 years, Old adult ≥ 40 , * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 4, participants' sex, income level, occupation type, and register status were associated with affect balance. As in life satisfaction, all health-related factors had a significant association with emotional balance. In social challenges, all the factors had no association with affect balance except for social

discrimination levels. Employment status still did not have an association with emotional balance, while other economic factors showed significant associations. In environmental factors, only the quality physical environment had an association with emotional state, while the rest did not.

Table 4 Association Between Independent Variables and Affect Balance

Dependent Factors	Category	Affect balance		Chi-square	
		Negative n (%)	Positive n (%)	X ²	p-value
Sex	Male	35 (26.9%)	95 (73.1%)	5.077	0.024*
	Female	54 (40.0%)	81 (60%)		
Age	Young adult	55 (33.1%)	111 (66.9%)	0.041	0.840
	Old adult	34 (34.3%)	65 (65.7%)		
Marital Status	Married	70 (33.3%)	140 (66.7%)	0.029	0.865
	Single or other	19 (34.5%)	36 (65.5%)		
Education	Secondary school or less	62 (33.3%)	124 (66.7%)	0.018	0.894
	High school or above	27 (34.2%)	52 (65.8%)		
Language Skill	Low skill	66 (33.3%)	132 (66.7%)	0.22	0.882
	High skill	23 (34.3%)	44 (65.7%)		
Income	Low Income	60 (40.3%)	89 (59.7%)	6.817	0.009**

Dependent Factors	Category	Affect balance		Chi-square	
		Negative n (%)	Positive n (%)	X ²	p-value
Household Number	High Income	29 (25.0%)	87 (75.0%)		
	Small Household	75 (35.2%)	138 (64.8%)	1.287	0.257
	Large Household	14 (26.9%)	38 (73.1%)		
Occupation	Industrial job	26 (23.6%)	84 (76.4%)	8.345	0.004**
	Non-industrial job	63 (40.6%)	92 (59.4%)		
Register Status	Documented	37 (26.8%)	101 (73.2%)	5.923	0.015*
	Not Documented	52 (40.9%)	75 (59.1%)		
Self-reported Health Status	Poor	63 (40.9%)	91 (59.1%)	8.842	0.003**
	Good	26 (23.4%)	85 (76.6%)		
Perceived Stress Level	Low Stress	21 (16.9%)	103 (83.1%)	28.962	<0.001***
	High Stress	68 (48.2%)	73 (51.8%)		
Perceived Social Support	Low Social Support	57 (42.9%)	76 (57.1%)	10.292	0.001**
	High Social Support	32 (24.2%)	100 (75.8%)		
Perceived Social Discrimination	Low Discrimination	39 (26.9%)	106 (73.1%)	6.422	0.011*
	High Discrimination	50 (41.7%)	70 (58.3%)		
Income Inequality	Low Inequality	41 (28.5%)	103 (71.5%)	3.696	0.055
	High Inequality	48 (39.7%)	73 (60.3%)		
Crime Experience	Absence	56 (31.6%)	121 (68.4%)	0.905	0.341
	Presence	33 (37.5%)	55 (62.5%)		
Cultural Difference	Low Difference	44 (30.6%)	100 (69.4%)	1.298	0.255
	High Difference	45 (37.2%)	76 (62.8%)		
Employment Status	Part-time or other	62 (36.7%)	107 (63.3%)	2.012	0.156
	Full-time	27 (28.1%)	69 (71.9%)		

Dependent Factors	Category	Affect balance		Chi-square	
		Negative n (%)	Positive n (%)	X ²	p-value
Job insecurity	Low job insecurity	39 (25.0%)	117 (75.0%)	12.532	<0.001***
	High job insecurity	50 (45.9%)	59 (54.1%)		
Income Instability	Low Instability	28 (20.7%)	107 (79.3%)	20.353	<0.001***
	High Instability	61 (46.9%)	69 (53.1%)		
Income Growth Opportunity	Low Opportunity	65 (46.8%)	74 (53.2%)	22.759	<0.001***
	High Opportunity	24 (19%)	102 (81.0%)		
Accessibility to Health Care	Low accessibility	56 (37.6%)	93 (62.4%)	2.440	0.118
	High accessibility	33 (28.4%)	83 (71.6%)		
Perceived quality of physical environment	Low quality	62 (43.7%)	80 (56.3%)	13.928	<0.001***
	High quality	27 (22.0%)	96 (78.0%)		
Accessibility to green spaces	Low accessibility	51 (37.8%)	84 (62.2%)	2.169	0.141
	High accessibility	38 (29.2%)	92 (70.8%)		
Facing environmental hazards like flooding and landslides	Not experienced	84 (34.0%)	163 (66.0%)	0.292	0.589
	Experienced	5 (27.8%)	13 (72.2%)		

Note. Young adult - ≤ 39 years, Old adult ≥ 40 , * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 5, several factors remained as statistically significant predictors of higher life satisfaction. Healthy participants were nearly 2 times more likely to report high life satisfaction than those with poor health (AOR = 1.981, $p = 0.024$). Those who perceived lower income inequality had significantly greater odds of having greater life satisfaction. (AOR= 2.78, $p = 0.001$). Participants who experienced higher

income instability were less likely to report high life satisfaction (AOR=0.337, $p < 0.001$). Migrant workers, perceiving high opportunity for income growth, were four times more likely to report higher life satisfaction. (AOR= 4.111, $p < 0.001$). Furthermore, participants who had better access to healthcare services had greater life satisfaction. (AOR = 2.228, $p = 0.008$).

Table 5 Bivariate and Multiple Logistic Regression Analysis of Factors Associated with SWLS

Variable	Reference	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Sex	Male	Female	1.147 (0.708-1.857)	0.578		
Age	Young adult	Old adult	1.071 (0.651-1.762)	0.788		
Marital Status	Married	Single or other	0.897 (0.495-1.625)	0.719		
Education	Secondary school or less	High school or above	0.862 (0.509-1.461)	0.581		
Language Skill	Low skill	High skill	1.365 (0.782-2.380)	0.274		
Income	Low Income	High Income	3.038 (1.834-5.033)	<0.001***		
Household Number	Small Household	Large Household	1.029 (0.561-1.886)	0.927		
Occupation	Industrial job	Non-industrial job	0.513 (0.313-0.843)	0.008**		
Register Status	Not Documented	Documented	2.055 (1.259-3.355)	0.004**		
Self-reported Health Status	Bad	Good	2.284 (1.387-3.762)	0.001**	1.981 (1.096 – 3.579)	0.024*
Perceived Stress Level	High Stress	Low Stress	3.005 (1.821-4.959)	<0.001***		
Perceived Social Support	Low Social Support	High Social Support	2.180 (1.335-3.562)	0.002**		
Perceived Social Discrimination	High Discrimination	Low Discrimination	1.772 (1.087-2.889)	0.022*		
Income Inequality	High Inequality	Low Inequality	2.204 (1.346-3.610)	0.002**	2.782 (1.520 – 5.093)	0.001**

Variable	Reference	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Crime Experience	Absence	Presence	1.034 (0.620-1.725)	0.897		
Cultural Difference	Low Difference	High Difference	0.895 (0.552-1.452)	0.654		
Employment Status	Full-time	Part-time or other	1.100 (0.666-1.816)	0.710		
Job insecurity	Low job insecurity	High job insecurity	0.537 (0.327-0.882)	0.014*		
Income Instability	Low Instability	High Instability	0.187 (0.110-0.315)	<0.001***	0.337 (0.188 – 0.604)	<0.001***
Income Growth Opportunity	Low Opportunity	High Opportunity	4.816 (2.863-8.101)	<0.001***	4.111 (2.262 – 7.471)	<0.001***
Accessibility to Health Care	Low accessibility	High accessibility	2.664 (1.615-4.393)	<0.001***	2.228 (1.237 – 4.013)	0.008**
Perceived quality of physical environment	Low quality	High quality	1.986 (1.217-3.242)	0.006**		
Accessibility to green spaces	Low accessibility	High accessibility	1.180 (0.729-1.911)	0.501		
Facing environmental hazards like flooding and landslides	Not experienced	Experienced	1.302 (0.497-3.408)	0.591		

Note. Young adult - ≤ 39 years, Old adult ≥ 40 , * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In table 6, the final MLR model also identified several significant indicators of positive emotional balance. Participants with lower stress had significantly greater odds of positive emotions (AOR = 3.07, $p < 0.001$). Those who perceived lower income inequality were more likely to report positive emotional

balance, while income instability significantly reduced the odds of positive affect balance (AOR = 0.494, $p = 0.022$). Meanwhile, participants, having a greater income growth opportunity, were more likely to report a positive affect balance. (AOR = 2.633, $p = 0.002$).

Table 6 Bivariate and Multiple Logistic Regression Analysis of Factors Associated with Affect Balance

Variable	Reference	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Sex	Male	Female	0.553 (0.329-0.928)	0.025*		
Age	Young adult	Old adult	0.947 (0.560-1.603)	0.840		
Marital Status	Married	Single or other	0.947 (0.507-1.771)	0.865		
Education	Secondary school or less	High school or above	0.963 (0.552-1.679)	0.894		
Language Skill	Low skill	High skill	0.957 (0.533_1.716)	0.882		
Income	Low Income	High Income	2.022 (1.187-3.445)	0.010**		
Household Number	Small Household	Large Household	1.475 (0.752-2.895)	0.258		
Occupation	Industrial job	Non- industrial job	0.452 (0.262_0.779)	0.004**		
Register Status	Not Documented	Documented	1.893 (1.129-3.173)	0.016*		
Self-reported Health Status	Bad	Good	2.263 (1.313-3.900)	0.003**		
Perceived Stress Level	High Stress	Low Stress	4.569 (2.574-8.110)	<0.001***	3.070 (1.656 – 5.694)	<0.001***
Perceived Social Support	Low Social Support	High Social Support	2.344 (1.385-3.965)	0.001**		
Perceived Social Discrimination	High Discrimination	Low Discrimina- tion	1.941 (1.159-3.253)	0.012*		
Income Inequality	High Inequality	Low Inequality	1.652 (0.989-2.760)	0.055	1.854 (1.024- 3.357)	0.042*

Variable	Reference	Comparison	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Crime Experience	Absence	Presence	0.771 (0.452-1.317)	0.342		
Cultural Difference	Low Difference	High Difference	0.743 (0.446-1.239)	0.255		
Employment Status	Full-time	Part-time or other	0.675 (0.392-1.163)	0.157		
Job insecurity	Low job insecurity	High job insecurity	0.393 (0.233-0.633)	<0.001***		
Income Instability	Low Instability	High Instability	0.296 (0.172-0.508)	<0.001***	0.494 (0.271 – 0.903)	0.022*
Income Growth Opportunity	Low Opportunity	High Opportunity	3.733 (2.142-6.507)	<0.001***	2.633 (1.420 – 4.881)	0.002**
Accessibility to Health Care	Low accessibility	High accessibility	1.514 (0.899-2.553)	0.119		
Perceived quality of physical environment	Low quality	High quality	2.756 (1.605-4.731)	<0.001***		
Accessibility to green spaces	Low accessibility	High accessibility	1.470 (0.879-2.457)	0.142	1.742 (0.972 – 3.120)	0.062
Facing environmental hazards like flooding and landslides	Not experienced	Experienced	1.340 (0.462-3.885)	0.590		

Note. Young adult - ≤ 39 years, Old adult ≥ 40 , * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

DISCUSSION

In this study, 49.4% of the migrant workers had high levels of life satisfaction, while 66.4% had positive emotional balance. Migrants usually have a lower level of happiness than ever before in their home country because of their challenges in host countries. However, there is another concept that migrants would increase their SWB level in the host country because of their hope of achieving their goals, better job opportunities, and career development (28). So,

this finding supports the latter concept. Participants in better health conditions were nearly 2 times more likely to report high life satisfaction. This finding is consistent with previous finding that people with better health condition are more likely to have higher level of subjective well-being which leads to better health and longevity (29).

Extreme poverty, lack of job opportunity, financial difficulty, and route of migration are common pre-migration stressors for the migrants

(8). In post-migration, they have to face many challenges in new places (5, 30). This study reported that lower stress level can predict their positive emotional balance significantly.

The study also found that income inequality significantly predicted the SWB of the participants, even though the income level was not a significantly associated factor. Those who perceived lower income inequality tended to report higher levels of life satisfaction and positive emotional balance. This finding supports existing literature, suggesting that not only the level of income, but also its distribution, plays a critical role in well-being (31).

Another significant predictor of SWB is income instability. Greater income instability was associated with a lower likelihood of reporting high life satisfaction and positive emotional well-being. This suggests that income alone is not responsible for financial security and satisfaction (32). Furthermore, previous studies have indicated that life satisfaction does not increase linearly with personal income (16). Therefore, policymakers' efforts to slightly increase the household income may not significantly improve people's SWB because of the subjective nature of financial satisfaction (32).

Furthermore, income growth opportunity successfully predicted the participants' SWB. Those who had high levels of income growth opportunity tended to be more satisfied with their life and had positive emotions. This finding is consistent with the previous study among Taiwanese workers, which found that career growth opportunities played an important role in job satisfaction, turnover rate, and emotional exhaustion (33).

Lastly, participants with better access to healthcare services were more likely to report higher life satisfaction. This finding highlights the important role of healthcare accessibility in shaping the well-being of the migrant population. Despite being a universal human right, getting equitable access to necessary healthcare services is still a challenge for this marginalized population. Barriers like language difficulty, poor neighborhood conditions, lack of financial support, and fear of being arrested, especially for undocumented immigrants, often prevent them from accessing necessary healthcare services (13, 29).

RECOMMENDATION

Based on the findings, improving healthcare accessibility, reducing income instability and income inequality among migrants and locals, while promoting opportunities for income or career growth, should be prioritized by both local authorities and NGOs working with the migrant population. A strong social support system is recommended to relieve the stressors of the migrant workers, especially in their working and residential environments. In addition, future studies should consider a longitudinal or mixed method to explore the causal relationships and better understanding of their life.

LIMITATION

As a cross-sectional study, it cannot establish causal relationships between the independent variables and SWB. Participants' stress levels, health status, social supports, and well-being conditions were assessed through self-reported questionnaires, which may be subject to biases and recall errors. Furthermore, the generalizability of the findings is limited as the study was conducted only in Mae-Sot, a single border district in Thailand. Therefore, the results may not represent the broader population of Myanmar migrant workers in the whole country.

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DEMOGRAPHIC DETERMINANTS OF WORKFORCE PARTICIPATION AMONG THE OLDER PERSONS IN INDONESIA

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ABSTRACT

Background: Indonesia is entering the aging society phase, with a growing population aged 60 and above. While this shift offers potential for productive aging, many older individuals remain outside the labor force. As the country prepares for its demographic transition and sustainable development goals, it is vital to understand how demographic factors influence older persons' employment.

Objectives: This study aimed to examine the relationship between demographic characteristics and employment status among older persons individuals in Indonesia.

Methodology: This cross-sectional study used data from the 2023 National Socio-Economic Survey (Susenas), including 115,783 individuals aged 60 years and above. Inclusion criteria were individuals aged 60+ who are Indonesian citizens residing in the country. Excluded were those living in military barracks, dormitories, prisons, orphanages, or similar institutions. Employment status was categorized as unemployed, formally employed, or informally employed. Descriptive analyses and chi-square tests were conducted to assess associations between employment status and demographic variables: sex, education, marital status, household size, and region.

Results: Most older persons were informally employed (51.5%), followed by 10.1% formally employed and 38.4% unemployed. Employment was significantly associated with all demographic factors studied ($p < 0.001$). Males were more likely to be employed than females. Most working older persons had only primary or no formal education. Divorced individuals and those in small households (2–4 members) had the highest participation. Java and Sumatera had the highest older persons' employment participation, while Maluku and Papua had the lowest.

Conclusion: Demographic factors are strongly associated with employment among older Indonesians. Targeted policies are needed to expand job access and social protection for this group, supporting active aging. Interventions should focus on education, gender equity, and support for informal workers. Future research should examine the role of health and social services in employment outcomes.

Keywords: Older persons, Employment Status, Demographic Factors, Indonesia.

INTRODUCTION

Population aging represents a pervasive global phenomenon characterized by an increasing proportion of older individuals within the population. This demographic transformation is predominantly attributable to declining fertility rates and rising life expectancy, both of which are outcomes of advancements in healthcare and broader socio-economic development (1,2). Reductions in fertility rates are largely influenced by enhanced access to education, urbanization, and the widespread availability of family planning services, culminating in smaller family units

and a diminished proportion of younger cohorts (3,4). Concurrently, significant progress in medical science and healthcare delivery has extended life expectancy, enabling a greater number of individuals to reach advanced ages (5,6). Collectively, these dynamics underpin a demographic transition, wherein societies shift from regimes of high fertility and mortality to lower rates, resulting in an increasingly aged population structure.

Indonesia is currently experiencing such a demographic transition, progressing toward the status of an aging society. Data from the 2023 National Socio-Economic Survey

(Susenas) indicate that individuals aged 60 years and above constitute a growing segment of the population (7). This demographic evolution presents both challenges and opportunities in areas such as economic participation, healthcare provision, and social protection. While older adults possess the potential to contribute substantially to economic activities, a considerable proportion remain either unemployed or engaged in informal sectors. In 2023, only 61.6% of the older persons was economically active, with 51.5% participating in informal employment, 10.1% in formal sectors, and 38.4% classified as unemployed (7).

Demographic projections further suggest that Indonesia, akin to other developing nations in Asia, is undergoing rapid demographic changes (8). The country confronts the imperative of addressing the needs of a swiftly aging population, necessitating the development of robust, affordable, and sustainable healthcare systems, social security mechanisms, and pension schemes to support its expanding older persons demographic (9,10). Moreover, it is essential for Indonesia to harness the potential benefits associated with increased longevity and improved health, which may enhance labor force participation among older adults.

Access to healthcare is critical for preserving the physical and mental health required for older adults to remain economically productive (11). SDG 8, on the other hand, seeks to foster sustained, inclusive economic growth and decent work for all, inherently encompassing the active engagement of older individuals in the labor market (12). Achieving these objectives necessitates a comprehensive understanding of the multifaceted factors influencing labor market participation among the older persons. In the Indonesian context, aligning national policy frameworks with the SDGs, as well as Presidential Decree Number 88 (2021) concerning the national strategy for aging, can enhance the quality of life for older adults while promoting their continued economic involvement (13). Such policy alignment is vital for cultivating an environment in which older individuals can flourish and make meaningful contributions to society.

Despite these considerations, research on older persons labor force participation in Indonesia reveals several notable gaps. Firstly,

existing studies often concentrate on specific subpopulations or geographic regions, lacking comprehensive comparative analyses across Indonesia's diverse contexts—particularly between rural and urban settings, where patterns of older persons employment diverge significantly. For instance, older adults in rural areas are predominantly engaged in agriculture, whereas their urban counterparts may have greater access to services but encounter distinct challenges (14). Secondly, a substantial proportion of older persons workers are employed in the informal sector, characterized by low wages, job insecurity, absence of social protection, limited access to training, and age-based discrimination, all of which impede their ability to secure decent employment (14,15).

In summary, the determinants of labor force participation among Indonesia's older persons are shaped by a complex interplay of demographic and policy-related variables. Elucidating these determinants is crucial for formulating effective interventions aimed at enhancing the economic engagement of older individuals, thereby benefiting both the aging population and the broader national economy. This study seeks to examine the association between demographic factors and employment status among older persons, with the objective of identifying groups most susceptible to labor market exclusion and informing the development of inclusive policy responses.

METHODOLOGY

Study Design

This study used a cross-sectional design, analyzing secondary data from all 34 provinces in Indonesia, grouped into 7 regions. The focus was on individuals aged 60 years and above, examining their participation in the workforce whether they continued working or retired at both individual and household levels. The main aim was to assess how demographic, are related to employment among the older persons (16). While this design allows for identifying associations, it does not establish causal relationships between variables.

Study Source

Data for this study came from the National Socio-Economic Survey (Susenas), a large-scale household survey conducted by Statistics Indonesia (BPS). Susenas collects information on various aspects of social and economic conditions, including education,

employment, health, and household characteristics. The survey is carried out twice a year and uses strict recruitment and data validation processes to ensure quality. The March 2023 Susenas provided representative data at the district, provincial, and national levels. Both household and individual data were used, focusing on socio-demographic characteristics, employment, health, and social protection. This study used processed data from the Directorate for Poverty Alleviation and Social Welfare, Ministry of National Development Planning. Sample weighting provided by BPS was applied during analysis to ensure representativeness and generalizability to the national population.

Operational Definition of Employment Status

Employment status was categorized into three groups:

- a. **Unemployed:** Refers to older persons (aged 60 and above) who are not involved in any type of income-generating or economic activity during the reference period.
- b. **Formal Workers:** Older persons who are actively working and have more stable job arrangements, such as being employees in government or private

companies, or entrepreneurs who run a business with permanent, paid workers. These individuals typically have clearer employment terms and may receive wages or social protection benefits.

- c. **Informal Workers:** Older persons who are still engaged in work but under more flexible or less secure conditions. This group includes self-employed individuals, small business owners with unpaid or temporary helpers, casual laborers (in agriculture or other sectors), and family members who help with work without getting paid. They often lack formal contracts and access to employment-related benefits.

Study Population and Sample

The survey covered all 34 provinces in Indonesia, with samples from 514 districts and cities. In total, Susenas 2023 observed 1,223,377 individuals. For this study, the target population was all men and women in Indonesia aged 60 years and above. After applying inclusion and exclusion criteria, 115,783 older persons were included, of whom 71,367 were actively working.

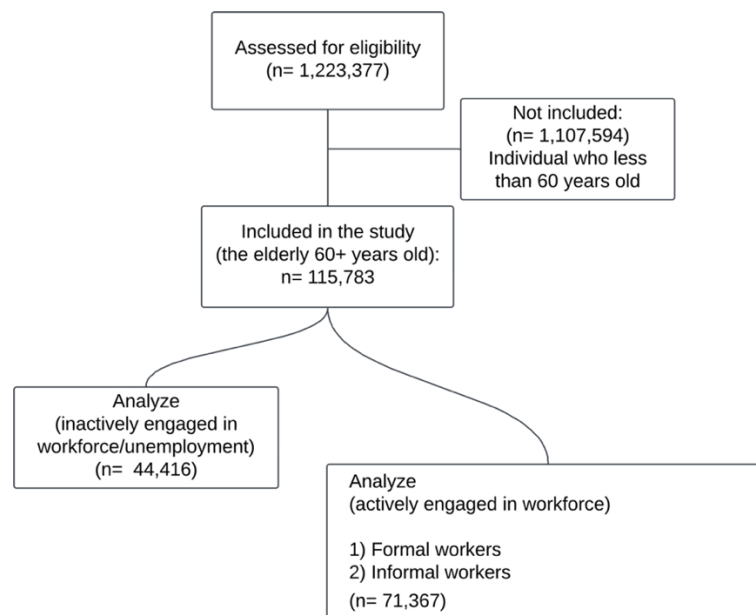


Figure 1 Study Population and Sample

Inclusion Criteria: Individuals aged 60 years or older Residents of Indonesia

Exclusion Criteria: Individuals living in institutions such as military barracks, dormitories, prisons, or orphanages

Data Management and Analysis

Both descriptive and bivariate analyses were used. Descriptive analysis included frequencies, and percentages for all variables. Bivariate analysis involved chi-square tests to examine the association between demographic factors and employment status. Employment status was categorized as unemployed, formally employed, or informally employed.

RESULT

As presented in Table 1, the majority of older persons populations were actively employed, with the majority of these individuals (51.5% of the total older persons population) engaged in informal employment and a smaller percentage (10.1% of the total older persons population) in formal employment. Meanwhile, a 38.4% of the older persons population were unemployed. This distribution highlights the predominance of informal work among older adults, with formal sector participation remaining relatively low.

Table 1 Distribution of employment status among older persons worker in Indonesia

Employment Status	Frequency	Percentage (%)
Unemployed	44,416	38.4
Formal Worker	11,740	10.1
Informal Worker	59,627	51.5
Total	115,783	100.0

Table 2. summarizes the associations between key demographic variables and employment status among older persons, as determined by chi-square tests. The results

demonstrate that employment status among the older persons in Indonesia has a statistically significant association with all demographic factors.

Table 2 Association between independent variables and workforce participation among older persons

Variable	Workforce participation			P-value
	Unemployed (%)	Formal Worker (%)	Informal Worker (%)	
Sex				$\chi^2=15558.37$ ($p<0.001$)
Male	11,591 (20.5)	8,561 (15.1)	36,486 (64.4)	
Female	32,825 (55.5)	3,179 (5.4)	23,141 (39.1)	
Household Category				$\chi^2=514.48$ ($p<0.001$)
Alone: 1 HH member	5,567 (40.2)	1,487 (10.7)	6,805 (49.1)	
Small: 2-4 HH member	27,715 (36.2)	8,078 (10.6)	40,716 (53.2)	
Medium: 5-6 HH member	8,553 (43.7)	1,696 (8.7)	9,327 (47.6)	
Large: >7 HH member	2,581 (44.2)	479 (8.2)	2,779 (47.6)	
Education Level				$\chi^2 = 2737.23$ ($p <0.001$)
Didn't have any education certificate	11,817 (36.1)	2,861 (8.7)	18,060 (55.2)	

Variable	Workforce participation			P-value
	Unemployed (%)	Formal Worker (%)	Informal Worker (%)	
Elementary school	12,873 (33.4)	3,965 (10.3)	21,649 (56.3)	
Junior high school	4,582 (39.0)	1,429 (12.2)	5,734 (48.8)	
Senior high school	5,942 (46.7)	1,651 (13.0)	5,137 (40.4)	
University/Higher	4,344 (55.9)	1,109 (14.3)	2,319 (29.8)	
Marital Status				$\chi^2=4362.26$ ($p<0.001$)
Never married	722 (44.1)	176 (10.7)	741 (45.2)	
Married	24,251 (31.8)	8,566 (11.2)	43,484 (57.0)	
Divorced	1,022 (37.8)	292 (10.8)	1,387 (51.4)	
Widowed	18,421 (52.4)	2,706 (7.7)	14,015 (39.9)	
Island Group (Region)				$\chi^2=1020.41$ ($p<0.001$)
Sumatera	10,318 (37.3)	3,227 (11.7)	14,082 (51.0)	
Java	16,995 (38.9)	4,890 (11.2)	21,781 (49.9)	
Kalimantan	3,622 (40.9)	911 (10.3)	4,320 (48.8)	
Sulawesi	6,584 (41.5)	1,259 (7.9)	8,021 (50.6)	
Bali & Nusa Tenggara	3,294 (32.9)	589 (5.9)	6,140 (61.3)	
Maluku	1,296 (36.1)	276 (7.7)	2,018 (56.2)	
Papua	1,102 (28.6)	281 (7.3)	2,465 (64.1)	

There was a statistically significant association between education level and workforce participation ($\chi^2 = 2737.23$, $p < 0.001$). Older persons with lower education level such as no formal education, elementary school, and junior high school were most likely to be unemployed (55.2%, 56.3%, and 48.3%, respectively). In contrast, those with higher educational attainment (university or above) had a greater likelihood of unemployment/not working (46.7% and 55.9%). This suggests that higher education facilitates more prefer retired in old age.

Marital status was also significantly associated with employment status ($\chi^2 = 4362.26$, $p < 0.001$). Married older persons exhibited the highest participation in both formal (11.2%) and informal employment (57%), while widowed individuals had higher unemployment percentage (52.4%). This indicates that marital status may provide social and economic support that encourages continued workforce participation.

A significant gender disparity was observed in employment status ($\chi^2 = 15558.37$,

$p < 0.001$). Male older persons were more likely to be employed, especially in informal work (64.4%), and had a lower unemployment rate (20.5%) compared to females. In contrast, most older persons women were unemployed (55.5%), and only 5.4% were in formal employment. These findings highlight persistent gender inequalities in labor force participation among the older persons.

Household size was significantly related to employment status ($\chi^2 = 514.48$, $p < 0.001$). Older persons individuals living alone or in large households (>7 members) had the highest unemployment rates (40.2% and 44.2%, respectively). Those residing in small (2–4 members) or medium-sized households (5–6 members) were more likely to be employed, particularly in informal work (53.2% and 47.0%, respectively). This suggests that household composition may influence the economic activity of older adults, possibly due to shared responsibilities or economic necessity.

Regional differences in employment status were also significant ($\chi^2 = 1020.41$, $p < 0.001$). Older persons residents of Papua and Bali & Nusa Tenggara displayed the highest rates of informal workers (64.1% and 61.3%, respectively). In contrast, regions such as Sulawesi and Kalimantan had higher proportions of unemployment worker (41.5% and 40.9%, respectively) and lower formal employment rates. These findings indicate that regional disparities persist in older persons labor force participation, potentially reflecting differences in economic development, labor market structure, and social support systems across Indonesia.

These findings show that many factors like gender, education, marital status, household size, and where someone lives are closely tied to whether older persons in Indonesia are still working, and in what kind of jobs. Most are engaged in informal work, with limited access to stable, formal jobs. Women and those with lower education levels are more likely to be unemployed, while being married or living in a small household seems to support continued work. Regional differences also reveal that job opportunities for older persons aren't the same across the country. Overall, this points to the importance of creating fairer job opportunities and stronger support systems to help older Indonesians stay active and contribute to their communities.

DISCUSSION

Since 2021, Indonesia has experienced a demographic shift with about one in ten individuals classified as older persons. This transition offers a potential second demographic dividend, as older adults can still contribute economically (7,17). However, if they are unable to remain productive, this group may pose socio-economic challenges.

Globally, the aging workforce is a critical issue driven by lower birth rates and longer life expectancy. The population aged 60 and above is expected to more than double by 2050, especially in developed regions where older adults already constitute over 20% of the population. This shift leads to a shrinking labor force, increased dependency ratios, and greater economic pressure on social systems to support retirees (18–20).

Sex

According to the result, studies confirm that elderly men are more likely to be employed than women, particularly in informal sectors. Cultural expectations and traditional gender roles where men are seen as breadwinners contribute to this disparity (21). Gender disparities remain prominent, as older persons males are substantially more likely to be economically active than females, highlighting persistent inequalities in employment opportunities among older persons (22).

Households Category

Elderly individuals living alone have notably higher unemployment rates. Larger households may provide more social and economic support, facilitating continued employment (23). Household dynamics further affect participation, older persons often engage in financial exchanges with their children, both providing and receiving support, which can influence their economic activity (24).

Education

The previous study findings such as educational attainment were showed significantly influences labor force participation among the older persons in Indonesia. Higher education tends to reduce workforce involvement, likely because more educated individuals have access to pensions or alternative income sources, decreasing their need to work (15). However, those with senior high school education or above are more likely to be employed in the tertiary sector, reflecting a shift from primary-sector jobs to service-oriented employment opportunities (25).

Marital Status

Marital status also plays a crucial role, with married older persons showing greater labor force participation compared to those who are single, divorced, or widowed, suggesting that spousal support may encourage continued economic activity (25).

Island Group (Region)

Regionally, residing on Java Island is associated with higher likelihood of employment, possibly due to greater economic development and labor demand in both rural and informal sectors compared to other regions (14). These findings underscore the multifaceted demographic factors shaping labor force participation among Indonesia's older persons, emphasizing the need for policies that address education, gender, marital status, household support, and regional disparities to promote inclusive economic engagement in later life.

CONCLUSION

This study found that demographic factors such as sex, education, marital status, household size, and region are closely linked to workforce participation among older persons in Indonesia. Most older persons individuals are engaged in informal work, while formal employment remains low. Women, those with lower education, and the widowed are more likely to be unemployed or in vulnerable work situations. These results highlight the importance of creating targeted policies to improve employment opportunities and social protection for older adults, helping them to age actively and contribute to society.

Relevant government bodies including the Ministry of Manpower, the Ministry of Social Affairs, the Ministry of Cooperatives and Small and Medium Enterprises (SMEs), as well as local governments should take a leading role in formulating and implementing these policies. At the same time, strong collaboration with civil society organizations and private-sector actors is essential to create inclusive and sustainable solutions that genuinely respond to the diverse circumstances and needs of older persons throughout Indonesia.

RECOMMENDATIONS

To address the challenges faced by the older persons workforce in Indonesia, several actions are recommended:

- a) Expand lifelong learning and training opportunities for older persons, especially those with limited formal education, to enhance skills and open access to better employment opportunities.

- b) Design gender-responsive support programs to empower older women in the workforce, helping reduce gender disparities and ensuring equal access to decent and secure jobs.
- c) Strengthen social protection systems, including pensions and health insurance, with a focus on workers in the informal sector and those without strong family support.
- d) Promote balanced regional development to address disparities in job opportunities between Java and other regions of Indonesia. Encourage family and community support, recognizing the central role of intergenerational and household relationships in sustaining the economic participation and well-being of older persons.

LIMITATIONS

This study has several limitations. First, its cross-sectional design means it cannot show cause-and-effect relationships between demographic factors and employment status. Second, the data rely on self-reported information, which may be affected by memory or reporting bias. Third, the study did not include factors such as health status or access to social services, which may also influence employment among the older persons. Future research should use longitudinal data and consider a wider range of factors to better understand the dynamics of older persons employment.

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ENVIRONMENTAL AND BEHAVIORAL DETERMINANTS OF RESPIRATORY SYMPTOMS IN CHILDREN AGED 2 TO 5: A CROSS-SECTIONAL SURVEY IN THE NORTHERN REGION THAILAND

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ABSTRACT

Introduction: Respiratory health problems continue to pose a major public health concern among young children, particularly in areas with high levels of air pollution. In Thailand, the northern region is especially affected by seasonal declines in air quality, primarily due to agricultural burning and other environmental contributors. Exposure to both indoor and outdoor air pollutants, especially particulate matter, significantly elevate the risk of respiratory symptoms in vulnerable populations.

Objective: This study aimed to investigate the associations between environmental and behavioral determinants and respiratory symptom patterns among children aged 2 to 5 years attending childcare centers equipped with clean air rooms in northern Thailand.

Methodology: A cross-sectional analysis was conducted using secondary data obtained from the Health Impact Assessment Division, Department of Health, Ministry of Public Health, Thailand. The analysis included children (n=381) with complete data records. Associations between environmental and behavioral factors, including individual characteristics, household environments, childcare center environments, and children's behaviors and the presence of respiratory symptoms were assessed using Chi-square and Fisher's exact tests at significant level (p<0.05).

Results: The analysis identified several significant associated factors, including residing in households that use firewood for cooking (p<0.001), pets at home (p=0.006), and the location of childcare centers near traffic (p<0.001) or open burning areas (p<0.001). Spending longer durations in childcare centers equipped with clean air rooms (p<0.001) and avoiding outdoor activities (p=0.005) during periods of high air pollution were associated with respiratory symptoms.

Conclusion: These findings concluded that environmental and behavioral factors were associated with respiratory symptoms. Enhancing living conditions, along with promoting behavioral adaptations, may contribute to a reduction in respiratory health risks among children.

Keywords: respiratory symptoms, children, environmental factors, behavioral factors, clean air rooms, childcare centers

INTRODUCTION

Air pollution is a critical global and national public health issue, responsible for an estimated 4.2 million premature deaths worldwide in 2019, primarily from cardiovascular disease, respiratory illnesses, and cancers. Over 90% of the global population live in areas exceeding the World Health Organization (WHO) air quality standards (1,2). In Thailand, the problem is most severe in the

northern provinces, where seasonal haze from January to April, largely driven by agricultural burning alongside urban and industrial emissions, causes particulate matter less than 2.5 microns (PM_{2.5}) concentrations exceeding standard levels (3,4). In 2023, about 11.4 million Thai children (44.1% of those aged 0-14) were exposed to levels above recommended thresholds (5).

Children aged 2 to 5 years are particularly vulnerable to air pollution due to physiological and behavioral factors, including narrower airways, faster respiratory rates, and immature immune systems. Studies indicate that PM_{2.5} exposure in early life is associated with adverse neurological development, reduced cognitive function, and elevated risks of respiratory diseases such as asthma and pneumonia (1,6,7). Children tend to breathe at nearly twice the rate of adults and often through the mouth, which bypasses the natural filtration of the nasal passages, thereby increasing their intake of airborne pollutants (8).

Respiratory diseases in children are influenced by interaction between environmental exposures and behavioral patterns. Exposure to air pollution from indoor and outdoor sources such as secondhand smoke, solid fuel combustion for cooking, traffic emissions and open burning, can trigger inflammation and acute respiratory infections, particularly in rural areas or poorly ventilated settings. Behaviorally, children's activities and habits play a critical role in modulating their exposure risk such as playing outdoors, increases their risk of inhaling high amounts of particulate matter. They are also less likely to wear protective equipment, further heightening their vulnerability to air pollution-related health impacts.

In fact, children typically spend around 30 - 35 hours each week in childcare centers and indoor PM_{2.5} levels can reach 85% of outdoor concentrations (9). Clean Air Rooms (CARs), implemented since 2019 in selected centers, aim to reduce exposure using HEPA filtration, controlled ventilation, and real-time air quality monitoring. However, the effectiveness of these interventions and the influence of other environmental and behavioral factors remain underexplored.

This study investigates the association between environmental and behavioral determinants and respiratory symptoms in children aged 2 to 5 years attending childcare centers with CARs in northern Thailand. It aims to identify significant factors across four domains, including individual characteristics, household environments, childcare center environments, and children's

behavior. Findings will support evidence-based guidance for targeted recommendations.

METHODOLOGY

Source of data and study design

The data utilized in this study were secondary data obtained from the Health Impact Assessment Division, Department of Health, Ministry of Public Health. Data collection for the original study occurred during the peak PM_{2.5} season (March - May 2024) by using questionnaires. The dataset was reported by teachers at each childcare center. Information regarding household environments was obtained from parents. Childcare center environmental data was collected once per center, representing activities that occurred throughout the study period. It was assumed that all children attending a given center were exposed to the same environmental conditions. Children's behaviors and respiratory symptoms were recorded over a 13-week period, using a one-week recall method for each data collection point. A cross-sectional analysis was conducted to examine factors associated with respiratory symptoms among children residing in the northern region of Thailand.

Study area and sample

The original study was conducted across 26 childcare centers located in nine northern provinces of Thailand: Chiang Mai, Chiang Rai, Phrae, Nan, Phayao, Lampang, Lamphun, Mae Hong Son, and Tak. Stratified and purposive sampling methods were employed to select childcare centers equipped with clean air rooms in areas with elevated PM_{2.5} concentrations and under local administrative authority based on voluntary participation.

All children aged 2 to 5 years who had attended a childcare center for at least one year and whose parents provided consent were eligible for inclusion in this study. The initial sample comprised 426 children. For analysis, only records with complete data were retained. Thirty-four cases were excluded due to missing respiratory symptom data across first four consecutive weeks, and eleven were excluded for incomplete covariate information. The final analytical sample included 381 children as Figure 1.

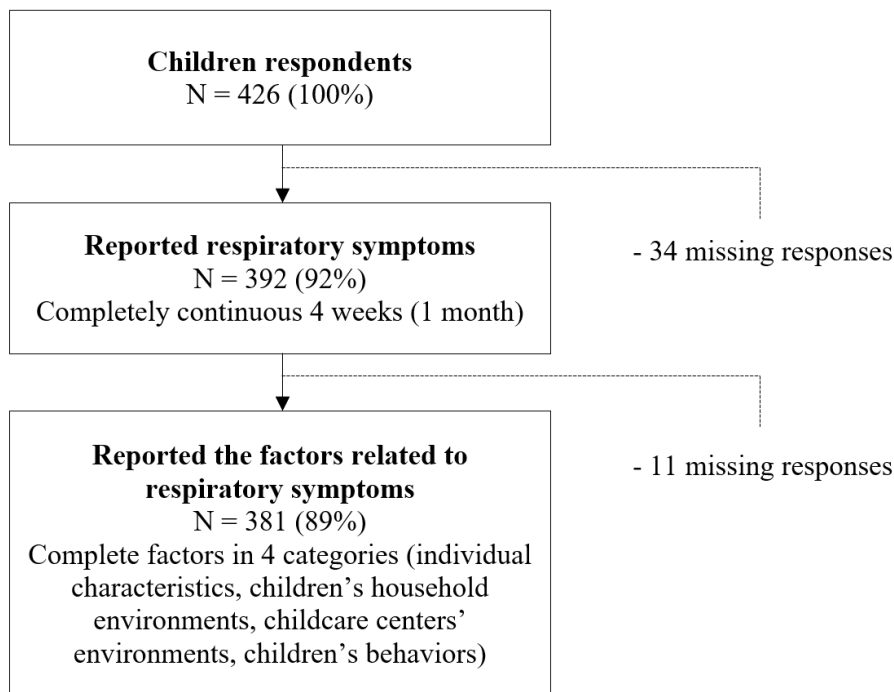


Figure 1 Selection of analyzed population from the Department of Health

Data preparation

The data were dichotomized into "yes" or "no" responses. Independent variables related to PM_{2.5} exposure encompassed four domains factors included child characteristics (gender, underlying diseases), household environment (smoking, cooking with solid fuels, living in an enclosed room, and keeping pet at home), childcare center environment (planting tall trees or shrubs, water spraying, smoking, cooking, burning of incense sticks or candles, traffic, open burning, and construction), and children behaviors (duration of time spent in the facility, wearing masks, staying indoors, and limiting outdoor activities).

The dependent variable is respiratory symptoms, identified children as having symptoms if they reported at least one of seven respiratory symptoms (cough, phlegm, wheezing, chest tightness, runny nose, sneezing, and stuffy nose).

Data analysis

Descriptive and inferential statistics were applied using STATA version 14. Descriptive analysis summarized the characteristics of all study variables. Bivariate analyses were performed to examine associations between independent variables (environmental and behavioral factors) and dependent variables (respiratory symptoms) with Chi-square and Fisher's exact test. Variables with a p-value < 0.05 in the bivariate analysis were considered statistically significant.

RESULTS

Individual characteristics

Among the 381 children, the gender distribution was nearly equal (50.9% male and 49.1% female), and most of them (92.7%) had no underlying health conditions. Neither gender nor the presence of underlying disease showed a significant association with respiratory symptoms (table 1).

Table 1 Association between individual characteristics and respiratory symptoms among children (n = 381)

Individual characteristics	Total (%)	Respiratory symptoms		p-value
		No (%)	Yes (%)	
Gender				0.546
Male	50.9	53.6	46.4	
Female	49.1	56.7	43.3	
Underlying diseases				0.864
No	92.7	55.2	44.8	
Yes	7.3	53.6	46.4	

Significant level at p-value<0.05 from chi-square and fisher's exact test

Children's household environment

Most children (77.7%) lived in smoke-free households, and nearly half (45.9%) were exposed to biomass fuel combustion, such as firewood or charcoal used for cooking. Approximately one-third (32.3%) lived in

enclosed rooms, and 45.4% resided in homes with pets. Among household factors, the use of solid fuels for cooking and pet ownership were significantly associated with children's respiratory symptoms, whereas exposure to cigarette smoke and living in enclosed rooms showed no significant association (table 2).

Table 2 Association between children's household environments and respiratory symptoms among children (n=381)

Children's household environments	Total (%)	Respiratory symptoms		p-value
		No (%)	Yes (%)	
Smoking				0.052
No	77.7	57.8	42.2	
Yes	22.3	45.9	54.1	
Cooking with solid fuel				<0.001
No	54.3	65.2	34.8	
Yes	45.7	43.1	56.9	
Living in an enclosed room				0.134
No	67.7	57.8	42.2	
Yes	32.3	49.6	50.4	
Keeping pets at home				0.006
No	54.6	61.5	38.5	
Yes	45.4	47.4	52.6	

Significant level at p-value<0.05 from chi-square and fisher's exact test

Childcare centers' environment

Most children (96.1%) were in childcare centers with tall trees or shrubs and 60.4% engaging in regular water spraying, likely for dust suppression. Indoor pollutant exposure was relatively low: 12.6% of children were exposed to tobacco smoke, 10.5% to indoor cooking, and 4.2% to incense or candle burning. In contrast, outdoor pollution sources were more prevalent,

with 55.6% of children exposed to traffic emissions and 53.3% to nearby open burning. Exposure to construction activities was low, reported at only 2.6%. Most environmental variables within childcare centers, except construction activity, were significantly associated with respiratory symptoms (table 3).

Table 3 Association between childcare centers' environments and respiratory symptoms among children (n=381)

Childcare centers' environments	Total (%)	Respiratory symptoms		p-value
		No (%)	Yes (%)	
Planting tall trees or shrubs				<0.001
No	3.9	0.0	100.0	
Yes	96.1	57.4	42.6	
Water spraying				0.040
No	39.6	61.6	38.4	
Yes	60.4	50.9	49.1	
Smoking				0.009
No	87.4	57.7	42.3	
Yes	12.6	37.5	62.5	
Cooking				<0.001
No	89.5	59.5	40.5	
Yes	10.5	17.5	82.5	
Burning of incense sticks or candles				<0.001
No	95.8	57.5	42.5	
Yes	4.2	0.0	100.0	
Traffic				<0.001
No	44.4	75.7	24.3	
Yes	55.6	38.7	61.3	
Open burning				<0.001
No	46.7	69.1	30.9	
Yes	53.3	42.9	57.1	
Construction				0.354
No	97.4	55.5	44.5	
Yes	2.6	40.0	60.0	

Significant level at p-value<0.05 from chi-square and fisher's exact test

Children's behaviors

Most children (93.2%) spent more than 6 hours per day, and 58.3% attended for at least 5 days per week in childcare centers equipped with CARs. Mask-wearing was reported in 57.5% of children. Preventive behaviors to reduce outdoor exposure were also common, with 91.6% of children staying indoors and 94.7% limiting outdoor activities. Most childcare-related

variables, including duration of attendance, mask use, and restricted outdoor activities, were significantly associated with respiratory symptoms, except for staying indoors. Interestingly, mask use was significantly associated with a higher prevalence of respiratory symptoms, with who reported mask wearing (table 4).

Table 4 Association between children's behaviors and respiratory symptoms among children (n=381)

Children's behaviors	Total (%)	Respiratory symptoms		p-value
		No (%)	Yes (%)	
Duration in childcare center (hour/day)				<0.001
≤6 hours per day	6.8	15.4	84.6	
>6 hours per day	93.2	58.0	42.0	
Duration in childcare center (day/week)				0.002
1-4 days per week	41.7	45.9	54.1	
≥5 days per week	58.3	61.7	38.3	
Wearing masks				0.002
No	42.5	64.2	35.8	
Yes	57.5	48.4	51.6	
Staying indoors				0.177
No	8.4	43.8	56.2	
Yes	91.6	56.2	43.8	
Limiting outdoor activities				0.005
No	5.3	25.0	75.0	
Yes	94.7	56.8	43.2	

Significant level at p-value<0.05 from chi-square and fisher's exact test

DISCUSSION

In the household, the use of solid fuels (wood or charcoal) for cooking was associated with respiratory symptoms in children, primarily due to indoor air pollutants generated from incomplete combustion (10,11). Pet ownership was also linked to respiratory symptoms via airborne allergens (12), though some studies suggest dog ownership may mitigate pollutant-related respiratory effects (13,14).

In childcare centers, green barriers like tall trees or shrubs have been associated with children's respiratory symptoms by filtering PM_{2.5}. However, effectiveness depends on species, density, and airflow. Supporting this, Lovasi et al. reported an inverse relationship between street tree density and asthma prevalence in early childhood (15). Water spraying during high PM_{2.5} periods also was related to symptoms by settling airborne particles and limiting indoor dust infiltration to reduce airway irritation, though its effects are temporary (16).

Exposure to tobacco smoke was significantly associated with respiratory symptoms in children, including wheezing and chest tightness, due to harmful pollutants such as PM_{2.5}, carbon monoxide, and formaldehyde (17,18). Cooking within childcare centers,

particularly in settings with poor ventilation or the use of solid fuels, was linked to symptoms like sneezing and phlegm, reflecting similar risks observed in household environments (19). Burning incense or candles, especially those with synthetic fragrances, released PM_{2.5}, VOCs, and PAHs, contributing to cough and wheezing (20,21).

Additionally, childcare centers located near high-traffic areas exhibited associations with respiratory symptoms due to exposure to vehicle emissions, which can irritate developing respiratory systems (22). Similarly, proximity to open burning of agricultural or household waste was associated with wheezing and bronchitis, attributed to elevated levels of PM_{2.5} and black carbon in the surrounding air (23).

Regarding behavioral factors, children spend extended hours in CARs was linked to respiratory symptoms, highlighting the protective role of HEPA filtration against PM_{2.5} and PM₁₀ exposure (24). Lei et al. confirmed the use of HEPA filters supports lung health and may help prevent long-term impairment (24). Although mask-wearing was associated with respiratory symptoms, potentially reflecting reverse causality, evidence supports the effectiveness of

masks in reducing pollution-related health issues (25). N95 and surgical masks remain essential protective measures during periods of high air pollution (26). Additionally, limiting outdoor activity during elevated PM_{2.5} levels showed a relationship with respiratory symptoms, aligning with WHO recommendations and studies associating PM_{2.5} exposure with increased cough frequency (27). However, the finding that staying indoors was not significantly associated with respiratory outcomes presents a paradox. This discrepancy may reflect respondent misunderstanding during data collection, particularly regarding the interpretation of “staying indoors” as a protective behavior. It is possible that indoor environments may not have been adequately shielded from ambient air pollution, and children might still have been exposed to pollutants from indoor sources or other activities, thereby reducing the expected protective benefit.

This study has certain limitations. The use of secondary data obtained from self-reported questionnaires may introduce information bias due to potential recall errors or incomplete reporting. As a cross-sectional study, this research provides preliminary insights into factors influencing the respiratory health of children in childcare centers. However, its design limits the ability to infer causality and may introduce potential bias in interpretation. For future research, multivariate analysis should be employed to control for potential confounding variables and to better identify the independent effects of each factor on respiratory symptoms.

CONCLUSION

This study identified significant associations between environmental and behavioral factors and respiratory symptoms among children attending childcare centers in northern Thailand. Household exposures such as solid fuel use and pet ownership, together with center-related exposures including smoking, indoor cooking, incense burning, and proximity to traffic or open burning, were linked to respiratory symptoms. Protective measures, such as green barriers, water spraying, mask wearing, and spending time in clean air rooms, were associated with respiratory symptoms. These findings highlight the importance of integrated

household and childcare center interventions targeting the reduction of air pollution sources and the prevention of respiratory symptoms in children.

RECOMMENDATIONS

Environmental controls and behavioral adaptations offer practical interventions to protect children’s respiratory health. At the household level, promoting the use of cleaner cooking fuels and reducing indoor pet exposure can help lower indoor air pollution. At the childcare center level, enforcing strict control of pollution sources within and around the premises, along with enhancing the use of green barriers and regular water spraying, can effectively reduce particulate matter exposure. In addition, encouraging mask wearing and promoting time spent in clean air rooms during periods of high PM_{2.5} can further prevent health risks.

ETHICAL DECLARATION

This study was reviewed and approved by The Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University (Approval Number: COA No. 110/68).

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SEDENTARY BEHAVIOUR AND SCREEN TIME ASSOCIATED TO OFFICE SYNDROME AMONG DESK JOBS WORKERS IN SINGAPORE

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ABSTRACT

Background: Prolonged sedentary behaviour has become a defining characteristic of contemporary office-based occupations, particularly in digitally intensive work environments. In Singapore, recent studies indicate that administrative staff spend an average of over 400 minutes per day seated, with extended screen exposure and after-hours connectivity often perceived as indicators of productivity. This sociocultural norm has contributed to the rising prevalence of Office Syndrome, a cluster of musculoskeletal and visual symptoms including neck pain and eyestrain.

Objective: This study aimed to determine the prevalence of Office Syndrome symptoms (neck pain and eyestrain) and to explore the associations between sedentary behaviour, screen time, and Office Syndrome symptoms among desk job workers in Singapore.

Methods: A cross-sectional study was conducted among 445 desk-based workers aged 20–60. Data were collected via an online questionnaire addressing demographics, sitting time, screen time, movement breaks, and symptoms. Chi-square tests and binary logistic regression were used ($p < 0.05$).

Results: The mean age was 38.5 years. Most participants reported 5–7 hours of sitting and screen time daily. Neck pain was reported by 52.1%, and eyestrain by 48.1%. Sitting > 7 hours (OR = 2.80) and screen time > 7 hours (OR = 3.20) were significantly associated with neck pain. Lack of movement breaks (OR = 1.65) also contributed. For eyestrain, significant predictors included sitting > 7 hours (OR = 2.25) and screen time > 7 hours (OR = 2.90).

Conclusion: Prolonged sitting and screen exposure were significantly associated with Office Syndrome symptoms. Movement-friendly workplace interventions are recommended.

Keywords: Sedentary behaviour, Screen time, Desk job, Office syndrome, Occupational health

INTRODUCTION

The transformation of the global economy toward knowledge-based industries has profoundly reshaped the nature of work. Rather than relying on physical tools and machinery, the modern workforce increasingly engages with computers and digital platforms. While this shift has enabled increased productivity, it has also introduced new occupational health concerns, particularly due to prolonged physical inactivity and poor ergonomic conditions. The World Health Organization recognizes sedentary behaviour as an independent risk factor for chronic diseases, distinct from general physical inactivity. Office workers, in particular, are prone to extended periods of static sitting and digital screen exposure, both of which contribute to a range of

health issues including musculoskeletal disorders and visual strain.

These issues have coalesced into a condition known as Office Syndrome, which encompasses symptoms such as neck and back pain, headaches, carpal tunnel syndrome, and digital eye strain. The prevalence of these symptoms has been exacerbated by the COVID-19 pandemic, which normalized remote work arrangements often lacking proper ergonomic support. In Singapore, where the workforce is highly digital and performance-driven, extended sitting and screen time are pervasive. While the statutory workweek is capped at 44 hours, the culture of extended availability has led to significantly longer working hours for many employees. Recent studies have reported that office staff in Singapore spend over 400 minutes seated daily,

and the average sitting time for employed Singaporeans exceeds five hours. These figures suggest a substantial public health concern.

Despite growing recognition of Office Syndrome globally, limited local data exist regarding the prevalence and risk factors in Singapore's specific socioeconomic context. Additionally, international health authorities such as the WHO recommend that sedentary bouts be interrupted every 30–60 minutes and discourage sitting for more than two consecutive hours. Such benchmarks provide useful reference points for evaluating workplace behaviours. This study seeks to address this gap by examining the prevalence of neck pain and eyestrain, and their associations with sedentary behaviours such as sitting time, screen exposure, and the frequency of movement breaks among desk-based workers in Singapore. The findings aim to inform context-specific occupational health strategies and promote the design of healthier digital work environments.

Research Questions

What is the prevalence of Office Syndrome symptoms specifically neck pain and eyestrain among desk-based office workers in Singapore?

Is there a significant association between sedentary work behaviours (e.g., prolonged sitting, extended screen time, lack of movement breaks) and Office Syndrome symptoms among these workers?

Research Objective

This study aimed to determine the prevalence of Office Syndrome symptoms (neck pain and eyestrain) and to explore the associations between sedentary behaviour, screen time, and Office Syndrome symptoms among desk job workers in Singapore.

METHODOLOGY

This study utilized a cross-sectional quantitative research design to investigate the relationship between sedentary behaviours and Office Syndrome symptoms among desk-based employees in Singapore. The setting was chosen for its high level of digital integration and reliance on office-based roles, making it an ideal context for examining the health effects of prolonged sedentary exposure.

The target population included individuals aged 20 to 60 who had been employed in a sedentary

office-based job for at least one year and whose work primarily involved computer use. This included employees in sectors such as finance, administration, marketing, IT, and human resources. Both on-site and remote workers were included to reflect contemporary work patterns. Individuals with pre-existing spinal or neurological conditions not related to work, or those who had undergone recent surgery, were excluded to avoid confounding effects.

Participants were recruited using a combination of snowball and convenience sampling. Initial participants were identified through professional networks and invited to complete the survey and share it within their own networks. The questionnaire was distributed online via LinkedIn, email, and company intranets where permitted. Data collection was conducted over six weeks, from May to June 2025.

The online questionnaire comprised four sections. The first section captured socio-demographic characteristics, including age, gender, height, and weight. The second section assessed sedentary behaviour. Participants were asked to estimate their average daily sitting time and screen time during work hours using categorical options (<2, 2–4, 5–7, >7 hours). The frequency of movement breaks was assessed with a yes/no question. Sleep duration was measured using categorical responses (<5, 5–6, 7–8, >8 hours).

The third section measured Office Syndrome symptoms using binary yes/no questions adapted from the Nordic Musculoskeletal Questionnaire (NMQ). Participants were asked whether they had experienced neck pain or eyestrain within the past 30 days. The recall period was chosen to balance recency with the need to capture recurring symptoms.

Content validity was evaluated using the Index of Item-Objective Congruence (IOC) by a panel of three public health experts. Items scoring ≥ 0.5 were retained. A pilot test was conducted with 30 respondents, yielding a Kuder-Richardson Formula 20 (KR-20) score of 0.78, indicating acceptable internal consistency.

Data were analysed using SPSS version 25. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated. Chi-square tests were used to examine associations between independent categorical variables (sitting time, screen time,

movement breaks) and dependent binary outcomes (neck pain, eyestrain). Binary logistic regression was used to identify significant predictors and estimate odds ratios (OR) with 95% confidence intervals. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 445 eligible desk-based employees participated in the study. The mean

age was 38.5 years (SD = 9.2), with a gender distribution of 53.7% female and 46.3% male. In terms of sitting time, 46.1% reported sitting for 5–7 hours per day, while 33.3% sat for more than 7 hours. Similarly, 41.6% reported 5–7 hours of screen time, and 37.8% reported screen exposure exceeding 7 hours daily. Slightly over half (51.9%) reported taking movement breaks, and the most common sleep duration was 7–8 hours per night (46.7%).

Table 1 Participant Characteristics (n = 445)

Note: Values are presented as number (percentage) unless otherwise specified. SD = standard deviation.

Variable	Category	n (%)
Age (years)	Mean ± SD	38.5 ± 9.2
Gender	Male	206 (46.3%)
	Female	239 (53.7%)
Sitting time	< 2 hours	54 (12.1%)
	2–4 hours	38 (8.5%)
	5–7 hours (mode)	205 (46.1%)
	> 7 hours	148 (33.3%)
Screen time	< 2 hours	36 (8.1%)
	2–4 hours	56 (12.6%)
	5–7 hours (mode)	185 (41.6%)
	> 7 hours	168 (37.8%)
Movement breaks	Yes	231 (51.9%)
	No	214 (48.1%)
Sleep duration	< 5 hours	39 (8.8%)
	5–6 hours	123 (27.6%)
	7–8 hours (mode)	208 (46.7%)

Variable	Category	n (%)
	> 8 hours	75 (16.9%)
Neck pain	Yes	232 (52.1%)
	No	213 (47.9%)
Eyestrain	Yes	214 (48.1%)
	No	231 (51.9%)

Assessment of Socio-Demographic Variables as Confounders: As part of a sensitivity analysis, socio-demographic variables specifically age, weight, height and gender were examined to assess their potential confounding influence on the severity of Office Syndrome (OSS) symptoms. Age, weight, height, treated as a continuous variable, were analysed using independent t-tests, while gender, as a categorical variable, was evaluated via chi-square tests. Neither variable demonstrated a statistically significant association with the presence of neck pain or eyestrain.

The prevalence of Office Syndrome symptoms was notable. Neck pain was reported by 52.1% of respondents, and 48.1% reported symptoms of eyestrain. Chi-square analyses revealed significant associations between both sitting time and screen time with the presence of neck pain and eyestrain ($p < 0.001$). Movement breaks were significantly associated with neck pain ($p < 0.001$) but not with eyestrain ($p = 0.218$).

Table 2 Association Between Sedentary Behaviours and Office Syndrome Symptoms

Note: Chi-square (χ^2) test was used to assess association. *df* = degrees of freedom. Asterisks (*) denote statistically significant results ($p < 0.05$).

Variable	Associated Symptom	χ^2	df	<i>p</i> -value
Sitting time	Neck pain	61.720	3	< 0.001 *
Sitting time	Eyestrain	54.115	3	< 0.001 *
Screen time	Neck pain	73.243	3	< 0.001 *
Screen time	Eyestrain	76.836	3	< 0.001 *
Movement breaks	Neck pain	14.859	1	< 0.001 *
Movement breaks	Eyestrain	1.517	1	0.218

Binary logistic regression further identified risk factors for these symptoms. Sitting for more than 7 hours was significantly

associated with neck pain (OR = 2.80, 95% CI: 1.70–4.62) and eyestrain (OR = 2.25, 95% CI: 1.34–3.78). Screen time exceeding 7 hours also

significantly increased the odds of neck pain (OR = 3.20, 95% CI: 1.90–5.42) and eyestrain (OR = 2.90, 95% CI: 1.70–4.94). Not taking movement breaks was associated with a higher

risk of neck pain (OR = 1.65, 95% CI: 1.15–2.36) but showed no significant association with eyestrain.

Table 3 Binary Logistic Regression of Risk Factors for Neck Pain and Eyestrain

Note: OR = Odds Ratio; CI = Confidence Interval. Asterisks (*) denote statistically significant results ($p < 0.05$).*

Predictor	Outcome	OR	95% CI	p-value
Sitting > 7 hrs/day	Neck pain	2.80	1.70 – 4.62	< 0.001 *
Screen > 7 hrs/day	Neck pain	3.20	1.90 – 5.42	< 0.001 *
No movement breaks	Neck pain	1.65	1.15 – 2.36	0.006 *
Sitting > 7 hrs/day	Eyestrain	2.25	1.34 – 3.78	0.002 *
Screen > 7 hrs/day	Eyestrain	2.90	1.70 – 4.94	< 0.001 *
No movement breaks	Eyestrain	1.12	0.85 – 1.47	0.218

DISCUSSION

This study highlights the occupational health implications of prolonged sedentary behaviour in modern digital workplaces, particularly among desk job workers in Singapore. The high prevalence of neck pain (52.1%) and eyestrain (48.1%) aligns with findings from other office-based populations globally, where musculoskeletal and visual strain are increasingly common outcomes of sustained static posture and digital screen use (9, 15, 18, 19).

A clear dose-response relationship was observed between the number of hours spent sitting or using screens and the severity of Office Syndrome symptoms. These results reaffirm evidence that prolonged sitting impairs spinal alignment, reduces blood flow, and contributes to muscular fatigue, while excessive screen exposure heightens the risk of digital eye strain through reduced blinking and sustained near-focus effort (2, 19, 20).

The association between the absence of movement breaks and increased neck pain supports global ergonomic guidelines advocating for regular postural variation and micro-activities to reduce biomechanical load (7, 14, 17). Simple interventions—such as standing or walking every 30–60 minutes—

have been shown to alleviate cervical tension and improve circulation (18, 20). However, the lack of association between movement breaks and eyestrain suggests that visual symptoms require targeted strategies like the 20-20-20 rule, anti-glare screens, and screen positioning adjustments (20).

Singapore’s unique work culture characterized by high productivity demands, long working hours, and strong digital integration may intensify the health burden of sedentary exposure (19,20). In such environments, employees may normalize discomfort or overlook preventive behaviours due to workload pressures or limited ergonomic awareness. This reinforces the need for locally adapted health promotion programs, emphasizing both musculoskeletal and visual ergonomics, and inclusive of temporary staff and interns who may face higher risk (3).

Overall, these findings contribute to a growing body of evidence urging employers and policymakers to prioritize ergonomic design, encourage regular movement, and support digital eye health as part of comprehensive workplace wellness frameworks. Future research using objective sedentary behaviour tracking (e.g., wearable devices) and longitudinal designs would

provide deeper insight into causal pathways (13).

CONCLUSION

This study provides important evidence linking prolonged sitting and screen time to the prevalence of Office Syndrome symptoms among desk workers in Singapore. While regular movement breaks can mitigate neck pain, they are insufficient to address eyestrain, suggesting the need for tailored ergonomic and visual strategies. The findings support the integration of movement-friendly policies and visual hygiene practices into workplace wellness programs. Given the widespread nature of sedentary work in Singapore and similar economies, these interventions are essential for maintaining workforce health and productivity.

Recommendations

Implications for Practice and Policy

The findings of this study offer valuable insights into the prevalence and associated factors of Office Syndrome (OSS) symptoms among desk-based employees in Singapore. These results carry important implications for public health strategies, workplace ergonomics, and occupational wellness policies. Given the multifactorial nature of OSS and its association with modifiable behavioural and environmental factors, a multi-tiered approach is essential.

At the Individual Level (Employee Self-Management)

Employees play a central role in preventing and mitigating OSS symptoms through health-promoting behaviours. The results support the promotion of daily physical activity, particularly walking, stretching, and moderate-to-vigorous exercise, as protective factors. Incorporating micro-breaks, posture changes, and avoiding prolonged uninterrupted sitting are effective self-care strategies. Sleep hygiene and balanced nutrition further contribute to musculoskeletal recovery and overall health. Digital wellness tools such as activity trackers and mobile apps may support behaviour change if users are appropriately educated on their meaningful application.

At the Organizational Level (Employer Responsibilities)

Employers are responsible for ensuring a supportive work environment that reduces ergonomic risks. Provision of ergonomic office furniture such as height-adjustable desks, supportive chairs, and screen risers should be standardized. Workplace wellness programs should be inclusive and promote physical activity, ergonomic education, and awareness of sedentary risks. All employee categories, including contract and freelance staff, must be granted equitable access to these resources. Supervisors should encourage and model healthy work practices, such as walking meetings and scheduled movement breaks. Periodic ergonomic assessments and personalized workstation adjustments should be institutionalized within human resource and occupational health policies.

At the National and Policy Level

Occupational health authorities must establish enforceable national standards for sedentary work. Policies should mandate ergonomic assessments, minimum workstation design standards, and provide screen time and sitting duration guidelines tailored to digital office environments. Broader occupational health campaigns should raise public awareness about OSS and support small businesses through subsidized ergonomic evaluations. Policymakers should ensure occupational health protections extend to all workers, including freelancers and remote staff, under inclusive and comprehensive legislation.

Recommendations for Future Research

While the present study contributes meaningful data on sedentary risk factors for OSS in the Singaporean context, it is limited by its cross-sectional design and reliance on self-reported measures. Future studies should adopt longitudinal or cohort designs to establish causality and symptom progression. Expanding the study population to encompass varied industries, company sizes, and regional settings will enhance generalizability. Additionally, interventional studies are recommended to evaluate the impact of combined ergonomic, behavioural, and organizational strategies. Research focusing on subgroup analysis such as age, gender, or job function-specific factors is needed. In light of evolving work arrangements, future investigations should also examine the long-term musculoskeletal effects of hybrid and

remote working models in post-pandemic environments.

ETHICAL CONSIDERATION

This study was conducted in accordance with the ethical standards of the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University. Ethical approval was granted under study code No. 680089 (COA No. 140/68) on May 28, 2025.

Participation was entirely voluntary. Participants were provided with a detailed Participant Information Sheet at the beginning of the survey, outlining the purpose, procedures, potential risks, and benefits of the study. They were informed of their right to withdraw at any time without consequence. Informed consent was obtained digitally by requiring participants to confirm their agreement through a checkbox before proceeding to the main questionnaire.

No identifiable personal data were collected. All responses were anonymized and securely stored, accessible only to the authorized research team. The questionnaire design avoided any intrusive or sensitive items, thereby upholding participant dignity and confidentiality throughout the data collection process

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THE LEVEL OF PERCEPTIONS, AWARENESS, AND PRACTICES TOWARD THE PM 2.5 DURING THE AIR POLLUTION EPISODE AMONG CHINESE STUDENTS IN BANGKOK AND VICINITY, THAILAND

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ABSTRACT

Introduction: PM_{2.5} poses significant health risks worldwide and has become a major public health concern due to its strong association with diseases. However, the adaptive behaviors of mobile populations, such as international students, remain underexplored. Chinese international students form one of the largest international student groups in Thailand, which reference for making them a relevant group for air pollution exposure.

Objective: To assess the air pollution awareness, health risk perception, and protective practices toward PM_{2.5} during the air pollution episode among Chinese students in Bangkok and its vicinity (Nonthaburi, Pathum Thani, Nakhon Pathom, and Samutprakarn).

Methodology: A cross-sectional survey was conducted during June 2025. Data was collected using a self-administered online questionnaire, distributed via convenience sampling through social media platforms and university networks. Awareness was measured using 17 single-choice questions and categorized based on Bloom's taxonomy. Perceptions were assessed through 13 items using a 5-point Likert scale, where higher scores indicated stronger concern and perceived severity. Practice was measured by 5 items on a 5-point frequency scale (never to always), reflecting the consistency of protective behaviors. Descriptive statistics (frequencies, means, and standard deviations) were used to summarize participant characteristics and key variables.

Results: This study surveyed 393 participants (49.1% aged 26-35; 69.2% female; 48.1% master's degree). Academic backgrounds included environmental sciences (30.5%), medicine (26.2%), and others. 37.7% reported a monthly income between 15,000 and 25,000 (Baht). Average scores were 48.0 ± 7.6 out of 65 for perception, 6.3 ± 2.9 out of 17 for awareness, and 12.5 ± 4.6 out of 25 for practice, respectively. While 38.4% perceived PM_{2.5} as a severe threat to health, only 3.8% had high awareness of its air pollution, and just 9.7% consistently practiced protective behaviors such as mask-wearing and reducing outdoor exposure.

Conclusion: The public generally lacks awareness about PM_{2.5}, and the implementation rate of protective behaviors is low, although the perception level is medium to high. It is recommended to improve international students' awareness and adapt to air pollution challenges through targeted health education.

Keywords: PM_{2.5}, Perception-Awareness-Practice, Chinese international students, air pollution

INTRODUCTION

With the rise of globalization, an increasing number of Chinese students are studying abroad, with Thailand becoming a top destination due to its proximity, affordability, and cultural appeal. Chinese students now make up about half of the international student population in Thailand (1). However, they face various health challenges, including exposure to unfamiliar environmental risks such as air pollution. Students from regions with relatively clean air may lack awareness and experience in managing air pollution-related health risks, making them particularly vulnerable (2).

Among various pollutants, PM_{2.5} is a major concern in Thailand. It is linked to serious respiratory, cardiovascular, and mental health conditions (3, 4). According to the 2024 World Air Quality Report, Bangkok's annual average PM_{2.5} concentration reached 18.9 $\mu\text{g}/\text{m}^3$, exceeding the WHO's recommended 24-hour exposure limit of 15 $\mu\text{g}/\text{m}^3$ (4, 5). Particularly during the dry season (November to April), PM_{2.5} levels often exceed safe standards for multiple consecutive days (6). Although the Thai government has implemented mitigation measures, air pollution remains a pressing issue. Language barriers and limited access to reliable information further hinder Chinese students from taking timely protective actions (7).

This study focuses on Chinese students living in Bangkok and explores their awareness and perception of PM_{2.5}-related health risks. The primary objectives are to assess how these students perceive the risks associated with PM_{2.5}, identify key influencing factors such as sources of information and cultural differences, and examine the protective behaviors they adopt during high PM_{2.5} periods. Bangkok serves as an ideal research setting due to its large and diverse international student population and its ongoing struggle with fine particulate pollution.

Understanding how Chinese students adapt to PM_{2.5} exposure not only contributes to the academic literature on environmental risk perception but also provides practical insights.

METHODOLOGY

Study design and Participants

This study was designed as a cross-sectional study. It focused on the awareness, perception of air pollution and health risks among Chinese students in Bangkok and its surrounding areas (Nonthaburi, Pathum Thani, Nakhon Pathom and Samutprakarn). The target population was Chinese international students currently living in Bangkok and its surrounding areas, mainly studying in different majors at various universities.

Data collection and assessment tools

This study recruited participants through an online questionnaire distributed through social media platforms using a convenience sampling method. The questionnaire was in English and covered general socio-demographic data such as age, gender, education level, and length of residence in Bangkok. The questionnaire used multiple-choice and true-or-false questions to assess the respondents' perception of air pollution, such as the sources of air pollution and health effects. The questionnaire used a Likert scale (strongly agree, agree, neutral, disagree, strongly disagree) to measure the respondents' perception of air pollution. The questionnaire used a 5-point frequency scale (Always, Often, Sometimes, Occasionally, Never) to measure the respondents' practices of the measures of air pollution.

Bloom's taxonomy was used to assess the level of air pollution awareness, perception, and practice, which were divided into three levels: low, moderate, and high. Perception and practice were scored using a 5-point scale. Higher scores indicate higher concern or perceived severity about air pollution and its health risks (strongly

agree = 5, agree = 4, neutral = 3, disagree = 2, strongly disagree = 1). Higher scores indicate more frequent preventive measures (always = 5, often = 4, sometimes = 3, occasionally = 2, never = 1). The validity of the questionnaire was reviewed by three experts, and the (IOC) score was greater than 0.95.

Data analysis

Descriptive statistical analysis was performed using frequencies and percentages to summarize the demographics, cognition, perception, and practice levels of Chinese international students.

RESULTS

This cross-sectional study was conducted in Bangkok and its vicinity. The researchers collected a total of 411 responses from Chinese international students through an online questionnaire survey. A total of 393 valid questionnaires were obtained after removing those that did not pass the screening question, yielding a response rate of 96% (393/411).

The demographic characteristics of Chinese international students in this survey are summarized. Most of the participants were between 26 and 35 years old (49.1%). In this study, more than half of them were female (n =

272, 69.2%). Among the participants, most were graduate students (48.1%). Chinese international students studied various majors in Bangkok and its surrounding areas. The main majors of participants in our study were primarily from Environment Science (30.5%) and Medicine/Public Health (26.2%). In terms of income, 37.7% of the participants had a monthly income between 15,000 and 25,000 (Baht). Regarding the length of the stay in Bangkok, nearly half of the participants (48.1%) stayed for 1-2 years.

Level of awareness

To evaluate the level of awareness, 18 items were used. 17 items measured awareness (maximum possible score = 17), while 1 item assessed participants’ sources of information about air pollution. The results showed awareness scores ranged from 1 to 16, with a mean score of 6.3 ± 2 . According to Bloom’s cut-off classification, awareness levels were categorized into three groups: Low (0-8 points), Moderate (9-14 points), and High (15-17 points). Most participants (84.2%) fell into the low-awareness group. The high and moderate levels of awareness were combined as shown in Table 1.

Table 1 Level of awareness (N = 393)

Awareness level	n	%
High	15	3.8
Moderate	47	12
Low	331	84.2

Level of perception

Participants’ perception of PM_{2.5} was assessed using 13 items (8 items for perception of PM_{2.5} and 5 items for its health issues). The perception scores of participants ranged from 22 to 65, with a mean score of 48.0 ± 7.6 (mean \pm

SD), indicating a generally high level of perception among the respondents. According to Bloom’s cut-off classification, perception levels were categorized into three groups: Low (13-32 points), Moderate (33-51 points), and High (52-65 points). The level of perception was shown in Table 2. Most participants (57.8%) fell into the moderate-perception category, and 38.4%

perceived PM_{2.5} as a severe threat to health.

Table 2 Level of perception (N = 393)

Perception level	n	%
High	151	38.4
Moderate	227	57.8
Low	15	3.8

Level of practices

Protective practice against air pollution (mainly PM_{2.5}) was measured with 10 items. 5 questions assessed specific protective behaviors (e.g., wearing masks, using air purifiers), while the remaining 5 evaluated the level or consistency of those practices. Scores in this section ranged from 5 to 25, with a mean score of 12.5 ± 4.6 (mean ± SD), suggesting varied yet generally proactive behavioral responses among participants.

According to Bloom’s cut-off classification, practice levels were categorized into three groups: Low (5-12 points), Moderate (13-19 points), and High (20-25 points). The level of practice was shown in Table 3. Most participants (57.5%) fell into the low-practice category, just 9.7% consistently practiced protective behaviors such as mask-wearing and reducing outdoor exposure.

Table 3 Level of practice (N = 393)

Practice level	n	%
High	38	9.7
Moderate	129	32.8
Low	226	57.5

For the specific practices related to PM_{2.5}, 36.6% reported using N95/KN95 masks. Regarding the use of air purifiers, only 33.3% reported using air purifiers to reduce PM_{2.5} exposure, and just 35.1% indicated they would shower or change clothes after going outside during periods of heavy PM_{2.5} pollution. Based on the use of air purifiers, the frequency of use and level of knowledge of air purifiers were investigated. Nearly half of the users (n = 131, 48.9%) used purifiers regularly every day. Regarding the filter membrane of the air purifier used, most people used a carbon filter (40.5%). These results suggest that while protective equipment, such as N95 masks, is relatively high, sustained behavioral practices (such as using air purifiers or practicing post-exposure hygiene) are less commonly adopted. This highlights areas where targeted public health

education is needed.

DISCUSSION

This study aimed to investigate the perception, awareness, and practices of Chinese international students in and around Bangkok regarding PM_{2.5}-related air pollution, and to explore the impact of sociodemographic factors and information sources on perception and practices, as well as the level of awareness.

This study found that social media (34.1%) was the main channel for Chinese international students to obtain PM_{2.5} information in Bangkok, followed by government or environmental protection organizations (25.4%). This result was consistent with a study on the public of Muscat, the capital of Oman, indicating that social media has become the preferred source of information due to its immediacy and language adaptability (8). For local Bangkok residents,

they are easier to get the information from official sources such as the Thai Pollution Control Department, due to greater familiarity with the local language and government systems. This discrepancy can be attributed to international students' linguistic and cultural barriers, which often lead them to seek information through familiar platforms like WeChat and Weibo that offer Chinese-language content and push real-time pollution alerts (7).

The mean awareness score of Chinese students in this study (6.3/17) was notably lower. Among participants, 84.2% were categorized as the low-awareness group. The main reasons may include the lack of formal environmental health education in university curricula, minimal exposure to local public campaigns due to language shame, and a reliance on informal or peer-shared information (9). The finding underscores a critical communication gap that needs to be addressed through targeted culturally and linguistically tailored interventions (10). In addition, while social media can disseminate information rapidly, the quality and depth of content may be insufficient to foster a comprehensive understanding, especially given the inconsistency of health-related content on Chinese social platforms [11]. That also affected the level of awareness. Although participants had low awareness scores (mean = 6.3/17), the average perception score (48.0 ± 7.6) and desirability bias in terms of protective behaviors.

The non-random sampling (online survey) may limit the generalizability of the study to all Chinese international students. Additionally, the questionnaire was administered in English, which may have caused misunderstandings due to limited language proficiency and cultural differences in interpreting health terms. Only Chinese international students were included, highlighting the need for more culturally and linguistically appropriate survey tools.

practice score (12.5 ± 4.6) suggested a moderate level of understanding and engagement in protective behaviors.

Interestingly, the low-awareness group took protective behaviors more frequently, such as wearing masks or reducing outdoor activities. This contradicted the health belief model, which believed that higher levels of awareness and risk perception should be the core drivers of behavioral change (12). We speculate that this phenomenon may be because individuals with lower awareness rely more on sensory and emotional responses to trigger actions, which is called "emotion-driven preventive behavior", rather than rational health risk assessment (13). That shows that people with lower awareness may rely more on intuitive reactions (for example, wearing masks due to discomfort or visible haze) rather than knowledge-based risk assessment. In contrast, individuals with higher awareness may be more inclined to question the effectiveness of protective measures or to slack off in behavior due to the "illusion of control" (14). Therefore, they show less protective behavior. This highlights the potential gap between awareness and perception-driven behavior, which deserves further study.

The cross-sectional design limits the interpretation of the causal relationship between awareness and perception. Self-report data may be biased, especially social

CONCLUSION

This study aimed to examine the awareness, perception, and protective behaviors of Chinese international students regarding PM_{2.5} in and around Bangkok. Although students showed high risk perception, their actual awareness of PM_{2.5} health effects and protective measures was limited. China also faces serious PM_{2.5} and air pollution issues. Chinese students were not as aware as expected. These findings highlight the gap between perceived risk and preventive

measures and underscore the need for culturally sensitive and understandable health communication. This study provides valuable insights into how cultural, informational, and experiential factors influence international students' environmental health coping. Based on the findings, we make several recommendations, such as incorporating air pollution education into orientation, providing learning materials in Thai, English, and Chinese, providing subsidies for N95/KN95 masks and air purifiers, and installing central air purifiers in dormitories and libraries to improve indoor air quality. Future studies should include students from countries with lower pollution levels to compare knowledge and behaviors. Future research should examine behavioral changes during different pollution cycles and explore cultural perceptions through interviews or comparative studies.

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DIGITAL HEALTHCARE LITERACY RELATED TO TELEMEDICINE PERCEPTION AMONG DIGITALLY ACCESSIBLE YOUNG ADULTS IN MYANMAR

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ABSTRACT

Introduction: Telemedicine is increasingly used to address healthcare access barriers, particularly during emergencies such as the COVID-19 pandemic. In Myanmar, where there are internet instability, political instability and healthcare disparities persist, telemedicine may offer new pathways for healthcare services. However, little is known about how young adults with digital access perceive telemedicine services, or how digital healthcare literacy may shape their views. Therefore, this study aimed to 1) assess perceptions toward telemedicine among digitally accessible young adults in Myanmar, 2) compare perceptions across socio-demographic characteristics, previous telemedicine use and digital healthcare literacy levels, and 3) identify predictors of positive perception.

Methodology: A cross-sectional online survey was conducted from 27 May to 3 June 2025 among 266 digitally accessible Myanmar nationals aged 18–35 years by recruiting through non-probability convenience sampling. The survey included validated scales for digital healthcare literacy (3 items; $\alpha = 0.88$) and perceptions towards telemedicine (17 items; $\alpha = 0.79$). Descriptive statistics, Mann-Whitney U and Kruskal-Wallis tests, and multiple linear regression were used to compare perception scores and analyze predictors of positive perception.

Results: The median perception score was 58 out of 85. Most participants recognized its convenience, communication benefits, and time-saving potential, though concerns persisted about limited physical examination and equipment reliability. Higher perception scores were significantly associated with age above 24 years ($p = 0.018$), income $\geq 500,000$ MMK ($p = 0.023$), and good digital healthcare literacy ($p < 0.001$). In multiple linear regression, rural residence ($B=3.35$, $p = 0.007$) and good digital literacy ($B = 3.40$, $p < 0.001$) were significant predictors of more favorable perceptions.

Conclusion: Digitally accessible young adults in Myanmar hold positive perceptions toward telemedicine, with even stronger views among those in rural areas and with strong digital skills. These findings highlight the need to strengthen digital infrastructure and promote digital inclusion and training as part of national telehealth expansion strategies.

Keywords: Digital Health, Health Literacy, Myanmar, Perception, Telemedicine

INTRODUCTION

Telemedicine, the delivery of healthcare services by using information and communication technologies for the exchange of valid information for diagnosis, treatment, and prevention of diseases and injuries, has become popular in response to rising healthcare demands, geographic barriers and systemic inefficiencies (1, 2). This acceleration is catalyzed by the COVID-19 pandemic due to restrictions on mobility and overwhelmed healthcare systems, turning telemedicine from a complementary

option into a mainstream modality of care in both high- and low-resource settings (1, 3-5).

During the pandemic, telemedicine use expanded rapidly worldwide. In the U.S., visits rose from 840,000 in 2019 to 52.7 million in 2020, while Norway saw teleconsultations increase from 43,000 in January to 470,000 by March 2020 (6). In LMICs, telemedicine supported essential care despite limited infrastructure. Thailand recorded 177,266 visits for 68,960 patients between 2020 and 2022 (7). These trends highlight telemedicine's global

adaptability and rapid integration into care delivery.

However, telemedicine adoption faces significant barriers, including high costs, limited infrastructure, and privacy concerns (2). In low- and middle-income countries, issues such as poor internet access, low digital literacy, and regulatory gaps are common (2). In India, systemic challenges such as inadequate rural infrastructure and workforce shortages are accompanied by patient-level barriers, including limited digital literacy among the elderly and perceptions that virtual care lacks personal connection (8). Similar obstacles are likely present in countries like Myanmar, where political and infrastructural instability further hinder implementation.

Before 2020, telemedicine use in Myanmar was limited due to weak infrastructure and low digital readiness. During the COVID-19 pandemic, usage increased rapidly out of necessity, with providers turning to platforms like Facebook, Viber, and Telegram (9, 10). Data from the Telekyanmar platform showed over 65,000 consultations in its first month, followed by a decline and a period of sustained but low usage (11). Despite ongoing political instability and digital inequality, telemedicine showed resilience, with a notable resurgence bringing cumulative consultations to over 170,000 by the end of 2024 (11). Myanmar's fragile health system and uneven digital access, however, continue to challenge equitable and consistent adoption.

While prior studies have highlighted a high adoption of telemedicine in Myanmar (9), limited research has examined how people in Myanmar perceive these services, particularly in the aftermath of COVID-19 and amid persistent digital access disparities. Given that access to digital devices and the internet is a crucial factor for telemedicine utilization (12), that such access remains limited in many parts of the country (13). Therefore, understanding the perceptions of those who do have access is vital. Moreover, young adults (18-35 years) are more likely to own smartphones and engage with online platforms (14), making them a key demographic for designing sustainable and youth-responsive telemedicine systems.

This study aimed to address this gap by focusing on the digitally accessible young adults in Myanmar. The objectives were to: 1) Access perceptions toward telemedicine, 2) Compare perceptions across socio-demographic, previous telemedicine use and digital healthcare literacy levels and, 3) Identify key predictors of favorable telemedicine perceptions.

METHODOLOGY

Study Design: A cross-sectional online survey was conducted from May 27 to June 3, 2025, to assess the association between socio-demographic, digital healthcare literacy levels and use of telemedicine and perception at one point in time.

Sampling Method: A non-probability convenience sampling method was used to recruit digitally accessible adults aged 18–35 living in Myanmar. Inclusion criteria were aged 18-35 years, Myanmar nationality, current residence in Myanmar, at least one health issue in the past 12 months requiring healthcare consultation (via telemedicine or in-person), internet and digital device access, and ability to complete an online survey. Exclusion criteria included lack of informed consent and being a health-related professional. Participants were recruited via social media (Facebook), messaging apps (Messenger, Viber, Telegram), and professional networks. Screening questions ensured eligibility. Due to the online nature, the study may not be generalizable to rural or digitally disconnected young adults in Myanmar.

Sample Size Calculation: The required sample size was calculated using the formula for estimating a population in an infinite population, where the outcome variable is continuous (15);

$$n = z_{1-\frac{\alpha}{2}}^2 \cdot \frac{\sigma^2}{d^2}$$

A 95% confidence level ($z=1.96$), a standard deviation of 4.1, and a margin of error (d) of 0.5 were used based on the pilot study. The calculated sample size was 259 participants, rounding up from 258.31. The calculation was performed using the n4Studies mobile application (version 2.3) (15).

Survey Instrument: The survey consisted of four sections: eligibility screening (7 items), socio-demographic data and telemedicine use (10 items), digital healthcare literacy (3 items), and perceptions toward telemedicine (17 items), with the latter two measured on a 5-point Likert scale. The digital healthcare literacy scale was adapted from Nelson et al, 2022 (16), and perceptions toward telemedicine, from Demiris et al, 2000 (17). The questionnaire, originally in English, was reviewed by three public health experts and validated through back-translation. It demonstrated strong content validity (IOC = 0.92) and internal consistency (Cronbach's α = 0.88 for literacy; 0.79 for perceptions).

Measurement and Scoring: Digital health literacy scores ranged from 0–12, with scores ≥ 9 categorized as good (Median = 9). Perception scores ranged from 17–85, with higher scores indicating more favorable views.

Data Analysis: Data were analyzed using IBM SPSS Statistics (version 29.0.2.0). Descriptive statistics were used to summarize variables, with

distribution assessed via the Shapiro–Wilk test. Non-parametric tests (Mann–Whitney U and Kruskal–Wallis) were applied for group comparisons. Multiple linear regression (enter method) was conducted to identify predictors of telemedicine perception, with no violations of assumptions including multicollinearity, linearity, homoscedasticity, and residual normality.

RESULTS

A total of 266 participants were included in the study. The median age was 24 years (IQR = 8). The sample was predominantly female (56%), Bamar ethnicity (83.8%), and single (82.7%). Most participants resided in urban areas (85%), primarily from the Mandalay and Yangon Regions (34.6% each). The majority (67.7%) had attained university-level education or higher. The largest occupational group was private employees (33.5%), followed by students and dependents (39% combined). The most reported monthly income was between 200,000 and 499,999 MMK (33.1%). Additional demographic characteristics are summarized in Table 1.

Table 2 Socio-demographic characteristics of the participants (N= 266)

Variable	Categories	N (%)
Age	Median (IQR) - 24 (8)	
	24 years and below	135 (50.7%)
	Above 24 years	131 (49.3%)
Gender	Male	99 (37.2%)
	Female	149 (56.0%)
	Others	18 (6.8%)
Ethnicity	Bamar	223 (83.8%)
	Shan	10 (3.8%)
	Kayin	9 (3.4%)
	Others	7 (2.6%)
	Kachin	5 (1.9%)
	Mon	5 (1.9%)

Variable	Categories	N (%)
	Kayar	4 (1.5%)
	Rakhine	2 (0.8%)
	Chin	1 (0.4%)
Marital Status	Single	220 (82.7%)
	Married	43 (16.2%)
	Separated/Divorced	2 (0.8%)
	Widow	1 (0.4%)
Education	Read & write	2 (0.8%)
	Primary School Level	1 (0.4%)
	Middle School Level	7 (2.6%)
	High School Level	76 (28.6%)
	University and above	180 (67.7%)
Occupation	Government Employees	22 (8.3%)
	Private Employees	89 (33.5%)
	Freelancer/ Own Business	49 (18.4%)
	Students	73 (27.4%)
	Dependent	32 (12%)
	Others	1 (0.4%)
Residence	Urban	226 (85%)
	Rural	40 (15%)
Regions	Mandalay Region	92 (34.6%)
	Yangon Region	92 (34.6%)
	Sagaing Region	21 (7.9%)
	Shan State	14 (5.3%)
	Union Territory_Nay Pyi Taw	13 (4.9%)
	Kayar State/ Karenni State	7 (2.6%)
	Bago Region	7 (2.6%)
	Magway Region	5 (1.9%)
	Kayin State	4 (1.5%)
	Ayeyarwady Region	4 (1.5%)

Variable	Categories	N (%)
	Kachin State	3 (1.1%)
	Tanintharyi Region	3 (1.1%)
	Mon State	1 (0.4%)
Income	<100,000 MMK	47 (17.7%)
	100,000 - 199,999 MMK	32 (12%)
	200,000 - 499,999 MMK	88 (33.1%)
	500,000 - 999,999 MMK	43 (16.2%)
	>/=1,000,000 MMK	56 (21.1%)

Previous Telemedicine Use

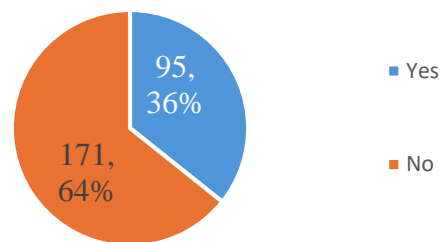


Figure 1 Previous telemedicine use within the past 12 months among study participants (N = 266)

As shown in Figure 1, 36% (n = 95) of respondents reported having used telemedicine services in the past 12 months, while the remaining 64% (n = 171) had no prior experience with telemedicine.

Over 70% of participants reported being able to use video call applications and independently set up video calls without assistance. Additionally, 60% indicated

confidence in resolving simple technical issues. Only a small proportion reported difficulties in using video call platforms or handling basic technical problems.

Table 3 Distribution of Responses to Digital Healthcare Literacy Items (N=266) and Categorization of Digital Healthcare Literacy

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N	N	N	N	N
	(%)	(%)	(%)	(%)	(%)
I can use video call apps or programs (for example, Zoom) without needing help from others.	9 (3.4%)	15 (5.6%)	46 (17.3%)	137 (51.5%)	59 (22.2%)
I can set up a video call on my phone, computer, or other devices by myself.	4 (1.5%)	10 (3.8%)	41 (15.4%)	149 (56%)	62 (23.3%)
I can fix simple technical problems on my own without asking someone for help.	4 (1.5%)	17 (6.4%)	72 (27.1%)	130 (48.9%)	43 (16.2%)

On the 3-item digital skills scale (total possible score = 12), the median score was 9 (IQR = 2), and 59.4% of participants were

classified as having good digital health literacy (score ≥ 9).

Table 4 Classification of Digital Healthcare Literacy (N=380)

Variable	Category	N (%)
Digital Healthcare Literacy	Median – 9, IQR 2, Minimum - 0, Maximum - 12	
	Poor Literacy (<9)	108 (40.6%)
	Good Literacy (≥ 9)	158 (59.4%)

The median perception score was 58 out of 85 (IQR = 9), reflecting generally favorable attitudes toward telemedicine. Most participants agreed that telemedicine saves time, supplements in-person care, improves communication with providers, and may become a standard healthcare approach. While many believed it could reduce organizational costs, only 30.4% felt it would

save them money. The lowest-rated item was related to equipment difficulty, with just 19.2% perceiving it as a challenge. However, concerns about technical reliability (57.2%) and privacy (22%) were noted. The perception scale demonstrated good internal consistency (Cronbach's alpha = 0.80). Full results are shown in Table 4.

Table 5 Distribution of Responses to Perceptions Towards Telemedicine (N=266)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N (%)	N (%)	N (%)	N (%)	N (%)
Healthcare providers (doctors, nurses) can understand my medical problems well through online or phone communication.	10 (3.8%)	12 (4.5%)	72 (27.1%)	153 (57.5%)	19 (7.1%)
Telemedicine can violate my privacy.	28 (10.5%)	67 (25.2%)	112 (42.1%)	49 (18.4%)	10 (3.8%)
The use of the necessary equipment for telemedicine seems difficult for me.	56 (21.1%)	99 (37.2%)	60 (22.6%)	41 (15.4%)	10 (3.8%)
I can be as satisfied talking to the healthcare provider through online or phone communication as talking in person.	4 (1.5%)	20 (7.5%)	90 (33.8%)	133 (50.0%)	19 (7.1%)
Telemedicine can improve my general health.	5 (1.9%)	9 (3.4%)	93 (35.0%)	138 (51.9%)	21 (7.9%)
Telemedicine can save time for healthcare providers.	4 (1.5%)	5 (1.9%)	64 (24.1%)	162 (60.9%)	31 (11.7%)
Telemedicine cannot save me any money.	18 (6.8%)	72 (27.1%)	95 (35.7%)	66 (24.8%)	15 (5.6%)
Using telemedicine, the healthcare provider will be able to monitor my condition well.	5 (1.9%)	28 (10.5%)	100 (37.6%)	116 (43.6%)	17 (6.4%)
I don't like receiving medical treatment at home through phone or online examinations without having an in-person physical examination.	12 (4.5%)	59 (22.2%)	111 (41.7%)	71 (26.7%)	13 (4.9%)
Telemedicine is a convenient form of health-care delivery for me.	2 (0.8%)	11 (4.1%)	79 (29.7%)	150 (56.4%)	24 (9.0%)
Telemedicine saves me time.	3 (1.1%)	3 (1.1%)	53 (19.9%)	167 (62.8%)	40 (15.0%)
Telemedicine will be a standard way of health-care delivery in the future.	4 (1.5%)	11 (4.1%)	66 (24.8%)	150 (56.4%)	35 (13.2%)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N (%)	N (%)	N (%)	N (%)	N (%)
Telemedicine is an additional healthcare service that can supplement my regular healthcare (in-person visits with a doctor or nurse) that I am receiving.	2 (0.8%)	7 (2.6%)	50 (18.8%)	167 (62.8%)	40 (15.0%)
Telemedicine can reduce costs for healthcare providers and organizations (hospitals, clinics, institutions, and insurance companies)	3 (1.1%)	9 (3.4%)	67 (25.2%)	150 (56.4%)	37 (13.9%)
The healthcare provider (doctor or nurse) cannot examine me properly through online or phone as they would in person.	7 (2.6%)	39 (14.7%)	111 (41.7%)	92 (34.6%)	17 (6.4%)
Telemedicine makes it easier for me to communicate with healthcare providers (doctors or nurses)	3 (1.1%)	6 (2.3%)	58 (21.8%)	167 (62.8%)	32 (12.0%)
I cannot always trust that the equipment (phone or computer) and internet connections used for telemedicine will work properly.	4 (1.5%)	14 (5.3%)	96 (36.1%)	130 (48.9%)	22 (8.3%)

In Table 5, factors such as age, income level, and digital health literacy showed statistically significant differences in perception scores, with higher scores observed among participants who were above 24 years ($p=0.018$), had an income of $\geq 500,000$ MMK ($p=0.023$), and

reported good digital health literacy (<0.001). There were no significant differences in perception scores by gender, ethnicity, marital status, education, occupation, region, residence, or previous telemedicine use.

Table 6 Comparison of Perception Scores across different groups (N = 266)

Variables	N (%)	Mean \pm SD	Median (IQR)	P-value
Age				
24 years and below	135 (50.75%)		57 (10)	0.018 ^{a*}
Above 24 years	131 (49.25%)	59.41 \pm 6.24		
Gender				
Male	99 (37.22%)		57 (11)	0.501 ^b

Variables	N (%)	Mean ± SD	Median (IQR)	P-value
Female	149 (56.02%)		59 (8)	
Others	18 (6.77%)	57.61 ± 6.64		
Ethnicity				
Bamar	223 (83.83%)		58 (9)	0.972 ^a
Others	43 (16.17%)		57 (9)	
Marital Status				
Single	220 (82.71%)		59 (9)	0.198 ^a
Others	46 (17.29%)		57 (9.25)	
Education Level				
Below University Level	86 (32.33%)		58 (10.25)	0.419 ^a
University Level and Above	180 (67.67%)		58.5 (9)	
Occupation				
Employed	161 (60.53%)		59 (10)	0.299 ^a
Unemployed	105 (39.47%)		57 (9)	
Residence				
Urban	226 (84.96%)		58 (9.25)	0.052 ^a
Rural	40 (15.04%)	61.05 ± 7.63		
Regions				
Mandalay Region	92 (34.59%)	58.65 ± 6.87		0.868 ^b
Yangon Region	92 (34.59%)	59.16 ± 7.38		
Others	82 (30.83%)		58 (7.5)	
Income Level				
<200,000 MMK	79 (29.70%)		57 (9)	0.023 ^{b*}
200,000 – 499,999 MMK	88 (33.08%)		58 (10)	
≥500,000 MMK	99 (37.22%)	60.06 ± 6.84		
Previous Telemedicine Use				
Yes	95 (35.71%)		58 (9)	0.332 ^a
No	171 (64.29%)		59 (9)	
Digital Healthcare Literacy				
Poor Literacy	108 (40.60%)		56 (10)	<0.001 ^{a*}

Variables	N (%)	Mean ± SD	Median (IQR)	P-value
Good Literacy	158 (59.40%)	60.25 ± 6.22		

^a - Mann-Whitney Test, ^b - Kruskal-Wallis Test, p-value <0.05 – statistically significant, mean ± SD - used for normal distribution, Median (IQR) - used for non-normal distribution

A multiple linear regression was conducted to identify factors associated with perception toward telemedicine. The model was statistically significant, $F(14, 251) = 2.675$, $p=0.001$ and explained 13% of the variance in perception scores (Adjusted $R^2=0.081$), suggesting that additional unmeasured factors may also influence perception. Among the

predictors, good digital health literacy was the strongest positive predictor of perception scores ($B = 3.401$, $p < 0.001$), indicating that participants with good digital literacy rated telemedicine more favorably. Residence in a rural area was also a significant predictor ($B = 3.347$, $p = 0.007$). Full model results are presented in Table 6.

Table 7 Multiple Linear Regression Predicting Perception Scores (N = 266)

Variable	Category	B	SE	95% CI for B	P-value
Constant	–	52.945	2.482	[48.057, 57.834]	<0.001
Age	≤24 years (Reference)				
	Above 24 years	0.859	1	[-1.111, 2.829]	0.391
Gender	Others (Reference)				
	Male	0.503	1.751	[-2.945, 3.952]	0.774
	Female	1.414	1.714	[-1.962, 4.790]	0.41
Ethnicity	Others (Reference)	-0.764	1.144	[-3.016, 1.489]	0.505
	Bamar				
Marital Status	Others (Reference)				
	Single	1.036	1.132	[-1.193, 3.265]	0.361
Education Level	Below University Level (Reference)				
	University Level and above	0.258	0.978	[-1.669, 2.185]	0.792
Occupation	Unemployed (Reference)				
	Employed	0.671	0.965	[-1.230, 2.573]	0.487
Residence	Urban (Reference)				
	Rural	3.347	1.241	[0.903, 5.791]	0.007
Region	Others (Reference)				
	Mandalay	0.771	1.085	[-1.365, 2.907]	0.478

Variable	Category	B	SE	95% CI for B	P-value
	Yangon	1.485	1.135	[-0.751, 3.721]	0.192
	<200,000 MMK (Reference)				
Income Level	200,000–499,999 MMK	0.634	1.15	[-1.630, 2.898]	0.582
	≥500,000 MMK	1.604	1.126	[-0.614, 3.822]	0.156
Previous Telemedicine Use	No (Reference)				
	Yes	-1.152	0.872	[-2.869, 0.565]	0.188
Digital Healthcare Literacy	Poor Literacy (Reference)				
	Good Literacy	3.401	0.886	[1.657, 5.145]	<0.001

B = Unstandardized regression coefficient; SE = Standard error; CI = Confidence Interval; p-value < 0.05 - statistically significant, Model Fit Statistics: R = 0.360, R² = 0.130, Adjusted R² = 0.081, F (14, 251) = 2.675, p = 0.001, Standard Error of Estimate = 6.68

DISCUSSION

This study examined perceptions of telemedicine among 266 digitally accessible young adults in Myanmar, revealing generally favorable attitudes, with a median perception score of 58 out of 85, reflecting moderate to high acceptance. Perceptions were significantly more favorable among rural participants and those with higher digital healthcare literacy. While age and income also showed positive associations in bivariate analysis, only rural residence and digital literacy remained significant in the adjusted model. The fact that unexpectedly higher perception scores among rural participants despite well-documented infrastructural and connectivity barriers, suggests that perceived utility may outweigh access limitations when alternative healthcare options are scarce. This finding underscores the adaptive potential of telemedicine in underserved contexts, where even minimal access to remote care can fill critical service gaps.

Digital healthcare literacy emerged as a strong enabling factor, consistent with global evidence that individuals with greater confidence in using digital technologies are more likely to trust and adopt telemedicine services (1, 12). This underscores the need not only to expand digital infrastructure but also to invest in building users' technical skills to ensure equitable and effective

uptake. Most participants perceived telemedicine as a complementary tool that facilitates communication with healthcare providers, supports condition monitoring, and saves time.

However, concerns remained regarding its personal value, as many viewed the financial benefits of telemedicine as favoring healthcare institutions rather than individual users. In addition, despite being digitally capable, many participants expressed concerns about the reliability of devices and internet connectivity. These concerns, rooted in Myanmar's unstable digital infrastructure, may undermine trust in remote care even among otherwise willing users. Discomfort with the absence of physical examinations further highlighted a continued dependence on face-to-face consultations for diagnostic reassurance. This combination of technical and clinical concerns reflects a transitional stage in telemedicine acceptance, where digital care is appreciated for its convenience but not yet fully trusted as a standalone alternative.

Notably, prior use of telemedicine was not significantly associated with perception, suggesting that attitudes may be shaped more by perceived potential, societal narratives, and external messaging than by personal experience. These findings highlight the need for sustained community engagement, provider-driven

encouragement, and culturally responsive education to build confidence in telemedicine's reliability, both technically and clinically.

The findings of this study are consistent with international evidence that highlights the influence of digital literacy and contextual factors on perceptions of telemedicine. In Malaysia, 80.7 percent of participants reported favorable attitudes toward telemedicine, with digital literacy identified as a significant determinant of acceptance (18). In Ethiopia, acceptance was slightly lower at 71.1 percent, and nearly half of the respondents expressed concerns about the security of online health information (19). This contrast may reflect differences in regulatory environments and levels of digital trust. In the present study, privacy concerns were relatively limited, which may indicate lower awareness or different cultural attitudes toward data protection.

In Australia, high satisfaction with telehealth was reported among remote Indigenous communities. However, many participants continued to prefer in-person care, suggesting that cultural familiarity and personal interaction remain important (20). In the United States, telemedicine was well received, especially in home-based care settings. Nonetheless, concerns persisted regarding the reliability of technology and the lack of physical contact, particularly among older adults and those with limited digital confidence (17).

This study contributes to the global literature by demonstrating that, among digitally accessible young adults in Myanmar, digital health literacy played a more influential role in shaping perceptions of telemedicine than digital access alone. In addition, participants residing in rural areas reported more favorable attitudes, which is consistent with findings from the United States where rural populations were more likely to value telemedicine due to barriers in accessing in-person care (21). These comparisons reinforce the importance of digital competence, cultural context, and service accessibility in influencing the public's acceptance of telemedicine across diverse settings.

Therefore, enhancing digital health literacy through national education programs is

essential, particularly for building user confidence in rural populations. Outreach should focus on rural youth using mobile-accessible platforms and culturally tailored messaging. However, digital skills alone are insufficient without reliable infrastructure. Expanding internet connectivity and access to devices is crucial to support equitable telemedicine use. Given the strong willingness among rural participants, piloting telehealth programs in underserved areas is both timely and strategic. Sustainable implementation will require user-centered systems that align with local technological and healthcare needs.

This study has limitations, including sampling bias from digital-only participants, a cross-sectional design that prevents causal inference, and reliance on self-reported data, which may be subject to bias. The structured survey format also limited exploration of deeper barriers such as data costs, provider trust, or health status. Despite these constraints, the study's strengths include efficient online data collection, reduced interviewer bias, and increased response honesty through anonymity. Future research should include older adults, individuals with chronic conditions, and those with limited digital access to ensure a more inclusive understanding of telemedicine perceptions in Myanmar.

CONCLUSION

This study reveals that digitally accessible young adults in Myanmar perceive telemedicine positively, especially those in rural areas and with higher digital health literacy. These insights demonstrate telemedicine's potential to reduce healthcare disparities in underserved regions. To advance adoption, policymakers must integrate digital literacy into national education, expand digital infrastructure, and prioritize rural outreach. Community-level programs should equip youth with practical digital skills, while national strategies must establish secure platforms, improve internet access, and enforce data protection. International partners should support these efforts through funding, technical assistance, and advocacy for

ETHICAL DECLARATION

This study was approved by The Research Ethic Review Committee for Research Involving Human Research Participants, Chulalongkorn university (COA number 138/68)".

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Appendix – Questionnaires

Screening questions

Do you agree to participate in this research?

- Yes
- No

Are you a Myanmar citizen, between 18-35 years, and living in Myanmar?

- Yes
- No

Are you a health-related professional?

- Yes
- No

In the past 12 months, have you experienced any health issues that required you to consult a healthcare provider?

- Yes
- No

Do you have access to the internet and a device to fill out online forms?

- Yes
- No

I. Socio-demographic characteristics & Previous Telemedicine Use (10 Questions)

What is your age? (Fill your completed years)

What is your gender?

- Male
- Female
- Others

What is your ethnicity?

- Bamar
- Non-Bamar

What is your current marital status?

- Single
- Married
- Divorced/Separated
- Widow

What is the highest level of education you have completed?

- No Formal Education
- Primary School Level
- Secondary School Level
- High School Level
- College and above

What is your current job or occupation?

- Government Employee
- Private Employee
- Self-Employed
- Manual laborers
- Students
- Dependents
- Other, Please Specify. _____

Where do you live?

- Urban (if your address is in a ward)
- Rural (if your address is in a village or village tract)

What region or state in Myanmar do you live in?

- Kachin State
- Kayah State or Karreni State
- Kayin State
- Chin State
- Sagaing Region
- Tanintharyi Region
- Bago Region
- Magway Region
- Mandalay Region
- Mon State
- Rakhine State
- Yangon Region
- Shan State
- Ayeyawaddy Region
- Union Territories

What is your household income per month?

- Less than 100,000 Kyats
- 100,000-200,000 Kyats
- 200,000 – 500,000 Kyats
- Over 500,000 Kyats

In the past 12 months, have you used telemedicine to receive healthcare services from a doctor or healthcare provider through text messages, video calls, audio calls, phone calls, or mobile applications?

- Yes
- No

Digital Healthcare Literacy (3 questions)

Below are some statements about using electronic devices. For each statement, select the option that best matches your opinion.

No.	Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I can use apps or programs (like Zoom) on my phone, computer, or other devices without needing help.					
2	I can set up a video call on my phone, computer, or other devices by myself.					
3	I can fix simple technical problems on my own without asking someone for help.					

Perceptions towards telemedicine

Below are statements about your perceptions of telemedicine and its use in healthcare delivery. Please read each statement carefully and select the option that best reflects your opinion for each statement. For each statement, choose the most appropriate option.

No.	Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	A healthcare provider can get a good understanding of my medical problem over the television.					
2	Telemedicine can violate my privacy.					
3	The use of the necessary equipment seems difficult to me.					
4	I can be as satisfied talking to the healthcare provider over the television as talking in person.					
5	Telemedicine can improve my general health.					

No.	Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
6	Telemedicine can save time for the healthcare providers.					
7	Telemedicine cannot save me any money.					
8	Using telemedicine, the healthcare provider will be able to monitor my condition well.					
9	I don't like that there is no physical contact during a home telemedicine visit.					
10	Telemedicine is a convenient form of health-care delivery for me.					
11	Telemedicine saves me time.					
12	Telemedicine will be a standard way of health-care delivery in the future.					
13	Telemedicine can be an addition to the regular care I receive.					
14	Telemedicine can reduce the costs for the health-care agencies.					
15	A healthcare provider cannot examine me over the television as well as in person.					
16	Telemedicine makes it easier for me to contact the healthcare provider.					
17	I cannot always trust the equipment to work.					

SESSION 4: Population, Demography, Aging and Migration, Active Aging and Innovation. 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

PERCEIVED ACCURACY OF ONLINE HEALTH MISINFORMATION AMONG THAI ADULTS AGED 50-75 YEARS IN BANGKOK: A PILOT STUDY

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ABSTRACT

Introduction: The spread of online health misinformation poses a growing threat to public health, particularly among older adults. In Thailand, nearly half of adults aged ≥ 50 have encountered online threats, including misinformation. Despite this vulnerability, few studies have explored their perception of health misinformation or developed standardized assessment tools.

Objectives: This pilot study aimed to develop a tool to assess perceived accuracy of online health misinformation and examine associated factors among Thai adults aged 50-75 years.

Methodology: The self-report questionnaire was developed and tested for validity and reliability. A cross-sectional survey was conducted among 100 Thai adults aged 50-75 years in Bangkok with recent internet and social media use. Participants completed a structured questionnaire on socio-demographic characteristics, social media use behaviors, and perceived accuracy of online health misinformation by rating ten health-related fake news headlines from the Anti-Fake News Center. Binary and multiple logistic regression analyses identified factors associated with high perceived accuracy.

Results: The questionnaire showed high internal consistency (Cronbach's $\alpha=0.880$) and content validity (Index of Item-Objective Congruence >0.5). Most participants were female (71%), had at least secondary education (74%), income $<30,000$ Baht/month (85%), chronic disease(s) (80%), and accessed social media daily (71%) via mobile phone (92%). About 28% had high perceived accuracy of online health misinformation. Significant factors in binary analysis included age 70–75 years, primary education or below, housewife/househusband occupation, income $<10,000$ Baht/month, and chronic disease(s). In the multivariate model, age 60–69 years was associated with lower perceived accuracy than age 50–59 years, while chronic disease remained a strong predictor.

Conclusion: Nearly one-third of older adults had high perceived accuracy of online health misinformation, with key risk factors including younger age, socioeconomic disadvantages, and chronic diseases. Future studies with larger samples and additional factors, such as digital health literacy and health anxiety, are recommended.

Keywords: Bangkok, Older adults, Online health misinformation, Perceived accuracy

INTRODUCTION

Health misinformation, defined by the World Health Organization (WHO) as the spread of false information that is unintentionally misleading, poses a growing threat to public health. It has been linked to delays in evidence-based treatments and engagement in harmful practices (1). For example, in the 1990s, measles, mumps, and rubella (MMR) vaccines were falsely associated with autism due to a poorly designed study. Although this study was later retracted, the misinformation triggered widespread misunderstanding, reduced vaccination rates, and caused measles outbreaks. A more recent example occurred during the COVID-19 pandemic, when misinformation about vaccine

safety and effectiveness had widely circulated online. It caused delays in individual decision-making and resulted in an increase in COVID-19 infections and mortality rates (2,3). The WHO has described this rapid spread of misinformation as an “infodemic,” which had complicated public health responses (4). These examples show how impactful health misinformation can lead to serious public health consequences.

As older Thai adults adapt to the rapidly changing digital landscape, they increasingly become more vulnerable to fake news and misinformation. Age-related cognitive decline, social changes, and limited experience social media may heighten this risk (5). Nearly half of internet users aged 50 years

and older in Thailand have encountered various online threats, including call center scams and misinformation. Bangkok is particularly at risk, as it has the highest rate of internet access in Thailand, with 97.1% of households connected (6,7). Despite the country's efforts to raise awareness about online threats like misinformation and implement strategies such as the Anti-Fake News Center, the spread of health misinformation remains a significant concern (8).

Despite this growing threat, at present the prevalence of perceived accuracy of online health misinformation in Thai older adults, who are more susceptible to the online misinformation about health topics, has not been reported, partly due to the lack of standardized tool for assessment in the Thai population. It is also important to better understand how socio-demographic characteristics and social media use behaviors influence these perceptions, particularly in Bangkok, where internet exposure is high. However, until now only few studies have specifically explored its prevalence or associated factors in this population. This pilot study aimed to develop an assessment tool for evaluating perceptions of online health misinformation and to explore its associated factors among Thai adults aged 50-75 years in Bangkok. The insights gained from this research will help inform public health strategies to combat health misinformation effectively.

METHODOLOGY

Research Design

This pilot study employed a cross-sectional quantitative design to assess the perceived accuracy of online health misinformation and explore its associated factors, including socio-demographic characteristics and social media use behaviors.

Target Population and Setting

The study was conducted in Bangkok in June 2025. Bangkok was selected due to its highest internet penetration rate compared to other regions in the country. The target population consisted of Thai adults aged 50-75 who were active user of the internet and social media.

Sampling Technique

Participants were selected through purposive sampling from various elderly community groups across Bangkok. Inclusion criteria required participants to be aged 50-75 years, reside in Bangkok for at least six months, have internet access and used social media in the past three months. Individuals with limitations to complete the questionnaire and those unwilling to provide informed consent were excluded from the study.

Sample Size

A total of 100 participants were recruited, which was considered sufficient to evaluate the feasibility of the study design, test the data collection instrument, and identify potential challenges for implementing a larger-scale study.

Measurement Tools

The structured, paper-based, self-administered questionnaire was developed in Thai language and composed of three following sections:

1. Socio-demographic characteristics included age, sex, education, occupation, monthly income, and underlying disease, and were collected via multiple-choice and open-ended questions.
2. Social media use behaviors assessed the most frequently used device to access the internet and the frequency of internet use over the past three months. Responses were collected via multiple-choice questions.
3. Perceived accuracy of online health misinformation used ten health-related fake news headlines sourced from the Anti-Fake News Center, a fact-checking website supported by the Ministry of Digital Economy and Society. Participants rated each headline on a 5-point Likert scale (1=Not at all accurate, 5=Extremely accurate) without knowing the information was false. Total scores ranged from 10 to 50, with higher scores indicating higher perceived accuracy. Scores above the third quartile (Q3) were categorized as high perceived accuracy, and those at or below Q3 were categorized as low to moderate. This questionnaire-based tool and news rating method were modified from institutional sources and literature, following approaches used in tools such as the Misinformation Susceptibility Test

(MIST) from the University of Cambridge (9), as well as studies by Pan et al. (10) and Ahmed and Rasul (11).

The developed questionnaire was tested for validity and reliability. Content validity was reviewed by three experts using the Item-Objective Congruence Index (IOC), with items scoring ≥ 0.5 retained. A reliability test with 30 participants yielded a Cronbach's Alpha of 0.880, indicating high internal consistency.

Data Collection

Data were collected through in-person visits using paper-based questionnaires. Participants were informed about 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 administered in private settings to ensure privacy, and participants completed them independently.

Data Analysis

Data were analyzed using SPSS version 28.0. Descriptive statistics (frequency, percentage, mean, and standard deviation (SD)) summarized socio-demographic characteristics, social media use behaviors, and perceived accuracy of online health misinformation. Binary logistic regression was used to explore associations between each independent

variables and high perceived accuracy of online health misinformation, reporting crude odds ratios (ORs) and 95% confidence intervals (CIs). Variables with a p-value < 0.25 from the bivariate analysis were included in a multiple logistic regression model to identify independent predictors. Adjusted odds ratios (AORs) with 95% CIs were calculated, with statistical significance set at p-value < 0.05 .

RESULTS

1. Socio-demographic characteristics and social media use behavior

Socio-demographic characteristics and social media use behavior of the study participants were reported in Table 1. The mean age was 66.9 years (SD=6.72), with most aged 60-69 years (44%). The majority were female (71%) and held at least a bachelor's degree (43%). The most common occupation was housewife/househusband (35%), followed by government officers (31%). Most participants (85%) had income $< 30,000$ Baht/month. In terms of health conditions, 55% of participants had one underlying disease, while 20% had none, with hypertension (41%) and diabetes mellitus (21%) being the most common. Additionally, 43% reported having other health conditions. Regarding social media use, most participants (92%) primarily accessed the internet via mobile phones, followed by tablets (6%). 71% reported daily use of social media.

Table 1 Descriptive statistics for socio-demographic characteristics and social media use behaviors (Total N=100)

Characteristics	Frequency (N)	Percentage (%)
Age (years)		
50–59	15	15
60–69	44	44
70–75	41	41
Mean (SD) = 66.9 (6.72), Min=51, Max=75		
Sex		
Male	29	29
Female	71	71
Education		
Below primary education	2	2
Primary education	24	24
Secondary education	31	31
Bachelor's degree	36	36
Master's degree or above	7	7
Occupation		
Government officer	31	31
Private sector employee	16	16
Business owner	11	11

Characteristics	Frequency (N)	Percentage (%)
Farmer	2	2
Daily wage laborer	5	5
Housewife/Househusband	35	35
Monthly Income (Baht)		
<10,000	39	39
10,000–29,999	46	46
≥30,000	15	15
Number of underlying diseases		
0	20	20
1	55	55
2	18	18
≥3	7	7
Primary device		
Desktop computer	0	0
Laptop computer	1	1
Tablet	6	6
Mobile phone	92	92
Smart TV	1	1
Frequency of social media use		
Every day (several times a day)	61	61
Every day (once a day)	10	10
Almost every day (4-6 days per week)	15	15
Some days (1-3 days per week)	7	7
Less than once a week	7	7

2. Perceived Accuracy of Online Health Misinformation

Descriptive statistics for the perceived accuracy of online health misinformation are shown in Table 2. The mean score was 28.51 (SD=5.80), with scores ranging from 10 to 49. The interquartile range (IQR) indicated that the

25th percentile (Q1) was 25 and the 75th percentile (Q3) was 32. Using the IQR method for classification, 72% of participants had low to moderate perceived accuracy of online health misinformation (scores 10-32), while 28% were classified as having high perceived accuracy (scores 33-50).

Table 2 Descriptive statistics for perceived accuracy of online health misinformation (Total N=100)

Variable	Frequency (N)	Percentage (%)
Perceived accuracy of online health misinformation		
Low to moderate	72	72
High	28	28
Mean (SD) = 28.51 (5.80)		
Min–Max = 10–49		
IQR (Q1–Q3) = 25–32		

3. Factors Associated with High Perceived Accuracy of Online Health Misinformation

Binary logistic regression identified several factors associated with the high perceived accuracy of online health misinformation, as presented in Table 3. Participants with primary education or below were significantly more likely to report high perceived accuracy compared to those with a bachelor's degree or higher (OR=5.29). Participants whose occupations was

housewife/househusband also had higher odds of high perceived accuracy when compared to government officers (OR=5.68). Monthly income below 10,000 Baht was associated with higher perceived accuracy compared to income of 30,000 Baht or more (OR=5.57). For health status, those with one chronic disease (OR=8.50), two diseases (OR=12.09), or three or more diseases (OR=14.25) had progressively higher odds of high perceived accuracy when

compared to participants with no underlying disease.

Table 3 Binary logistic regression analysis of factors associated with high perceived accuracy of online health misinformation (Total N=100)

	Perceived accuracy of online health misinformation (Reference=Low to moderate)				
	Low to moderate N(%)	High N(%)	Crude OR	95%CI	p-value
Age (years)					
50–59	12(80)	3(20)	Reference		
60–69	38(86.4)	6(13.6)	0.63	0.14-2.92	0.556
70–75	22(53.7)	19(46.3)	3.46	0.85-14.10	0.084
Sex					
Male	21(72.4)	8(27.6)	1.03	0.39-2.70	0.953
Female	51(71.8)	20(28.2)	Reference		
Education					
Primary education or below	14(53.8)	12(46.2)	5.29	1.66-16.81	0.005**
Secondary education	21(67.7)	10(32.3)	2.94	0.93-9.23	0.065
Bachelor's degree or higher	37(86)	6(14)	Reference		
Occupation					
Government officer	27(87)	4(13)	Reference		
Private sector employee / Business owner	21(77.8)	6(22.2)	1.93	0.48-7.73	0.354
Farmer / Daily wage laborer	5(71.4)	2(28.6)	2.70	0.39-18.93	0.317
Housewife/Househusband	19(54.3)	16(45.7)	5.68	1.64-19.7	0.006**
Monthly income (Baht)					
<10,000	21(53.8)	18(46.2)	5.57	1.11-28.05	0.037*
10,000–29,999	38(82.6)	8(17.4)	1.37	0.26-7.29	0.713
≥30,000	13(86.7)	2(13.3)	Reference		
Number of underlying diseases					
0	19(95)	1(5)	Reference		
1	38(69)	17(31)	8.50	1.05-68.77	0.045*
2	11(61)	7(39)	12.09	1.31-111.66	0.028*
≥3	4(57)	3(43)	14.25	1.16-174.80	0.038*
Primary device					
Mobile phone	67(72.8)	25(27.2)	Reference		
Non-mobile devices	5(62.5)	3(37.5)	1.61	0.36-7.23	0.536
Frequency of social media use					
Daily	50(70.4)	21(29.6)	Reference		
Non-daily	22(75.9)	7(24.1)	0.76	0.28-2.04	0.583

p*-value <0.05, *p*-value <0.01

4. Independent Predictors of High Perceived Accuracy of Online Health Misinformation

Table 4 presents the results of the multiple logistic regression analysis. After adjusting for other covariates, participants aged 60–69 years were significantly less likely to perceive online health misinformation as accurate compared to those aged 50–59 years (AOR=0.11). Housewives/househusbands had higher odds of high perceived accuracy compared to government officers (AOR=8.53),

although this association was marginally significant. A strong and statistically significant association was found between the number of underlying diseases and high perceived accuracy. Participants with one disease (AOR=14.81), two diseases (AOR=50.63), and three or more diseases (AOR=267.97) were significantly more likely to perceive misinformation as accurate compared to those with no underlying disease.

Table 4 Multiple logistic regression analysis of factors associated with high perceived accuracy of online health misinformation (Total N=100)

	Perceived accuracy of online health misinformation (Reference=Low to moderate)				
	B	SE	p-value	Adjusted OR	95%CI
Age (years)					
50–59				Reference	
60–69	-2.25	1.07	0.036*	0.11	0.01-0.86
70–75	-1.39	1.04	0.179	0.25	0.03-1.90
Education					
Primary education or below	1.25	0.94	0.182	3.49	0.56-21.93
Secondary education	1.64	0.87	0.060	5.17	0.93-28.62
Bachelor's degree or higher				Reference	
Occupation					
Government officer				Reference	
Private sector employee / Business owner	0.91	0.99	0.357	2.49	0.36-17.33
Farmer / Daily wage laborer	0.46	1.28	0.716	1.59	0.13-19.35
Housewife/Househusband	2.14	1.10	0.051	8.53	0.99-73.40
Monthly income (Baht)					
<10,000	0.14	1.30	0.911	1.16	0.09-14.61
10,000–29,999	-0.48	1.13	0.672	0.62	0.07-5.69
≥30,000				Reference	
Number of underlying diseases					
0				Reference	
1	2.67	1.19	0.023*	14.81	1.45-151.18
2	3.93	1.38	0.005**	50.63	3.36-763.44
≥3	5.59	1.81	0.002**	267.97	7.74-9281.68

p*-value <0.05, *p*-value <0.01

DISCUSSION

The spread of health misinformation online poses a serious public health concern, especially for older adults who increasingly rely on digital platforms. In this study, nearly one-third of Thai adults aged 50–75 years perceived false health-related content as accurate, indicating significant vulnerability. Given the risks of poor health decisions and reduced trust in evidence-based care, identifying high-risk groups is essential for targeted intervention.

One of the more interesting findings was that participants aged 50–59 years were

more likely to perceive misinformation as accurate compared to older age groups. While this might seem counterintuitive, this finding aligns with a recent meta-analysis revealing that older adults generally possess greater discrimination abilities (12). This means they are better at distinguishing between true and false news despite having lower digital literacy. This ability may stem from life experience, stronger caution, or a higher false-news response bias (10,12). In contrast, adults aged 50–59 years may be more active online but may evaluate information less critically. However,

the small sample size in this age group could have affected the results, limiting statistical power and the generalizability of the observed association. Therefore, future studies with larger and more balanced age group samples are needed to validate this association.

Education was also examined as a potential predictor of perceived accuracy of online health misinformation. In the bivariate analysis, lower education levels were associated with higher perceived accuracy. However, this association did not remain statistically significant in the multivariate model, suggesting that other factors, such as socioeconomic status, may confound the effect of education. Despite this, previous studies have consistently shown that individuals with lower education levels are more likely to believe misinformation in association with reduced issue-specific knowledge, a tendency toward intuitive thinking, greater reliance on social media, and increasing susceptibility to scientific misinformation (13,14). Pan et al. further support this, showing that individuals with lower education and income levels were more likely to accept health misinformation. In contrast, those with higher socioeconomic status may benefit from better access to credible information sources, stronger critical thinking skills, and higher health literacy, factors that can help reduce susceptibility to misinformation (10). Therefore, further studies should explore how education interacts with other factors, such as digital health literacy, as well.

Occupation also emerged as an important factor for perceived accuracy of online health misinformation. Being a housewife or househusband was significantly associated with higher perceived accuracy in the bivariate analysis and remained marginally significant in the multivariate model. This suggests a potential relationship between occupational status and susceptibility to misinformation. Individuals in these roles may have fewer opportunities to access formal health education (15) or develop digital literacy skills, which can increase their vulnerability to misinformation (16,17). While socioeconomic disadvantage contributes to this vulnerability, it may not fully explain the observed patterns. For example, a study in Liberia found no significant associations between employment status or income and misinformation beliefs, suggesting that economic disadvantage alone may not fully

explain this susceptibility (18). Further research is needed to assess additional factors, such as digital health literacy, to better understand their roles in shaping health misinformation beliefs.

Another notable finding was the strong association between having chronic diseases and higher perceived accuracy of misinformation. This may be due to their increased exposure to online health content to manage their conditions. While searching for health information can provide reassurance, it can also heighten health anxiety, especially when individuals encounter information overload, conflicting messages, or cognitive biases such as catastrophic misinterpretation (19). Health anxiety is often more common among individuals with chronic diseases, especially when symptom burden or impairments in daily functioning increase their vulnerability to health threats (20). As a result, they may overestimate health risks or misinterpret benign symptoms, leading to excessive online searching and increased susceptibility to misinformation (10,21).

Overall, the findings of this study highlight the complex interplay between socio-demographic characteristics and the perceived accuracy of online health misinformation. While social media use behaviors were not significantly associated in this study, this does not rule out their potential influence. Future research should further investigate these variables, along with additional confounding factors such as digital health literacy and health anxiety. Moreover, limitations of this pilot study, such as sample size and self-reported measures, should be addressed in future studies to strengthen the generalizability and depth of understanding around the determinants of perceived accuracy of online health misinformation.

CONCLUSION

This pilot study successfully developed and validated a new assessment tool to measure the perceived accuracy of online health misinformation among older Thai adults. Using this tool, the study found that nearly one-third of participants perceived online health misinformation content as accurate, indicating notable susceptibility. Key factors associated with higher perceived accuracy included those being younger within the older adult age range, experiencing socioeconomic disadvantages and, most prominently, having chronic health

conditions. These findings underscore the need for targeted public health interventions to address misinformation vulnerability in this population. Future studies should involve larger and more diverse samples to validate these findings and investigate additional related factors, such as health anxiety and digital health literacy. Gaining a deeper understanding of these influences can help inform targeted public health strategies to reduce the spread and impact of health misinformation among older populations.

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SOCIO-DEMOGRAPHIC DETERMINANTS OF ORAL HEALTH KNOWLEDGE AMONG PEOPLE WITH TYPE II DIABETES MELLITUS IN MANDALAY, MYANMAR: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: This study aims to assess socio-demographic determinants of oral health knowledge among people with T2DM in Mandalay, Myanmar. Despite the well-established link between T2DM and oral health complications, knowledge of oral healthcare among individuals with T2DM remains limited among the population. Moreover, Mandalay recently experienced a magnitude 7.7 earthquake that caused significant infrastructure breakdown. As a result, people in that region face difficulties accessing oral healthcare facilities. Understanding current levels of oral health knowledge in this study is essential for informing targeted interventions and improving access to oral healthcare.

Methodology: A cross-sectional study was conducted among 281 people with T2DM who attended the two largest free-of-charge clinics in Mandalay, Myanmar. Data were collected through face-to-face interviews using a structured questionnaire. Analysis was performed using SPSS version 29.0.2.0, applying descriptive and inferential statistical methods, including the Chi-square test, Fisher's Exact test, and multinomial logistic regression. A p-value of 0.05 was considered statistically significant.

Results: Among 281 participants, 43.4% were between the ages of 45-54 years, 64.4% were female, and 74.7% were married. Most participants identified as Buddhist (70.1%) and Burmese (93.2%). About 61.2% had a high education and above, 51.2% were employed in the informal sector, and 48% reported middle-income. Only 10% of the participants had good oral health knowledge, 59% moderate, and 31% poor. Statistically significant associations were found between oral health knowledge and age ($p < 0.001$), educational level ($p < 0.001$), occupation ($p < 0.001$), and average family income per month ($p = 0.001$), but not with gender, marital status, religion, and ethnicity. Multinomial logistic regression indicated that participants aged 35-44 had significantly higher odds of having moderate (AOR=11.75, $p=0.002$) and good knowledge (AOR=31.59, $p=0.002$), compared to those 65 years and above. Participants with low (AOR=0.323, $p=0.033$) and middle income (AOR=0.323, $p=0.020$) were less likely to have moderate knowledge, and those in middle income (AOR=0.175, $p=0.010$) were less likely to have good knowledge, compared to high income.

Conclusion: Oral health knowledge among people with T2DM in Mandalay was generally low to moderate and significantly associated with age and family income. Targeted oral health education, particularly for disadvantaged groups, is essential. Integrating oral health promotion into diabetes care may improve health outcomes and reduce diabetes-related complications.

Keywords: Type II Diabetes Mellitus, Oral Health Knowledge, Socio-Demographic Characteristics, Mandalay, Myanmar

INTRODUCTION

Type II Diabetes mellitus (T2DM) is a non-communicable disease and a major public health problem worldwide. It results from hyperglycemia due to insufficient insulin

production, failed insulin action, or both (1). T2DM is associated with systemic complications and oral diseases such as periodontal diseases and delayed wound healing (2). According to the

International Diabetes Federation (IDF), over 537 million adults aged 20 to 79 years were living with diabetes globally in 2021, and it is estimated to increase to 783 million by 2045. In Southeast Asia (SEA), the incidence is approximately 90 million, with a tremendous rise anticipated in the coming decades (3).

T2DM is not only associated with serious systemic complications, but it also has important consequences for oral health. People with T2DM are at a higher risk of periodontal diseases, oral infection, delayed wound healing, and dryness of the mouth (2). Poor oral health may cause impairment in glycemic control, creating a bidirectional relationship between diabetes and oral health.

In Myanmar, the burden of T2DM is increasing, especially in urban areas. The first national survey conducted in 2014 found a higher prevalence of T2DM in urban areas, which may be influenced by factors such as lifestyle changes, limited physical activity, and gaps in disease awareness and knowledge (4). However, Myanmar's healthcare infrastructure remains underdeveloped, and much of the population relies on out-of-pocket payments for care (5). Access to oral healthcare is limited by a shortage of dentists, limited funding in the public health system, and geographic and financial barriers (6, 7).

Studies from SEA showed that people with T2DM have poor oral health literacy due to poor access to dental treatment, due to poor oral health knowledge, and a lack of awareness, especially brushing and regular visits to a dentist (8, 9). However, in Myanmar, there is a limited study on oral health knowledge among people with T2DM, particularly in the socio-demographic factors that influence oral health knowledge. Moreover, Mandalay recently experienced a magnitude 7.7 earthquake that caused significant infrastructure breakdown. As a result, people in that region face difficulties accessing oral healthcare facilities (10). These highlight the need for localized data to support better planning and oral health promotion.

This study aims to address those gaps by examining the levels of oral health knowledge and exploring how they vary according to socio-demographic characteristics among people with T2DM in Mandalay, Myanmar.

METHODOLOGY

Study design and Setting

A cross-sectional study was conducted to assess oral health knowledge and its socio-demographic determinants among people with T2DM who came to the two largest free-of-charge clinics in Mandalay, Myanmar.

Study Population and Sampling

The population consisted of people aged 35 years and older, including all genders, who had been diagnosed with T2DM by medical professionals and were selected who came to the two largest free-of-charge clinics which cover urban areas of Mandalay. A total of 281 people with T2DM were selected using a multiple-staged sampling method. Inclusion criteria included being clinically diagnosed with T2DM by medical professionals, living in Mandalay for more than 1 year, aged 35 or older, having at least one permanent tooth, and willing to provide informed consent. People with other severe major health conditions, people who worked in the medical and dental services, and pregnant women were excluded.

Data Collection Tool and Procedure

Data were collected by face-to-face interviews using structured questionnaires, which were already validated and developed based on previous studies and WHO oral health survey guidelines (11-14). The questionnaire was divided into two sections: socio-demographic characteristics and oral health knowledge. Before data collection, a pilot test was run on 10% of the sample size in a similar setting to ensure clarity, validity, and reliability, with a Cronbach's Alpha ≥ 0.7 being considered.

Variables and Measurements

The dependent variable was the level of oral health knowledge, measured using 14 questions covering their awareness and understanding of DM and its impact on oral health, prevention of oral diseases, and the importance of maintaining good oral health. Each correct response was scored as "1", and incorrect or don't know as "0". Total scores were categorized into poor, moderate, and good knowledge based on Benjamin Bloom's

Taxonomy theory. Independent variables included age, gender, marital status, religion, ethnicity, education level, occupation, and average family income per month.

Statistical Analysis

Data were first entered and cleaned by using Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 29.0.2.0. Descriptive statistics (median, IQR, frequency, and percentage) were used to summarize categorical variables. Bivariate analysis was performed using the Chi-square and Fisher's Exact test to explore the association between independent variables and oral health knowledge. Variables with p-values less than 0.05 were included in the multinomial logistic regression to determine adjusted odds ratios (AORs) with 95% confidence intervals (CIs). A

p-value less than 0.05 was considered statistically significant.

RESULTS

Socio-demographic Characteristics of Participants

As a result of Table 1, a total of 281 people with T2DM participated. The median age was 52 years (IQR:47-61), with the largest age group 45-54 years (43.4%). Most participants were female (64.4%), and married (74.7%). The majority were Buddhists (70.1%) and of Burmese ethnicity (93.2%). Over half (61.2%) had a high education and above. Regarding occupation, 51.2% worked in the informal sector, and nearly half of the participants (48.0%) reported a middle monthly income (400,000-800,000 MMK), while 32.4% had a low income.

Table 1 Number and Percentage Distribution of Socio-demographic Characteristics of Participants

Characteristics	Category	Study Participants (n=281)	
		n	%
Age group (Years)	35-44	37	13.2
	45-54	122	43.4
	55-64	72	25.6
	≥ 65	50	17.8
	Median (IQR)	52 (47-61)	
Gender	Male	100	35.6
	Female	181	64.4
Male: Female Ratio= 1:1.8			
Marital Status	Single	36	12.8
	Married	210	74.7
	Separated/ Divorced	11	3.9
	Widowed	24	8.5
Religion	Buddhism	197	70.1
	Others	84	29.9
Ethnicity	Burmese	262	93.2
	Others	19	6.8
Education Level	Primary Education and lower	60	21.4
	Middle Education	49	17.4
	High Education and above	172	61.2
Occupation	Dependent	94	33.5
	Formal Sector	43	15.3
	Informal Sector	144	51.2
Average Family Income Per Month	Low Income (<400,000 MMK)	91	32.4
	Middle Income (400,000-800,000 MMK)	135	48.0
	High Income (> 800,000 MMK)	55	19.6

1 USD ≈ 4500 MMK

Oral Health Knowledge

As shown in Table 2, out of 281 participants, oral health knowledge varied based on specific statements. A large proportion of participants correctly identified that tobacco chewing or smoking harms oral health (92.2%), dental plaque buildup causes gum disease (85.4%), fluorides prevent caries (82.9%), and that regular dental checkups maintain good oral health (86.1%).

More than half of the participants also responded correctly that diabetes increases gum

disease (62.6%), diabetes leads to tooth loss (56.6%), dental visits are essential (60.1%), horizontal toothbrushing harms teeth (59.4%), and brushing teeth once is not enough (60.1%).

However, lower proportions of participants were aware that diabetes affects oral health (34.5%), dry mouth raises oral infection risk (40.9%), diabetes causes bad breath (40.2%), missing tooth need replacing to improve oral health (42.3%), and tartar can't be removed by brushing alone (42.7%).

Table 2 Number and Percentage Distribution of Correct answers regarding knowledge of oral healthcare by participants

Statements of Knowledge		Study Participants (n=281)	
		Correct Answer	
		n	%
K1	Diabetes affects oral health.	97	34.5
K2	Diabetes increases gum disease and infection risk	176	62.6
K3	Diabetes leads tooth loss	159	56.6
K4	Dry mouth raises oral infection risk.	115	40.9
K5	Diabetes causes bad breath.	113	40.2
K6	Dental visits are essential.	169	60.1
K7	Tobacco chewing or smoking harms oral health	259	92.2
K8	Dental plaque buildup causes gum disease.	240	85.4
K9	Fluorides prevent caries.	233	82.9
K10	Missing tooth need replacing to improve oral health.	119	42.3
K11	Horizontal toothbrushing harms teeth.	167	59.4
K12	Brushing teeth once is not enough.	169	60.1
K13	Tartar can't be removed by brushing alone.	120	42.7
K14	Regular dental check-ups maintain good oral health.	242	86.1

Level of Oral Health Knowledge

Based on Table 3, among 281 participants, only 10% had good oral health knowledge, while 59% had moderate oral health knowledge and 31% had poor oral health knowledge.

Table 3 Number and Percentage Distribution of Level of Oral Health Knowledge

Level of Knowledge	Study Participants (n=281)	
	n	%
Poor Knowledge Level (<8 scores)	87	31.0
Moderate Knowledge Level (8-11 scores)	166	59.0
Good Knowledge Level (>11 scores)	28	10.0

Factors Associated with Oral Health Knowledge

The bivariate analysis in Table 4 shows

significant associations between socio-demographic characteristics and oral health knowledge. Age was significantly associated with knowledge ($p < 0.001$), with participants aged 35-44 years showing a higher proportion of good knowledge (16.2%) compared to other groups. Educational level was also significantly associated ($p < 0.001$), and those with middle education had the highest proportion of good knowledge (12.2%). The significant associations were also found between occupation and knowledge ($p < 0.001$), and between average family income per month and knowledge ($p = 0.001$). The prevalence of good oral health knowledge was highest in participants with high incomes (14.5%). There were no associations between oral health knowledge and gender ($p = 0.071$), marital status ($p = 0.058$), religion ($p = 0.129$), or ethnicity ($p = 0.234$).

Table 4 Bivariate analysis: Association between Socio-demographic Characteristics and Oral Health Knowledge

Characteristics	Knowledge Level						p-value
	Good		Moderate		Poor		
	n	%	n	%	n	%	
Age group							
35-44	6	16.2	29	78.4	2	5.4	<0.001*
45-54	12	9.8	81	66.4	29	23.8	
55-64	8	11.1	34	47.2	30	41.7	
≥ 65	2	4.0	22	44.0	26	52.0	
Gender							
Male	5	5.0	66	66.0	29	29.0	0.071
Female	23	12.7	100	55.2	58	32.1	
Marital Status							
Single	1	2.8	20	55.6	15	41.6	0.058
Married	22	10.5	132	62.9	56	26.6	
Separated/ Divorced/Widowed	1	9.1	4	36.4	6	54.5	
	4	16.7	10	41.7	10	41.6	
Religion							
Buddhism	18	9.2	124	62.9	55	27.9	0.129
Others	10	11.9	42	50.0	32	38.1	
Ethnicity							
Burmese	28	10.7	152	58.0	82	31.3	0.234
Others	-	-	14	73.7	5	26.3	

Characteristics	Knowledge Level						p-value
	Good		Moderate		Poor		
	n	%	n	%	n	%	
Education Level							
Primary Education and lower	4	6.7	25	41.7	31	51.6	<0.001*
Middle Education	6	12.2	22	44.9	21	42.9	
High Education and above	18	10.5	119	69.2	35	20.3	
Occupation							
Dependent	7	7.4	41	43.7	46	48.9	<0.001*
Formal Sector	5	11.6	32	74.4	6	14.0	
Informal Sector	16	11.1	93	64.6	35	24.3	
Average Family Income per Month							
Low Income							0.001*
Middle Income	10	11.0	41	45.0	40	44.0	
High Income	10	7.4	85	63.0	40	29.6	
	8	14.5	40	72.7	7	12.8	

**p-value<0.05

Multivariate Analysis

Variables that were significantly associated with oral health knowledge in the bivariate analysis (p<0.05) were included in the multinomial logistic regression to identify independent predictors of oral health knowledge. As Table 5, participants aged 35-44 had significantly higher odds of having moderate (AOR=11.75, p=0.002) and good knowledge (AOR=31.59, p=0.002), compared to those 65

years and above, relative to poor knowledge. Participants with low (AOR=0.323, p=0.033) and middle income (AOR=0.323, p=0.020) were less likely to have moderate knowledge, and those in middle income (AOR=0.175, p=0.010) were less likely to have good knowledge, compared to high income. Although gender and ethnicity were significant in bivariate analysis, they are not the significant predictors in this study according to multinomial logistic regression.

Table 5 Multivariate analysis between Associated Variables and Oral Health Knowledge

Characteristics	B	SE	p-value	AOR	95% CI		
					Lower	Upper	
Moderate Knowledge	Age group				Reference		
	≥ 65						
	35-44	2.464	0.810	0.002*	11.751	2.400	57.541
	45-54	0.525	0.421	0.213	1.691	0.740	3.861
	55-64	-0.090	0.417	0.830	0.914	0.404	2.070
Average Family Income per Month				Reference			
High Income							
Low Income	-1.131	0.530	0.033*	0.323	0.114	0.912	
Middle Income	-1.131	0.487	0.020*	0.323	0.124	0.838	

	Characteristics	B	SE	p-value	AOR	95% CI	
						Lower	Upper
Good Knowledge	Age group				Reference		
	≥ 65						
	35-44	3.453	0.952	0.002*	31.589	3.434	290.572
	45-54	1.273	1.132	0.141	3.570	0.655	19.456
	55-64	1.015	0.865	0.240	2.760	0.508	14.984
	Average Family Income per Month						
	High Income				Reference		
Low Income	-0.968	0.770	0.208	0.380	0.084	1.717	
Middle Income	-1.744	0.680	0.010*	0.175	0.046	0.664	

Reference= Poor Knowledge, *p<0.05

DISCUSSION

In this study, 281 participants participated, with a median age was 52 (IQR:47-61). The largest group was 45-54 years (43.4%), while the highest prevalence of good oral health knowledge was in the 35-44 age group. These align with a study by Sohal and colleagues in Tanzania, which also found better knowledge among younger adults (15). Younger adults may be more digitally literate and have more exposure to health information via social media or workplace programs. On the other hand, older adults may have lower digital engagement, suggesting a need for targeted outreach through clinics or community meetings. These findings suggest the need to promote oral health education among middle-aged and elderly adults.

Most of the Participants were female and married. Females had higher oral health knowledge than males, consistent with findings by Sohal and colleagues in Tanzania (15) and Al Shihi and colleagues in the Sultanate of Oman (16). These reflect a common trend in many low- and middle-income countries, where females often have greater oral health awareness compared to men (17). Most participants were Buddhist and of Burmese ethnicity, who also had higher oral health knowledge. However, gender and ethnicity were not significantly associated with oral health knowledge in bivariate analysis. This may be due to the fact that oral health knowledge may be shaped more by other factors such as age, education, occupation, or income rather than by demographic characteristics i.e; gender and ethnicity. These findings reflect cultural or community-based influences on oral health knowledge.

Participants with higher education had better oral health knowledge, similar to findings in studies by Sohal and colleagues in Tanzania (15) and by Kaphle and colleagues in Nepal (18). These findings highlight the positive influence of higher education on oral health knowledge. About half were employed in the informal sector. Knowledge was similar in both formal and informal workers, but higher than among dependent people. This finding mirrors results from a study by Kaphle and colleagues in Nepal (18). This may be because employed people may have more exposure to oral health information through workplace programs or the use of digital tools. On the other hand, dependent people may have fewer opportunities for such exposure or may rely on fewer sources, such as family or community.

Income also significantly influenced oral health knowledge. Participants with high showed the best oral health knowledge, supporting the relationship between socioeconomic status and oral health knowledge (19). Those with low incomes may prioritize basic needs rather than preventive care and have limited access to dental services.

In the bivariate analysis, age, education, occupation, and income were significantly associated with oral health knowledge, consistent with previous research by Kaphle and colleagues from Nepal (18). Age and income remained significant in multinomial logistic regression. Participants aged 35-44 years had moderate or good knowledge, likely due to active social usage and better access to digital health content. Those with low or moderate income were less likely to

have good knowledge, possibly because of limited resources, reduced access to healthcare, and prioritization of urgent needs rather than preventive care. Although education and occupation were significantly associated with oral health knowledge, they were not significant in multivariate analysis. This suggests that in this population, socio-demographic factors i.e, age and income, may play a more crucial role in shaping oral health knowledge than characteristics i.e, education and occupation.

CONCLUSION

This study explored the level of oral health knowledge and its socio-demographic determinants among people with T2DM in Mandalay, Myanmar. Younger age and higher income were significant predictors of better oral health knowledge. Participants aged 35-44 years were more likely to have moderate or good knowledge compared to those aged 65 and above, while lower-income people had poorer oral health knowledge. These findings highlight the importance of addressing age and income-related disparities in oral health promotion, especially for older and low-income populations

RECOMMENDATIONS

Oral health education should be included as part of diabetes care, especially for older adults and people with low incomes, to address the knowledge gap observed among them. Public health programs should provide easy-to-understand and culturally appropriate messages in both clinics and communities. To ensure effective delivery, collaboration is important between dental professionals, medical professionals, and community health workers. Strengthening outreach efforts to underserved groups through community-based programs can help reduce disparities and improve oral health outcomes among people with T2DM.

STRENGTHS

This study is among the first to investigate the level of oral health knowledge and its socio-demographic determinants among individuals with T2DM in Mandalay, Myanmar. Data collection through face-to-face interviews enhanced response accuracy by minimizing

missing data and allowing immediate clarification of questionnaire items.

LIMITATIONS

This study was a cross-sectional study, so it cannot establish causality. It was conducted in only two free-of-charge clinics and may not represent people with T2DM from other clinics and hospitals, and the whole of Myanmar.

ETHICAL DECLARATION

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (RECCU) granted ethical clearance for this study, while the heads of both clinics in Mandalay provided permission to conduct the study in their clinics. Only those participants who were willing to participate and signed the consent form were included. All participants' information was handled confidentially, and those who refused to participate did not face any consequences in their treatment.

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BARRIERS AND MOTIVATORS OF MALE INVOLVEMENT IN MATERNAL HEALTHCARE AMONG KAREN ETHNIC GROUP IN KAYIN STATE, MYANMAR

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ABSTRACT

Introduction: Despite significant progress in maternal healthcare worldwide, maternal mortality due to preventable causes remains a pressing issue, especially in Myanmar's rural and resource-limited areas. Male involvement has been recognized as a key factor in improving maternal healthcare utilization. However, research on male involvement in maternal healthcare in Myanmar is limited, with most studies focusing on urban areas, leaving rural and hard-to-reach regions underexplored.

Objectives: This study identifies the barriers and motivators influencing male involvement in maternal healthcare among the Karen ethnic group in Kayin State, Myanmar.

Methodology: Guided by the Social Ecological Model (SEM), this exploratory qualitative study examines individual, interpersonal, community, and societal-level determinants of male involvement throughout the maternal health continuum. Data were collected through purposive sampling involving five couples who had utilized maternal healthcare services, eleven individual women (regardless of their relationship status), and five key informants, including healthcare providers and a community leader.

Results: Among the Karen ethnic group, male involvement in maternal healthcare was stronger during delivery and postpartum than during antenatal care. Despite limited communication with providers and inconsistent support, men contributed through presence, practical help, and shared decisions. Key barriers included low educational attainment, physically demanding labor, limited income, poor health literacy, male-exclusionary healthcare environments, and the broader effects of political instability and migration that led to family separation. However, involvement was encouraged by strong fatherhood identity, emotional bonds, mutual respect and trust within marriage, and acceptance of linking caregiving to masculinity.

Conclusion: Despite socioeconomic and structural barriers, supportive relationships and caregiving rooted in positive masculinity enhance male involvement during childbirth and postpartum, where emotional bonds and shared responsibilities are culturally affirmed. To foster sustained involvement, culturally responsive and gender-inclusive strategies must be grounded in the lived experiences of migration, economic hardship, and health system challenges that can transform men into active, informed partners and agents of change across the continuum of maternal healthcare.

Keywords: Male involvement, maternal health, antenatal care, Karen ethnic group, rural Myanmar

INTRODUCTION

Maternal health is not solely a medical concern but a societal one, shaped by complex eco-social factors including economic conditions, family dynamics, and healthcare access (1). Global evidence shows that male involvement through antenatal care attendance, birth

preparedness, and decision-making significantly improves maternal health outcomes when aligned with respect for women's autonomy (2, 3). Despite global frameworks like the International Conference on Population Development (ICPD, 1994) and the World Health Organization's guidelines advocating male

engagement, men's roles remain underexplored in maternal healthcare research, especially in developing countries where they often serve as key decision-makers. Male involvement in maternal healthcare is broadly defined as a male partner's active support during pregnancy, childbirth, and the postpartum period through emotional and physical support, financial assistance, presence at healthcare visits, and help with transportation, communication, and joint decision-making(4). Such involvement has been associated with positive outcomes, including increased antenatal and postnatal care (ANC/PNC) utilization, higher rates of skilled birth attendance, and reduced postpartum depression (5, 6).

In Myanmar, reproductive health programs have largely focused on women, overlooking male involvement (7). This gap becomes especially concerning in Myanmar, where men as the primary household decision-makers and key sources of household income, thereby wielding substantial influence over women's access to maternal and neonatal healthcare services and associated health outcomes. Kayin State, located in southeastern Myanmar, is one of the country's most ethnically diverse regions, with the Karen ethnic group comprising 63% of the population(8) . Karen society maintains traditional gender roles, where women carry the dual burdens of domestic and agricultural work, with limited decision-making power (9).

The Kayin state has experienced prolonged civil conflict since 1949, resulting in political instability, underdeveloped infrastructure, and fragmented healthcare services. Much of the region remains beyond central government control, and health facilities frequently face a shortage of skilled personnel (10). Since the 2021 military coup, intensified violence, including airstrikes, has further disrupted essential services. Geographic isolation, economic hardship, and seasonal inaccessibility exacerbate barriers to maternal care (11). In such a setting, male involvement becomes crucial support from husbands in birth preparedness, transportation, and care-seeking can help navigate these structural challenges. Male involvement in maternal healthcare is shaped by a range of barriers and motivators

across individual, interpersonal, community, and societal levels. Barriers include low awareness, economic pressures, traditional gender norms, and institutional factors such as male-unfriendly healthcare settings and negative provider attitudes(12, 13). However, motivators for male participation include higher education levels, mutual respect, supportive partnerships, and the presence of male-inclusive healthcare environments and community outreach programs (12). These factors can encourage men to engage more actively in maternal health, contributing to improved outcomes.

Studies in Myanmar have shown that women with more educated or supportive husbands are more likely to attend ANC visits and make timely care-seeking decisions in urban areas(14, 15). Only a few studies have explored their roles in postnatal care or from the perspectives of both partners and providers. Despite national guidelines recognizing the importance of family involvement, there is a lack of targeted strategies and data on male engagement, particularly outside urban areas. No qualitative research has comprehensively explored male involvement in maternal healthcare within rural and hard-to-reach communities in Myanmar.

This study seeks to fill that gap by exploring the barriers and motivators of male involvement in maternal healthcare among the Karen ethnic group in Kayin State. It aims to explore the individual, interpersonal, community, and societal-level barriers that hinder male participation in maternal healthcare among the Karen ethnic population in Kayin State, Myanmar. The findings are intended to support gender-sensitive, community-based strategies to improve maternal and child health in conflict-affected and underserved areas.

METHODOLOGY

Study design

This qualitative study employed an exploratory research design using semi-structured in-depth interviews to investigate the barriers and motivators influencing male involvement in maternal healthcare among the Karen ethnic group in Kayin State, Myanmar. The Socio-Ecological Model

(SEM model) by Bronfenbrenner (16) served as the theoretical framework to guide the analysis at individual, interpersonal, community, and societal levels seen in Figure 1. In this study, the individual level focuses on personal factors such as education, income, health knowledge, and beliefs that influence a man's ability to support maternal care. The interpersonal level examines relationships, particularly between spouses, including aspects like communication,

emotional support, and shared decision-making. The community level considers community norms, peer influence, and the inclusiveness of local health services that impact male involvement. Lastly, the societal level addresses broader influences such as gender norms, political instability, and healthcare policies that shape men's opportunities to participate in maternal healthcare.

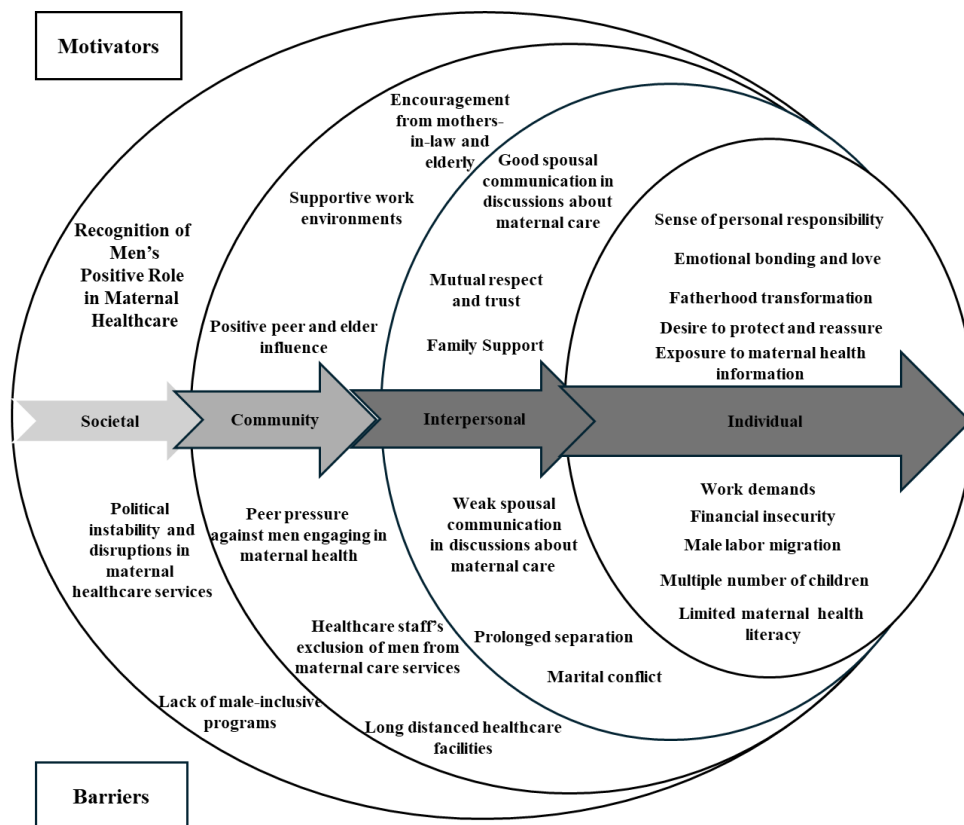


Figure 1 Conceptual framework of the study guided by the socio-ecological model to identify the barriers and motivators of male involvement in maternal healthcare

Participant recruitment

This study was conducted in the northern part of Kawkaeik District, located in Kayin State. The region was purposefully

selected due to its distinctive demographic characteristics, healthcare infrastructure challenges, and prolonged exposure to political conflict and armed instability. A

total of 26 participants were recruited using purposive and quota sampling techniques. The sample comprised sixteen women, five of whom were interviewed as part of couple dyads alongside their husbands, resulting in five male participants. In addition, five key informants were included, representing a midwife, an auxiliary midwife, a community health worker, a village health committee member, and a community leader. Inclusion criteria for male and female participants required individuals to be aged 18 years or older and to have at least one child under the age of one and a half years, and to be willing to give the informed consent to participate in this study. With the assistance of community health workers and a research assistant, eligible participants were identified with local referrals.

Data Collection

Data was collected through virtual interviews conducted via Zoom and Viber with the assistance of a trained research assistant. On-site interviews could not be done due to the active conflict conditions. For participants who preferred to speak in Karen, translation support was provided during recruitment and interviews to ensure inclusivity and clear communication. Each potential participant was contacted and invited to take part in the study with the help of a research assistant. Those who agreed were scheduled for an interview at a time and place convenient for them, and written informed consent was obtained before the interview. To minimize potential distress, male and female participants were interviewed separately. The researcher conducted interviews with empathy, respect, and cultural sensitivity, especially considering the topics related to gender roles and maternal care. Participant identities were anonymized using pseudonyms, and all electronic and physical data were securely stored and will be destroyed following

university guidelines after the completion of the thesis.

Data analysis

Interviews were recorded with informed consent, transcribed, translated into English, and thematically analyzed using an Excel sheet. Data was coded and categorized according to the four levels of the SEM, such as the individual, interpersonal, community, and societal levels. The analysis uncovered complex dynamics, especially within rural, conflict-affected communities, that affect men's participation in maternal healthcare.

RESULTS

Characteristics of the participants are described in Table 1 (Seen in the Appendix). The key findings of this study revealed key barriers and motivators at the individual, interpersonal, community, and societal levels of male involvement across the maternal healthcare continuum.

Barriers of Male Involvement in Maternal Healthcare

Individual barriers

Financial insecurity was a primary impediment to male involvement. Many families struggled to afford the costs of delivery and antenatal care, especially when birth occurred in Thailand. A 20-year-old first-time mother, who previously worked in Thailand, shared, "*Financially, he was the one who tried to find money for the delivery, but it wasn't enough. We had to borrow money.*" Similarly, a 28-year-old woman who returned alone to Myanmar for childbirth explained, "*Giving birth in Thailand would cost a lot...It was too much for us. So, I decided to come back to Myanmar to give birth alone.*" For others, the pressure of poverty meant continuing to work throughout pregnancy. A 39-year-old mother of three who runs a small shop said, "*I wanted to rest more during the pregnancy...But I had to keep working because of money.*"

Work commitments, both local and cross-border, also limited husbands' ability to participate. A 28-year-old mother of two

described her situation: *"During this pregnancy, my husband was working in Thailand...he came back only when I was eight months pregnant and left again one month after childbirth."* Another woman, 27 years old and a mother of three, said, *"I asked my husband to come with me, but he never did. He said he was too busy with fieldwork."*

Men's limited health knowledge was another barrier. A 27-year-old male migrant worker explained, *"I told her not to take pregnancy supplements because I believed they would make the baby too big."* His wife, a 24-year-old first-time mother, added, *"I didn't take any pregnancy supplement provided by the clinic because my husband told me not to...and I followed what he said."* Emotional disengagement further impacted support. A 20-year-old first-time mother noted, *"After ANC visits, we didn't talk about anything.... He didn't ask about the baby or how I was doing."*

Interpersonal barriers

Weak marital bonds and prolonged separation deepened emotional isolation. A 28-year-old first-time mother who delivered in Myanmar after her husband remained in Thailand shared, *"I felt so scared, so lonely, and deeply frustrated. I had been abandoned at the most vulnerable time in my life."* A 35-year-old first-time mother said, *"Although my husband was physically present during ANC and delivery, he wasn't very emotionally involved."* The conflict between couples was also reported due to a perceived lack of care. A 20-year-old first-time mother explained, *"We fought sometimes during my pregnancy because I felt like he didn't care enough for me."*

Community barriers

Community influences played a key role. Some men faced peer ridicule when taking on caregiving tasks. A 24-year-old first-time mother shared, *"Some of his friends teased him for doing things like washing my longyi or the baby's clothes."* Support from the husband's family was also often absent.

Societal barriers

Institutional settings often excluded men. A 37-year-old male village health volunteer mentioned that *"Men were not allowed inside the ANC room, so I stayed outside like the other husbands."* A 40-year-old female community health worker added, *"Only mothers and children attended healthcare knowledge sessions. Husbands were not involved because the sessions were not designed for men."* Political instability compounded these issues. Clinics were closed following the military coup, and the region had never seen male involvement programs. A 30-year-old midwife explained, *"Due to the political instability, we have not been able to organize programs like we used to share maternal health knowledge sharing programs to women. As for male engagement programs, there were not any before."*

Motivators for Male Involvement in Maternal Healthcare

Individual motivators

One of the strongest individual-level motivators was a sense of personal responsibility. Many men articulated that their involvement was not prompted by external encouragement but stemmed from internal values rooted in love, duty, and partnership. A 37-year-old male Village Health Volunteer shared, *"No one told me to do it – not my family, not her family, not my friends. I just felt that it was my duty as a husband. I would not feel secure if someone else cared for my wife instead of me."* His wife, a 32-year-old teacher, affirmed this, stating, *"I never felt there were any barriers for him to care for me. He did all this... I think because he loves me. No one needed to tell him what to do."* This intrinsic motivation was reflected in behaviors such as assisting with household chores, emotional support, and shared decision-making.

A desire to protect and reassure also strongly influenced male involvement. Many husbands described a personal drive to shield their wives from emotional and physical stress, especially during labor or political instability. A 27-year-old male migrant worker explained, *"I was worried about her. I just communicated with*

her through phone calls throughout the pregnancy. I was not assured that my wife would be alone to deliver while I was far away." Similarly, a 31-year-old male farm worker recalled, *"One of the hardest times was when I had to take her to the clinic while the political situation was unstable. I worried about checkpoints or something worse... But I still took her."*

Fatherhood also emerged as a significant motivator. Pregnancy and childbirth prompted emotional transformation and a deeper connection to the unborn child. A 36-year-old first-time mother shared, *"He sent me heartfelt messages thanking me for carrying his child... something he had never done before."* A 35-year-old mother of two described her husband's joy: *"He wasn't allowed inside the delivery room... so the midwife later told me how excited he was when he heard the baby was a girl. She recounted him saying, 'If no one were around, I would run through the entire hospital and shout loud that I had a baby girl.'"* These expressions underscored men's growing identification with their paternal roles and their investment in the maternal journey.

Interpersonal motivators

The family environment, particularly the influence of mothers-in-law, emerged as a key motivator. A 35-year-old first-time mother explained, *"My mother-in-law often reminded him to take care of me... he went to town on his own to buy clothes for the baby."* Another male participant recalled, *"My mother-in-law also helped and reminded him not to let me lift anything heavy... she told him to take care of me and even asked him to buy food I like."* Supportive work environments also facilitated involvement. A 31-year-old farm worker shared, *"Even the landowner told me to go home early to care for my pregnant wife... so I could give more time and help her more."*

Mutual respect and trust within marriage were foundational. A 37-year-old male Village Health Volunteer stated, *"We made decisions together. We even saved money before the delivery to be prepared."* A 24-year-old first-time mother shared, *"We communicate well... He never had to be told what to do... not by me, not by our parents."*

Community and Societal motivators

There is an increasing cultural recognition within the Karen community that caregiving during pregnancy and childbirth is not solely the woman's responsibility, but a shared duty embraced by men, reflecting an evolving notion of positive masculinity. A 40-year-old woman, a member of a village health committee, stated that *"It is not our tradition that childbirth is only responsible for the mother ...many men now accept that they also have a responsibility for pregnancy."* Male partners who actively participate, such as migrant workers returning for childbirth, exemplify this sense of responsibility and emotional commitment. Collectively, these narratives underscore the emergence of caregiving as an integral and valued component of masculine identity within the Karen cultural context, suggesting opportunities for interventions that build on these evolving gender norms.

DISCUSSION

This study explored the key barriers and motivators influencing male involvement in maternal healthcare among the Karen ethnic group in Kayin State. As the first study to examine this issue in a conflict-affected ethnic region of Myanmar, it offers context-specific insights that both reinforce and expand existing literature. Guided by the SEM Model, it sought to address two research objectives: (1) to identify the barriers that limit male involvement and (2) to identify the motivators that encourage male involvement across the maternal continuum of care. The findings revealed that male engagement is shaped by individual, interpersonal, community, and societal-level factors, which either facilitate or hinder their participation throughout the maternal care continuum.

At the individual level, financial issues compounded by labor migration, as husbands frequently left their families seeking work due to ongoing conflict and economic hardship, rendered them unable to provide crucial support during pregnancy and childbirth. This mirrors findings from prior studies, which indicate that economic hardship and male labor migration significantly reduce men's caregiving

involvement in maternal health (12, 17). Similarly, as observed in Nepal and Northern Tajikistan, labor migration and the scarcity of local job opportunities limit men's ability to provide timely support during the maternal period (18, 19), a pattern also evident in the current study. Furthermore, limited health literacy among male partners contributed to the spread of misinformation, such as discouraging women from taking supplements, which negatively impacted maternal decision-making. This aligns with research from Bangladesh, India, Mozambique, and Southern Ethiopia, where low male health literacy similarly influenced maternal health behaviors (12, 20-22). Emotional disengagement also emerged as a barrier, with several women reporting that their husbands failed to inquire about their health or the outcomes of their pregnancies. This emotional unavailability echoes earlier findings regarding the limited emotional involvement of male partners in maternal care (12, 17).

At the interpersonal level, weak spousal communication, marital conflict, and prolonged separation emerged as significant barriers to male involvement in maternal care. Many women in this study described feeling emotionally unsupported, particularly when husbands were working abroad or displayed indifference despite being physically present. These dynamics parallel findings from Northern Nigeria and India, where relationship tension and emotional disconnect were found to limit shared caregiving and joint decision-making (12, 23).

At the community level, multiple social and structural factors further constrained male involvement. For instance, some husbands reported facing ridicule from peers when performing maternal-related tasks, such as washing baby clothes or helping with household chores. This reflects broader patterns of gender role enforcement seen in other patriarchal settings. Additionally, a lack of encouragement from extended families, especially in-laws, discouraged men from participating in maternal duties. These community pressures were compounded by structural limitations: health facilities and outreach programs often excluded men, reinforcing the perception that maternal health is solely a woman's domain. Similar

gendered barriers within male-unfriendly healthcare environments have been documented in Ghana (24).

At the societal level, political instability, ongoing conflict, and the absence of male-focused health initiatives served as structural barriers. These findings reflect on how fragile settings exacerbate caregiving gaps and institutional exclusion (25). Prolonged conflict, political instability, and a fragmented health system in Kayin State, exacerbated by the 2021 military coup and widespread labor migration, have severely limited maternal healthcare access. In this context, husbands' active involvement in birth preparedness and care-seeking becomes a vital strategy to overcome structural barriers. While similar challenges are noted in other conflict-affected settings, this study uniquely reveals how these disruptions intersect with local cultural and family dynamics, further deepening men's disengagement from maternal healthcare.

Despite numerous barriers, this study identified several motivators of male involvement across multiple levels. At the individual level, a strong sense of personal responsibility and emotional connection to wives and unborn children emerged as key drivers of engagement. This intrinsic motivation echoes findings from other settings, such as Nepal and Indonesia, where fatherhood is described as a transformative experience fostering protective instincts and commitment (5, 18). However, this study emphasizes how these motivations persist even amid conflict and economic hardship, underscoring the resilience of paternal bonds in fragile contexts.

At the interpersonal level, mutual respect, trust, and open communication within marital relationships were crucial in enhancing male participation. These results align with research from Bangladesh and Indonesia, which similarly stress that strong marital bonds facilitate shared decision-making and proactive caregiving (19-21). Notably, this study highlights how prolonged separation due to labor migration challenges these dynamics, making effective communication especially vital to sustaining male involvement.

At the community level, encouragement from mothers-in-law and positive reinforcement from elders and community leaders helped

legitimize and normalize men's caregiving roles. This social validation reflects findings from other low-resource settings, where local champions and peer influence increase male engagement in maternal health (21). A distinctive contribution of this study is the identification of a shifting cultural norm within the Karen community, where caregiving is increasingly framed as a responsible expression of masculinity rather than a breach of tradition. This evolving perception contrasts with more rigid gender norms documented elsewhere and suggests opportunities for culturally tailored interventions to reinforce positive masculinities in conflict-affected ethnic minority groups.

CONCLUSION

This study provides valuable insight into the barriers and motivators shaping male involvement in maternal healthcare among the Karen ethnic group in conflict-affected Kayin State, Myanmar. Guided by the Social Ecological Model, the findings highlight the multilevel influence of male engagement, with constraints rooted in individual challenges such as financial hardship, low health literacy, and emotional disengagement; interpersonal issues including weak communication and marital separation; community-level gender norms and social pressures; and broader structural barriers stemming from political instability, conflict, and institutional exclusion.

Despite these challenges, the study also reveals significant motivators driving male participation. Intrinsic factors such as a sense of duty and emotional attachment to partners and children, supportive spousal relationships, and shifting community norms offer promising entry points for intervention. The emergence of caregiving as a legitimate expression of masculinity within the Karen context underscores the potential for culturally sensitive, gender-transformative approaches that promote male involvement as both a personal and social responsibility.

Overall, the findings reinforce the importance of designing multi-level interventions that address structural, social, and relational barriers while nurturing and legitimizing positive male roles in maternal health. In conflict-affected and culturally diverse settings such as Kayin

State, promoting inclusive and context-specific strategies is essential for improving maternal health outcomes and advancing gender-equitable care practices.

RECOMMENDATION

To enhance male involvement in maternal healthcare among the Karen ethnic group, targeted and context-specific strategies should be developed. First, health education interventions should be expanded to reach men, especially those in migrant or agricultural work, through culturally responsive and gender-inclusive strategies. Mobile technology should be leveraged to engage migrant husbands through short message service (SMS) updates, phone counseling, or remote decision-making support. Secondly, training Karen community volunteers as prenatal support counselors can provide psychosocial support to women with absent partners. Thirdly, gender-sensitive training for local male champions and involvement of community elders can promote positive masculinities and reduce stigma. Finally, integrating male involvement strategies such as the MiM program into mobile clinics in hard-to-reach areas is essential. Despite ongoing conflict in Kayin State, these efforts are critical to institutionalize male-inclusive care while safeguarding women's autonomy. For further studies, the present findings encourage to employ of mixed-methods or quantitative designs to systematically measure the extent of male involvement and to statistically examine how factors impact the effect of cross-border migration on men's engagement in maternal healthcare.

ETHICAL DECLARATION

This study was conducted following established ethical standards for research involving human participants. Ethical approval was obtained from the Institutional Review Board (IRB) of the Institute for Population and Social Research, Mahidol University. All participants were provided with clear, written, and verbal explanations of the study's objectives, procedures, and their rights, including the right to withdraw at any time without consequence.

Privacy and confidentiality were strictly maintained throughout the research process.

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APPENDIX

Table 8 Characteristics of the Participants

ID	Sex	Age (Yrs)	Educational Level	Relationship Status	Residence	Description
1	Male	37	High School	Married	Rural	Village Health Volunteer
2	Female	32	Graduate	Married	Rural	First-Time Mother, Teacher, Wife of ID.1
3	Female	36	Middle	Married	Rural	First-Time Mother, Former Migrant Worker
4	Female	39	Primary	Married	Rural	Mother of Four, Wife of a migrant worker, Dependence Farmer
5	Male	27	Primary	Married	Rural	First-Time Mother, Wife of ID.5, Dependent
6	Female	24	Primary	Married	Rural	First-Time Mother, Dependent
7	Female	35	Middle	Married	Urban	First-Time Mother, Dependent
8	Female	20	Primary	Married	Rural	First-Time Mother, Dependent
9	Female	28	Primary	Separated	Urban	First-Time Mother, Former Migrant Worker
10	Female	38	No formal education	Married	Rural	Mother of Two, Dependent
11	Female	27	Primary	Married	Rural	Mother of Three, Dependence
12	Male	27	Primary	Married	Rural	Former migrant worker and now unemployed

ID	Sex	Age (Yrs)	Educational Level	Relationship Status	Residence	Description
13	Female	24	Middle	Married	Rural	First-Time Mother, Wife of ID 12, Dependent
14	Female	31	High School	Married	Rural	Mother of three, Shopkeeper
15	Female	35	Primary	Married	Rural	Mother of two, Farm worker
16	Female	31	Graduate	Married	Urban	First-Time Mother, NGO staff working in the city
17	Female	28	Primary	Married	Rural	Mother of Two and Wife of a migrant worker
18	Male	31	No formal education	Married	Rural	Farm worker
19	Female	34	Primary	Married	Rural	Mother of three, Wife of ID 18, Dependence
20	Male	40	Primary	Married	Rural	Farm Worker
21	Female	39	No formal education	Married	Rural	Mother of two, Shopkeeper, Wife of ID 20
22	Female	40	High School	Married	Rural	Community Health Worker from Kayin Ethnic Health Organization with working experience of over 5 years
23	Female	48	High School	Married	Rural	Auxiliary Midwife with working experience of over 27 years
24	Female	40	High School	Married	Rural	Member of Village Health Committee with working experience of over 20 years
25	Male	58	Middle School	Married	Rural	Community Leader of a village with working experience of over 3 years
26	Female	30	Graduate	Single	Rural	Midwife with working experience for 6 years, and now working in an NGO

UNDERGRADUATE CRASH-CARE PREPAREDNESS IN NEW DELHI: LINKING KNOWLEDGE TO ATTITUDE IN A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Road traffic injuries are a leading cause of death among young adults in India, where prehospital care remains underdeveloped. University students frequently witness crashes and could provide critical first aid, yet little is known about how their knowledge correlates with their willingness to act.

Objective: To examine the association between emergency crash-care knowledge and attitude among undergraduate students in New Delhi.

Methodology: A cross-sectional survey of 400 undergraduates at Delhi University was conducted in June 2025 using a stratified random sample. A self-administered questionnaire assessed basic first-aid knowledge (score 0–10) and attitude toward bystander responsibility (dichotomized positive vs. non-positive). Data were analyzed with descriptive statistics, chi-square tests, and binary logistic regression adjusting for age and gender.

Results: Participants' mean knowledge score was 6.55 ± 2.40 ; 68.8% demonstrated a positive attitude. Positive attitude rates rose from 62.3% in the Low knowledge group (0–3) to 88.9% in the High group (8–10) ($\chi^2(2) = 16.74$, $p < 0.001$).

Conclusion: Higher first-aid knowledge significantly enhances undergraduates' readiness to intervene at crash scenes. Integrating hands-on crash-care modules and simulation drills within general curriculum could strengthen bystander preparedness and reduce preventable mortality.

Keywords: Attitude; Emergency Care; First Aid; India; Knowledge; Road Traffic Injuries; University Students.

INTRODUCTION

Road traffic injuries (RTIs) claim over 1.35 million lives globally each year and disproportionately affect low- and middle-income countries such as India, where formal prehospital systems remain fragmented. (1) According to World Road Statistics 2022 of International Road Federation, India has the highest number of total persons killed due to road accident (1,31,714) in the year 2022. According to the report of Ministry of Road Transport and Highways, Transport Research Wing, Road accidents in India, 2022- The number of road accidents in 2022 increased by 11.9 percent compared to the previous year 2021, claiming 1,68,491 lives and causing injuries to 4,43,366 persons. Young adults in the age group of 18 - 45 years accounted for 66.5 per cent of victims during 2022 whereas people in working age

group of 18 – 60 years share 83.4 per cent of total road accident fatalities. Similarly, the number of deaths and injuries on account of road accidents also increased by 9.4 percent and 15.3 percent respectively. (2)

Among the Union Territories, Delhi recorded the highest number of accidents and fatalities during 2018 to 2022 (5,652). Despite some marginal fluctuations, the accidents' severity had been on the increase since 2000 underscoring the need for improved emergency and trauma care. Timely prehospital care, including immediate first aid, can reduce preventable deaths and morbidity and prevent complications before arriving at the health care facilities. However, provision of emergency medical services (EMS) in India remains inadequate, with challenges such as limited

ambulance coverage, fragmentation of care, and delayed response times, especially in densely populated areas like Delhi.

Due to which, involvement of Bystanders plays a critical role especially in the first hour post-accident often termed as ‘Golden Hour’ in crash care. (3) Bystanders present during the ‘Golden Hour’ can substantially increase the victim survival through prompt first-aid. University students represent a substantial bystander population due to their mobility, frequent travel, and presence at the accident sites either as a spectator or a vulnerable road user. (4) Yet knowledge gaps and attitudinal barriers, including fear of legal repercussions and low self-efficacy, may impede their willingness to help. Despite this, data on university students’ knowledge and attitudes toward emergency crash care in India is limited. Although prior research in India has assessed KAP (knowledge, attitude, practice) among healthcare trainees, there is limited evidence on how knowledge directly influences attitude among non-medical undergraduates. Understanding this relationship is critical for designing targeted educational interventions that not only convey procedures but also foster confidence and responsibility.

Therefore, to address this gap, we conducted a cross-sectional survey of association between knowledge and attitude regarding emergency crash care among a diverse group of undergraduate students in Delhi.

METHODOLOGY

Study Design, Study Area, and Study Population

This cross-sectional survey was conducted in June 2025 in Ram Lal Anand College in Delhi University, India. A structured, self-administered questionnaire via Google Forms was distributed through social media (Instagram, Facebook, and WhatsApp) to the targeted Undergraduate students aged 18–25 years enrolled in various academic departments (Arts, Sciences, Commerce, Engineering, Humanities). Inclusion criteria were students enrolled in undergraduate course in Delhi University, residing in New Delhi, having internet access, consenting, and understanding English. The exclusion criteria were part time or distance learning students, foreign/international students, professional medical/ paramedical

course students and incomplete questionnaires. Four screening questions ensured that participants met the criteria. Completed questionnaires were anonymized, coded, and double-entered into a secure electronic database to minimize data-entry errors.

Sampling

The sampling technique in this study used Two stage Stratified Random sampling technique sampling. The sample size of 400 participants was calculated using the Cochran formula.

Data collection instrument

This study used self-administered questionnaire. The Knowledge questions were adapted and modified from research titled Youth led emergency care response at community level—an implementation project (co- authored by me) (5). The rest of the questionnaire was self-developed and validated by the public health experts of College of Public Health Sciences, Chulalongkorn University. The questionnaire has three sections: sociodemographic, knowledge, and attitudes about Emergency Crash Care Response.

Knowledge: Ten multiple-choice items (2.1–2.10) covering key crash-care procedures, each scored 0 (incorrect) or 1 (correct). Total scores ranged from 0 to 10, categorized into Low (0–3), Moderate (4–7), and High (8–10) for descriptive analysis.

Attitude: Eleven multiple-choice items (3.1–3.11). Statements rated on a five-point Likert scale (strongly disagree to strongly agree). Responses were dichotomized: positive attitude (agree/strongly agree) versus non-positive (other responses).

Demographic variables: age, gender, academic department

Data Analysis

SPSS version 29 was used to analyze the data. Descriptive statistics (mean, standard deviation, frequency, percentage) summarized participant demographics, knowledge scores (mean, SD), and attitude frequencies. Attitude was analyzed using cross-tabulations and chi-square tests for categorical predictors. Bivariate associations between continuous outcomes

(knowledge score) and categorical predictors (gender, department, prior experience) were examined using independent-samples t-tests and one-way ANOVA. Chi-square tests assessed categorical associations between knowledge level and positive attitude, with significance set at $p < 0.05$. Binary logistic regression modeled positive attitude as the dependent variable and continuous knowledge score as the independent variable, yielding ORs with 95% CIs, controlling for age and gender.

Reliability and validity

Content validity was established via an expert panel (I-CVI > 0.78), and a pilot test

(n=41) demonstrated internal consistency (Cronbach’s α for knowledge items = 0.82).

RESULTS

Characteristics of Participants (Sociodemographic)

According to Table 1, the mean age of participants was 20.8 years (SD = 1.9). More than half of the respondents 215 (53.8%) were Male and 185 (46.2%) Females. Major Departments included Arts (n=80), Sciences (n=100), Commerce (n=90), Engineering (n=70), Humanities (n=20) and others (n=40). Prior first aid experience was reported by 120 participants (30.0%).

Table 1 Sociodemographic of Participants

Variables	Number (n = 400)	Percentage
Age		
18	8	2
19	37	9.25
20	44	11
21	77	19.25
22	131	32.75
23	18	4.5
24	5	1.25
25	22	5.5
Range	18-25	
Age (Mean \pm SD)	20.8 \pm 1.9	
Gender		
Male	215	53.8
Female	185	46.2
Department		
Arts	80	20
Science	100	25
Commerce	90	22.5
Engineering	70	17.5
Humanities	20	5
Others	40	10
Prior First Aid Experience		
Yes	120	30
No	280	70

Knowledge of Emergency Crash Care

Response of Participants

The mean knowledge score was 6.55 \pm 2.40 (range 0–10). Knowledge category distribution: Low (n=95; 23.8%), Moderate (n=201; 50.3%), High (n=104; 26.0%).

Attitude Towards Emergency Crash Care

Response of Participants

A total of 275 students (68.8%) expressed a positive attitude. Distribution by knowledge category showed positive attitude

rates of 62.3% in Low, 64.9% in Moderate, and 88.9% in High knowledge groups.

Association between Knowledge and Attitude

Chi-square analysis indicated a statistically significant association between

knowledge category and positive attitude ($\chi^2 (2) = 16.74; p < 0.001$). Positive attitude rates increased from 62.3% in the Low knowledge group to 64.9% in Moderate and 88.9% in High. (Table 2).

Table 2 Association Between Knowledge Category and Positive Attitude

Knowledge Level	*n (%)	Positive Attitude n (%)	$\chi^2, p\text{-value}$
Low (0–3)	95 (23.8%)	59 (62.3%)	16.74, <0.001
Moderate (4–7)	201 (50.3%)	130 (64.9%)	
High (8–10)	104 (26.0%)	92 (88.9%)	

*n=400

Logistic regression analysis

Binary logistic regression, adjusting for age and gender, revealed each one-point increase in knowledge score was associated with higher odds of a positive attitude (OR = 1.17; 95% CI [1.08–1.28]; $p < 0.001$), indicating that high knowledge has practical significance in shaping positive attitudes towards emergency crash care. (Table 3).

Table 3 Logistic Regression Predicting Positive Attitude

Predictor	OR	95% CI	p-value
Knowledge score (per point)	1.17	1.08–1.28	<0.001

DISCUSSION

The findings of this study highlight a significant positive association between the level of knowledge and the attitude toward emergency crash care among undergraduate students in New Delhi. Participants with higher knowledge scores (8–10) were substantially more likely to demonstrate a positive attitude (88.9%) compared to those with lower scores (0–3), where only 62.3% had a positive attitude. This association is statistically significant ($\chi^2 (2) = 16.74, p < 0.001$), suggesting that enhancing knowledge may be a key driving force for improving attitudes toward emergency response.

These results are consistent with findings from similar studies conducted in both national and international contexts. For example, a study by Pallavisarji et al. (2013) in Karnataka, India,

found that higher knowledge of first aid was associated with greater confidence and willingness to intervene during road traffic accidents. (21) Similarly, research by Aekka et al. (2015) on first responders in India demonstrated that education and training significantly improve both knowledge and willingness to perform emergency care. (25) Internationally, a cross-sectional study in Ethiopia by Woyessa et al. (2020) also observed that knowledge positively influenced attitude toward prehospital care. (26)

However, while these findings are encouraging, they must be understood within the unique socio-cultural and infrastructural context of India. Indian bystanders often hesitate to assist accident victims due to fear of legal action, police questioning, and lack of emergency response training. The recent implementation of Good Samaritan Law seeks to address this fear by offering legal protection to those who assist injured people in emergencies. However, lack of awareness and inconsistent enforcement continue to obstruct its impact. Additionally, India's infrastructure is fragmented and lack resources, with vast differences between urban and rural settings. These issues reduce public confidence in prehospital emergency care and could further influence public attitudes.

The results of this study, while specific to a New Delhi undergraduate population, may be cautiously generalized to other low- and middle-income countries (LMICs) facing similar EMS challenges. Many LMICs struggle with limited access to trained emergency personnel, poorly equipped ambulances and lack of public response

and support to engage due to legal or cultural concerns. Therefore, targeted education programs aimed at increasing knowledge can potentially influence positive behavioral outcomes across similar settings.

From a policy perspective, these findings underscore the need to integrate mandatory Basic Life Support (BLS) and emergency crash care training into college curriculum. Policymakers and academic institutions should consider collaboration with health departments and NGOs to offer certified training modules for youth. Public health campaigns must also focus on spreading awareness of Good Samaritan protections.

This study has a few limitations. Firstly, its cross-sectional design restricts causal inference between knowledge and attitude. Secondly, self-reported data may be subject to recall and social desirability bias. Third, the study population is limited to undergraduate students in urban Delhi, limiting generalizability. Future studies could adopt longitudinal designs and include more diverse geographic and educational backgrounds. Exploring the long-term impact of training on actual emergency response behavior could provide deeper insights.

CONCLUSION

This study establishes that even small increases in crash-care knowledge significantly enhance undergraduates' readiness to provide first aid. By revealing a clear link between what students know and how willing they are to help, we stress the need to add hands-on emergency care training to all non-medical university programs.

Adding hands-on emergency training to non-medical programs will give students the practical skills and confidence to act quickly, encourage teamwork through peer-led drills during emergencies, and build stronger ties between departments so that future professionals learn together.

RECOMMENDATION

Future research should employ randomized controlled trials to evaluate training interventions and explore long-term retention of

skills and attitude shifts. Additionally, qualitative studies could help in identifying motivational barriers and enablers influencing willingness to act in real-world crash scenarios.

For lasting impact, universities should integrate certified crash-care modules into the general undergraduate curriculum, particularly for non-medical students, including Basic Life Support (BLS), bleeding control, and scene safety. They should also conduct peer-led simulation drills at regular intervals, establish student emergency response clubs to promote peer-to-peer learning, and train faculty and student leaders to run regular drills. In addition, universities must allocate resources for equipment, space, and instructor support.

As for the policymakers, they should mandate first-aid education as part of national higher education, with clear guidelines for implementation and assessment. They should also fund training infrastructure in universities, including simulation labs, equipment, and instructor support. In addition, it is essential to strengthen awareness of the Good Samaritan Law through campaigns in educational institutions, thereby reducing fear of legal repercussions and encouraging bystander intervention.

Non-governmental organizations should collaborate with universities to run community first responder programs and create a pool of trained youth. They can further support by offering refresher training and certification to ensure sustained preparedness. In addition, NGOs should conduct awareness campaigns in both communities and campuses to normalize emergency response and encourage public participation in lifesaving actions.

By taking these steps, we can turn ordinary students into capable bystanders, close critical gaps in prehospital care across Indian cities, and move closer to safer roads worldwide.

ETHICAL DECLARATION

The study protocol was approved by The Research Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group 1, Chulalongkorn University.

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HEALTH CARE UTILIZATION AND OUT-OF-POCKET COSTS AMONG THE ELDERLY PATIENTS WITH HYPERTENSION AND DIABETES

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ABSTRACT

Introduction: The global burden of non-communicable diseases (NCDs), particularly hypertension and diabetes, poses significant challenges to public health systems, especially in low- and middle-income countries like Vietnam. Among the elderly, long-term disease management often leads to high out-of-pocket (OOP) expenditures due to limited income and inadequate insurance coverage, creating barriers to healthcare access. While Vietnam has achieved over 93% population coverage under its social health insurance (SHI) scheme, significant gaps remain in financial protection, especially for the elderly living with chronic diseases.

Objectives: This study aimed to examine the utilization and health expenditure experienced by elderly patients with diabetes and hypertension in Vietnam.

Methodology: This study employed a cross-sectional analytical design using secondary data from a nationally representative household survey on the financial burden among older adults, conducted by the Health Strategy and Policy Institute in 2020. The survey encompassed three provinces representing the northern, central, and southern regions of Vietnam—namely, Yen Bai, Thanh Hoa, and Tien Giang. A total of 1,536 individuals aged 60 years and older were interviewed. Of these, 749 respondents who had been diagnosed with hypertension and diabetes were included in the analysis. Data were analysed using descriptive statistics and logistic regression. The level of statistical significance was set at 0.05.

Results: Among 749 elderly respondents with hypertension and/or diabetes, 24.6% had hypertension only, 5.7% had diabetes only, while the majority had comorbidities. Outpatient service utilization was reported by approximately 75% of participants in the past four weeks. Median out-of-pocket (OOP) expenditures were USD 7.98 (IQR: 3.80–19.00) for those with hypertension only, USD 8.55 (IQR: 4.26–55.10) for those with diabetes only, and USD 20.33 (IQR: 5.42–69.73) among those with both conditions and additional comorbidities. Bivariate analysis showed that gender, self-reported health status, frequency of health facility visits, and type of insurance were significantly associated with OOP expenditures. Multivariate logistic regression further identified female gender (AOR = 2.163, $p < 0.001$), poor health status (AOR = 1.480, $p = 0.033$), and frequent healthcare utilization (≥ 2 times visits in 4 weeks; AOR = 2.214, $p < 0.001$) as significant predictors of OOP payments. Not being married was associated with lower odds of incurring OOP expenses (AOR = 0.557, $p = 0.008$).

Conclusion: Multimorbidity is associated with higher out-of-pocket expenses and increased healthcare utilization, indicating a greater financial and healthcare burden.

Keywords: Elderly, Hypertension, Diabetes, Out-of-Pocket, Vietnam

INTRODUCTION

Non-communicable diseases (NCDs) are responsible for a significant proportion of mortality and morbidity worldwide and become more prominent with cancers, chronic respiratory diseases, diabetes entering whereas communicable diseases are on the decline with HIV dropping out of the top 10, accounting

for 75% of global mortality, or approximately 43 million deaths annually (1). Hypertension and diabetes are two of the most prevalent NCDs worldwide, contributing significantly to global morbidity and mortality. Hypertension affects approximately 1.28 billion adults globally (2). It is a major risk factor for cardiovascular diseases, stroke, and

kidney failure. Similarly, diabetes, particularly type 2 diabetes, has reached epidemic proportions, with an estimated 537 million adults living with the condition and one death occurring every five seconds in 2021. The number of people with diabetes is projected to increase to 783 million by 2045. Over 3 in 4 adults with diabetes live in low middle income countries(3). As reported in the 2020 Vietnam Health Statistics Yearbook, primary hypertension and diabetes are among the leading diseases. The prevalence of hypertension and diabetes per 100,000 population nationwide are 402.6 and 256.8, respectively (4) High blood pressure and high fasting plasma glucose were the leading metabolic risk factors contributing to disability-adjusted life years (DALYs) per 100,000 population, across all age groups. These risk factors demonstrated upward trend in prevalence between 2011 and 2021(5). Vietnam is undergoing rapid population aging, with the proportion of individuals aged 60 and above projected to increase significantly. This demographic shift is closely linked to a rising prevalence of non-communicable diseases (NCDs), which contributes to growing household healthcare expenditures. In low- and middle-income countries like Vietnam, the long-term management of chronic conditions imposes a substantial financial burden on families due to ongoing costs for medication, consultations, and diagnostic services (6). Despite over 93% population coverage under the national Social Health Insurance (SHI) scheme, elderly patients still face considerable out-of-pocket (OOP) expenditures due to limited benefit coverage, co-payments, and high non-medical costs (7). Older adults with diabetes and hypertension are at a higher risk of OOP healthcare costs than younger adults and people without diseases (8) (9). Such financial pressures may hinder equitable access to healthcare services, reduce adherence to long-term treatment, and heighten the likelihood of disease-related complications. Consequently, this study seeks to investigate healthcare utilization and out-of-pocket expenditures among elderly individuals living with hypertension and diabetes in Vietnam. This study aims to generate evidence that can inform policy interventions to enhance financial protection and ensure more equitable access to care for this vulnerable population.

METHODOLOGY

Study Design and Population

This cross-sectional analytical study utilized secondary data from the "Household Financial Burden Associated with Healthcare for Older People in Viet Nam" survey conducted by the Health Strategy and Policy Institute (HSPI) between 2019 and 2020. The dataset includes responses from 1,536 individuals aged 60 years and older, residing in three provinces: Yen Bai, Thanh Hoa, and Tien Giang. Of these, 749 individuals diagnosed with hypertension, diabetes, or both were included in this analysis.

Research Instrument

The conceptual framework was based on Andersen's model, which explains the factors influencing health care utilization and financial burden among elderly patients with hypertension and diabetes

Data were collected using a structured questionnaire adapted from validated national surveys. The instrument comprised three sections: (1) general demographic information; (2) health status and service utilization; and (3) healthcare expenditure. Data on outpatient visits were requested within the past 4 weeks. Out-of-pocket costs in this study included direct medical costs and indirect costs (e.g., transportation, food, accommodation, etc.)

Data Management and Analysis

Data were cleaned, coded, and verified using SPSS version 25. Inconsistent or incomplete entries were reviewed and excluded where appropriate. Variables were categorized, including socio-demographic factors (e.g., age, gender, education, marital status), health-related factors (e.g., self-rated health status, comorbidities), and access-related factors (e.g., insurance type, number of health facility visits). Descriptive statistics were applied to summarize healthcare utilization and out-of-pocket (OOP) expenditures. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as medians with interquartile ranges (IQR). Out-of-pocket (OOP) expenses were categorized into two groups: those who needed to pay and those who did not need to pay for outpatient services. Associations between categorical independent variables and OOP payment status were assessed using the Chi-square test. Variables with a p-value ≤ 0.25

from the bivariate analysis were considered for inclusion in the multiple logistic regression (MLR) model to determine the independent predictors of incurring OOP expenses. Adjusted odds ratios and 95% CI were calculated to estimate the strength of associations. Statistical significance was defined at the $p < 0.05$ level.

Ethical Consideration

The original survey received ethical approval from the Institutional Scientific Research Committee of HSPI and the WHO Research Ethics Review Committee (Protocol No. ERC.0003085). For secondary analysis, the researcher received formal data use approval from HSPI. Ethical clearance obtains from Mahidol University Central Institutional Review Board (MU-CIRB).

RESULTS

Table 1 shows the respondent's socio demographic characteristics. Among 749 respondents, the majority were female (61.1%) and aged 60–69 years (46.3%). Most were married (60.2%) and had education lower than high school (79%). Nearly all participants were of Kinh ethnicity (97.9%), and over half resided in urban areas (56.6%). Around 60.6% lived in households with three or fewer family members. Most were retired or unemployed (79.8%). Regarding health status, 52.3% rated their health as poor or very poor. Over half (56.2%) had monthly incomes $\leq 3,000$ thousand VND. In the past four weeks, 52.5% visited health facilities 0–1 time. In terms of health insurance, 62.1% had to partly contribute to the premium, 35.0% were fully subsidized, and 2.4% had no insurance coverage.

Table 1 General characteristics of the respondents (n=749)

Variable	n	Percentage (%)
Gender		
Male	291	38.9
Female	458	61.1
Age		
60-69	347	46.3
70-79	273	36.4
80+	129	17.2
Marital status		
Married	451	60.2
Others	298	39.8
Education		
Higher than high school	157	21
Lower than high school	592	79
Ethnicity		
Kinh	733	97.9
Others	16	2.1
Residence		
Urban	424	56.6
Rural	325	43.4
Number of family members		
≤ 3	454	60.6
> 3	295	39.4
Employment status		
Still working	151	20.2
Retirement/Unemployed	598	79.8
Self-report health status		
Fair to very good	357	47.7
Poor/very poor	392	52.3
Income		
≤ 3000 thousand dong	421	56.2
> 3000 thousand dong	328	43.8

Variable	n	Percentage (%)
Number of health facilities 4 weeks ago		
0 – 1 time	393	52.5
≥ 2 times	356	47.5
Type of health insurance		
Fully support	262	35.0
Partly support	465	62.1
No insurance	18	2.4

Table 2 Diseases characteristic of respondents (n=749)

Diseases	n	Percentage (%)
Only Hypertension	184	24.6
Only Diabetes	43	5.7
Hypertension and Diabetes	56	7.5
Hypertension with comorbidities	358	47.8
Diabetes with comorbidities	34	4.5
Hypertension and Diabetes with comorbidities	74	9.9

According to Table 2, the prevalence of comorbid conditions was notably high. Nearly half of the participants (47.8%) reported having hypertension along with other comorbidities. In contrast, 24.6% of respondents had only hypertension, and 5.7% had only diabetes. A smaller proportion (7.5%) presented both hypertension and diabetes without additional comorbidities. Furthermore, 4.5% had diabetes accompanied by other comorbidities, while 9.9% reported the coexistence of hypertension, diabetes, and other comorbid conditions. Utilization rates were higher among individuals with comorbid conditions.

Out-of-pocket (OOP) expenditures differed notably among the various disease groups (Figure 1). The median OOP

expenditure for outpatient services was USD 7.98 (IQR: 3.80–19.00) for individuals with hypertension alone, and USD 8.55 (IQR: 4.26–55.10) for those with diabetes alone. The presence of additional comorbidities was strongly associated with an increase in OOP costs, with the highest financial burden observed in individuals diagnosed with both hypertension and diabetes, in combination with other chronic conditions, where the median OOP expenditure was USD 20.33 (IQR: 5.42–69.73). This trend is clearly illustrated in the accompanying bar chart, which demonstrates a progressive increase in the financial burden in line with the growing number and complexity of chronic health conditions.

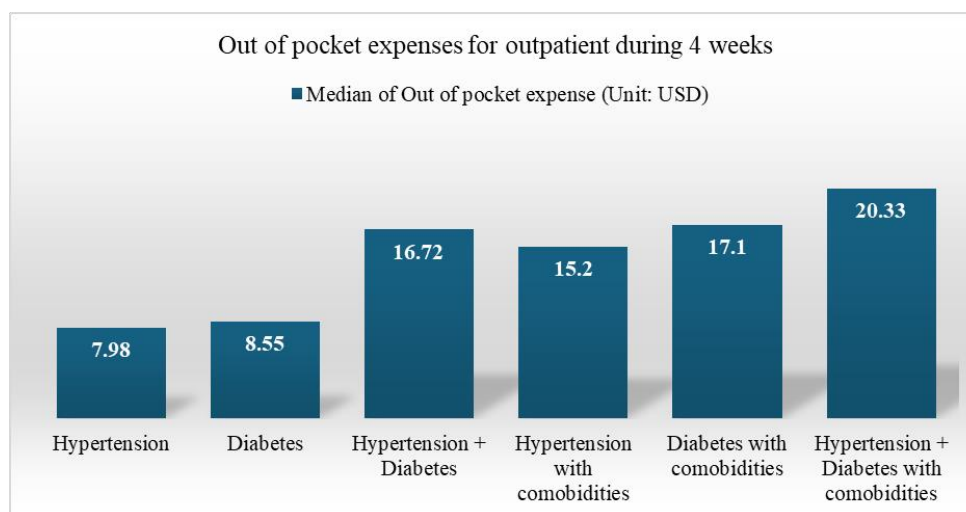


Figure 1 Out of pocket expenses for outpatient for 4 weeks

The analysis using the Chi-square test (Table 3) identified several statistically significant factors associated with the likelihood of incurring out-of-pocket (OOP) expenses among elderly patients with hypertension and diabetes. Female participants were significantly more likely to require OOP payments compared to males ($p = 0.007$). Additionally, individuals who reported poor or very poor health status were more likely to incur OOP expenses than those reporting fair to very good health ($p = 0.009$). A strong

association was also observed between the frequency of healthcare utilization and OOP expenditures; those who visited health facilities two or more times within the past four weeks were significantly more likely to incur OOP costs ($p < 0.001$). In contrast, variables such as age, marital status, educational attainment, ethnicity, place of residence, number of family members, employment status, income level, and type of health insurance were not significantly associated with OOP expenditures.

Table 3 Associations between independent variables and out-of-pocket expenses

Variable	Number of respondents	Out-of-pocket expenses N (%)		X ²	P-value
		Not paid	Paid		
Gender				7.381	0.007**
Male	214	106 (49.5%)	108 (50.5%)		
Female	351	133 (37.9%)	218 (62.1%)		
Age				3.623	0.163
60-69	261	101 (38.7%)	160 (61.3%)		
70-79	218	95 (43.6%)	123 (56.4%)		
80+	86	43 (50.0%)	43 (50.0%)		
Marital status				3.356	0.067
Married	337	132 (39.2%)	205 (60.8%)		
Others	228	107 (46.9%)	121 (53.1%)		
Education				2.417	0.299
High school and higher	182	80 (44.0%)	102 (56.0%)		
Primary and Secondary	232	104 (44.4%)	130 (55.6%)		
No formal school	149	55 (36.9%)	94 (63.1%)		
Ethnicity				0.824	0.364
Kinh	549	234 (42.6%)	315 (57.4%)		
Others	16	5 (31.3%)	11 (68.8%)		
Residence				0.518	0.472
Urban	329	135 (41.0%)	194 (59.0%)		
Rural	236	104 (44.1%)	132 (55.9%)		
Number of family members				1.943	0.163
≤3 members	350	156 (44.6%)	194 (55.4%)		
>3 members	215	83 (38.6%)	132 (61.4%)		
Median: 3; QD: 1.5; Min: 1; Max: 10					
Employment status				0.654	0.419
Still working	113	44 (38.9%)	69 (61.1%)		
Retirement/Unemployed	452	195 (43.1%)	257 (56.9%)		
Self-report health status				6.834	0.009**
Fair to very good	257	124 (48.2%)	133 (51.8%)		
Poor/very poor	308	115 (37.3%)	193 (62.7%)		
Income				0.003	0.955
≤3000 thousand dong	316	134 (42.4%)	182 (57.6%)		
>3000 thousand dong	249	105 (42.2%)	144 (57.8%)		
Median: 3000; QD: 1600; Min: 0; Max: 23000					
Number of visiting health facilities 4 weeks ago				23.685	<0.001***

Variable	Number of respondents	Out-of-pocket expenses		X ²	P-value
		N (%)			
		Not paid	Paid		
< 2 times	209	116 (55.5%)	93 (44.5%)		
≥ 2 times	356	123 (34.6%)	233 (65.4%)		
Median: 2; QD: 0.5; Min: 0; Max: 7					
Type of health insurance				0.225	0.635
Fully support	193	79 (40.9%)	114 (59.1%)		
Partly support and no insurance	372	160 (43.0%)	212 (57.0%)		

Notes: n = 565, *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001

The variables with a p-value of less than or equal to 0.25 were selected to consider for inclusion in multiple logistic regression model. The findings demonstrated that gender, marital status, self-perceived health status, and number of visiting health facilities were independently associated with the likelihood of incurring OOP expenses. Elderly female participants exhibited a significantly higher likelihood of incurring OOP expenses compared to their male counterparts, with an adjusted odds ratio of 2.163 (95% CI: 1.497–3.516; p < 0.001), suggesting that women were more than twice as likely to face financial burden from healthcare expenditures. Similarly, participants who rated their health as poor or very poor were at greater risk of paying OOP than those with better self-assessed health

(AOR = 1.568; 95% CI: 1.096–2.244; p = 0.014), suggesting a correlation between poor health status and higher reliance on health services that may not be fully insured. Additionally, marital status was also significantly associated with OOP expenditure. Married individuals were more likely to incur such expenses compared to those who were single, widowed, or divorced (AOR = 2.099; 95% CI: 1.351–3.263; p = 0.001). Notably, the number of visiting health facilities was a strong determinant; individuals who visited health facilities two or more times within the last four weeks had significantly higher odds of OOP payment (AOR = 2.146; 95% CI: 1.496–3.078; p < 0.001), underscoring the cost burden associated with increased service utilization.

Table 4 Multiple Logistic Regression of factors associated with out-of-pocket expenses

Variable	Out-of-pocket expenses N (%)		AOR	95% CI		P-value
	Not paid	Paid		Lower	Upper	
Gender						
Male	106 (49.5%)	108 (50.5%)	(ref)			
Female	133 (37.9%)	218 (62.1%)	2.295	1.497	3.516	<0.001***
Age						
60-69	101 (38.7%)	160 (61.3%)	(ref)			
70-79	95 (43.6%)	123 (56.4%)	0.844	0.570	1.250	0.398
80+	43 (50.0%)	43 (50.0%)	0.777	0.455	1.329	0.357
Marital status						
Others	132 (39.2%)	205 (60.8%)	(ref)			
Married	107 (46.9%)	121 (53.1%)	2.099	1.351	3.263	0.001**
Number of family members						
≤3 members	156 (44.6%)	194 (55.4%)	(ref)			
>3 members	83 (38.6%)	132 (61.4%)	1.272	0.885	1.830	0.194
Self-report health status						
Fair to very good	124 (48.2%)	133 (51.8%)	(ref)			
Poor/very poor	115 (37.3%)	193 (62.7%)	1.568	1.096	2.244	0.014*

Variable	Out-of-pocket expenses N (%)		AOR	95% CI		P-value
	Not paid	Paid		Lower	Upper	
Number of visiting health facilities 4 weeks ago						
<2 times	116 (55.5%)	93 (44.5%)	(ref)			
≥ 2 times	123 (34.6%)	233 (65.4%)	2.146	1.496	3.078	<0.001***

Notes: n = 565, AOR = adjusted odd ratio, CI = confidence interval, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

DISCUSSION

This study demonstrates a substantial prevalence of outpatient service utilization and OOP) expenses among elderly patients with hypertension and diabetes in Vietnam. Individuals with comorbidities incurred significantly higher healthcare expenditures, underscoring the disproportionate financial burden faced by those with more complex health needs (10). This pattern is consistent with previous evidence from low- and middle-income countries, where elderly individuals with multiple non-communicable diseases are at greater risk of catastrophic health spending due to heavy reliance on OOP payments (8). Despite Vietnam's extensive social health insurance coverage, the findings reveal persistent gaps in financial protection, particularly among older populations managing chronic diseases. Moreover, the results show that female gender, poor self-reported health status, frequent visits to health facilities, and marital status were significantly associated with increased OOP costs. Married individuals tended to incur higher OOP expenditures than others (unmarried, divorced, widowed, which is consistent with some studies suggesting that family members may encourage or facilitate greater healthcare utilization (11). This association likely reflects cultural and household dynamics specific to Vietnam, where financial protection mechanisms remain limited. Overall, these results are consistent with prior research in comparable settings, showing that elderly individuals with chronic conditions frequently face substantial OOP expenses due to restricted insurance coverage and limited access to healthcare services. (12). The findings indicate that the current social health insurance system provides limited financial risk protection for elderly patients with long-term conditions. This limited effect calls for urgent policy reforms aimed at strengthening benefit coverage for chronic disease management, reducing OOP

expenditures, and addressing inequities in healthcare financing among Vietnam's aging population.

CONCLUSION

Elderly individuals in Vietnam, particularly those with multimorbidity, face substantial out-of-pocket expenses and frequent utilization of outpatient services due to hypertension and diabetes. While the Social Health Insurance scheme has made notable strides in extending coverage, it continues to fall short in protecting elderly patients from financial distress. This underscores the urgent need to enhance the comprehensiveness and equity of healthcare benefits for this vulnerable population.

RECOMENDATION

To enhance financial protection and healthcare access for elderly individuals with chronic conditions, several key policy actions are recommended. First, the Social Health Insurance (SHI) benefit package should be expanded to provide full coverage for essential services, medications, and diagnostic procedures related to chronic disease management, particularly for elderly patients with comorbidities. Second, the development of targeted financial support programs, such as subsidies or exemption schemes and should be prioritized for elderly individuals with high healthcare needs and limited financial resources. Third, improving the accessibility and capacity of public healthcare facilities, especially in rural and underserved areas, is critical to reducing the dependence on costly private sector services. Lastly, establishing routine monitoring systems to assess healthcare utilization patterns and out-of-pocket expenditures among the elderly will provide essential data to inform and refine policy interventions, ensuring they are responsive to the evolving needs of this vulnerable population.

LIMITATIONS

This study used secondary data, which limited the ability to explore certain behavioural and contextual variables. Self-reported diagnoses and expenditures may also introduce recall bias. Furthermore, the study design does not allow for causal inference.

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DETERMINANTS OF CHOICE OF PLACE OF DELIVERY IN BANGLADESH

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ABSTRACT

Introduction: Despite progress in maternal health outcomes in Bangladesh, significant disparities persist in the institutional delivery utilization. Understanding the factors influencing maternal health-seeking behavior is important to develop effective policies to reduce the maternal mortality.

Objectives: To examine the determinants of women's choice of place of child delivery, using Anderson's Model of Health Service utilization.

Methodology: The data source was the secondary data from the 2022 Bangladesh Demographic and Health Survey. This study included 4217 ever-married women aged 15–49 who had a live birth within the two years preceding the survey. Two models were constructed, and a Binary logistic regression analysis was applied.

Results: Before adjusting for all population characteristics in Model 1, women in rural areas are 49% less likely to utilize institutional delivery than urban populations. (OR = 0.51, 95% CI = 0.44-0.59) After controlling for all factors in Model 2, the likelihood was reduced to 16%. Higher women's education (OR = 3.22, 95% CI = 1.97 - 5.26), husbands' education (OR = 2.11, 95% CI = 1.63 - 2.73), non-Muslim women (OR = 3.35, 95% CI = 2.43 - 4.63), 4 or more ANC visits (OR = 2.58, 95% CI = 2.20 - 3.03), and household wealth significantly increase use of institutional delivery. Employed women had a lower chance of delivering at institutions (OR = 0.77, 95% CI = 0.64 - 0.91).

Conclusion: The use of institutional delivery services is significantly influenced by women's and husband's education, religion, wealth, women's employment, residence, and ANC visits. Despite employment, some working women continue to face barriers in accessing institutional delivery services.

Keywords: Maternal Mortality Rate, Institutional Delivery, Antenatal Care

INTRODUCTION

Background of Study

Global Trends in Maternal Mortality

Although Maternal health and well-being have been crucial for enhancing the overall quality of health of countries globally, achieving this target differs across different countries (1). In 2023, approximately 260000 maternal deaths were due to pregnancy-related complications, and were highest among low and middle-income countries(2). The root causes of maternal mortality stem not only from biomedical conditions, but also from factors such as social

characteristics, conflict, and weaknesses of the healthcare system of the country (3).

Global maternal mortality trends vary across the regions. According to Figure 1, in 2023, Sub-Saharan Africa is the region where approximately 70% of global maternal deaths occurred and is classified as a high MMR region. Oceania, excluding Australia and New Zealand, with an MMR of 173, and Central and Southern Asia, at 112, were considered moderate. Lastly, Australia and New Zealand are classified as lowest MMR, with an estimated rate of 3 maternal deaths per 100000 live births (3).

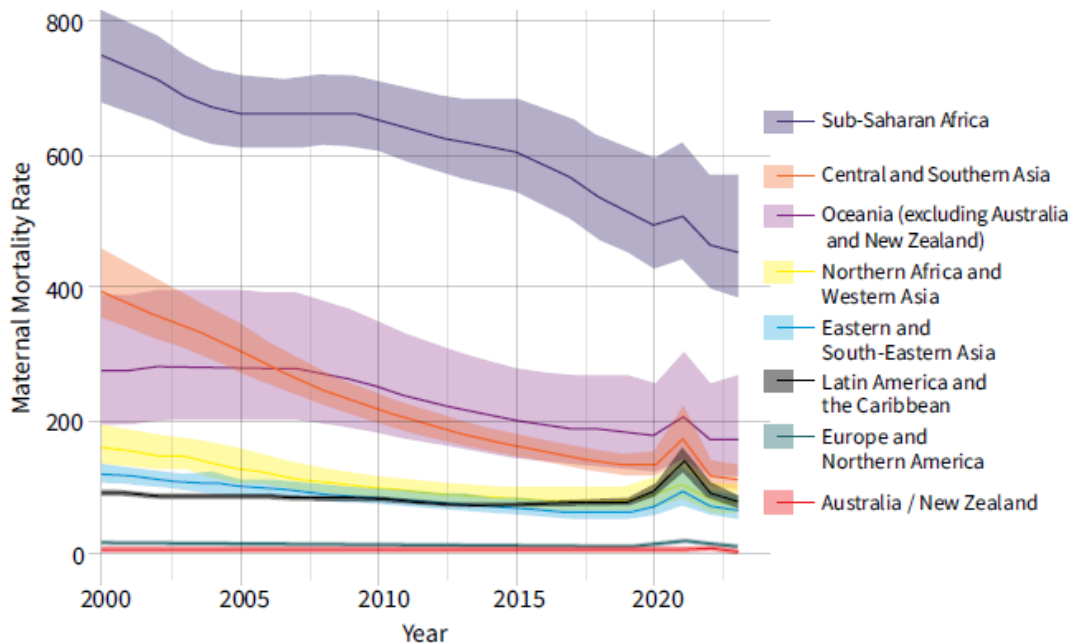


Figure 1 MMR estimates by SDG region
Source: Trends in maternal mortality estimates 2000 to 2023

Institutional delivery is effective in lowering the risks of maternal and infant mortality and morbidity, as it involves the utilization of various medical equipment and technologies(4). Despite the growing use of institutional delivery services in recent decades, due to improvements in healthcare infrastructure and policies, in some developing countries, it has yet to reach the SDG3 target. Inequalities in the use of institutional delivery are notable in low and middle-income countries, particularly across different economic statuses, urban and rural populations, and educational attainment(5).

Most pregnancy-related complications and deaths are preventable, as they are related to the limitation of access to healthcare facilities and home delivery without the aid of a healthcare professional during birth. Well-trained medical personnel, along with proper healthcare infrastructure, are mandatory for the safe delivery and prevention of unwanted maternal deaths(3).

Demographic Background of Bangladesh

Bangladesh's demographic composition reveals that while around two-thirds of the population resides in rural areas with limited access to healthcare services, compared to urban

areas(6). Due to these disparities, health outcomes are notably worse among rural residents, where inadequate access to healthcare leads to a higher risk of preventable diseases(6).

Although Bangladesh has shown remarkable improvement in reducing the maternal mortality rate in the previous two decades, with 115 maternal deaths per 100000 live births in 2023, it remains a major concerning matter of the country(7). According to the Bangladesh Demographic and Health Survey 2022, there was a significant elevation of institutional delivery, from 3% in 1993-94 to 65% in 2022. It indicated that only two-thirds of live births were delivered at healthcare centers, while one-third of the births were home deliveries, especially in the marginalized areas.

Despite the government's efforts to reduce maternal mortality through various programs such as the Bangladesh National Strategy for Maternal Health and Demand-Side Financing (DSF) programs, the maternal mortality rate is yet to reach the SDG 3 target. Although existing studies focus mainly on maternal health outcomes but they have failed to adopt an analysis using recent data within a comprehensive theoretical framework. This study aims to fill these gaps by applying Andersen's

Model of Health Service Utilization to investigate the determinants of institutional delivery.

Research Objectives and Questions

This study aims to examine the impact of the socioeconomic and external environmental factors of Bangladesh by using Andersen's model of health service utilization in order to answer the following questions.

1. What are the predisposing factors and enabling factors that significantly influence the seeking of institutional delivery?

2. Based on the results obtained from the study, what are the policies that can be implemented to increase institutional delivery rates so that Bangladesh's maternal mortality rate can reach the targeted SDG 3 level?

The Objectives of this study are as follows

1. To examine the factors that affect institutional delivery utilization.

2. To propose policy interventions for maternal healthcare utilization.

METHODOLOGY

Data Source and Sample

This study uses the cross-sectional data from the Bangladesh Demographic and Health Survey 2022, which is the ninth survey to provide health and socioeconomic information on the maternal and child health of the country.

The data and survey were based on a two-stage stratified sample of households. In the first stage, 675 Enumeration Areas (EAs) (237 EAs from urban and 438 from rural areas) were selected, and in the next stage, 45 households per

EAs were selected. The inclusion criteria focused on ever-married women aged 15–49 within reproductive age who had a live birth within the two years preceding the survey. The final sample, after excluding missing data, contains 4217 women, 1441 from urban and 2776 from rural areas.

Statistical Analysis

In descriptive statistics, frequency and percentage were calculated to summarize sample characteristics. Multivariate binary logistic regression was performed, and two models were constructed. In Model 1, a subset of contextual enabling factors was assessed, while Model 2 incorporated all predisposing, enabling, and need-based factors additionally. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were reported. Fitness of the model was evaluated using the Chi-square test, with p-values less than 0.05 indicating a good fit. All analyses were conducted using Stata version 15.

Variables

In this study, the dependent variable is the maternal health service utilization, which is the use of institutional delivery, whether the delivery takes place at home or in private and public healthcare facilities.

The explanatory variables are population characteristics which include predisposing factors (such as age, education level, employment status, religion), enabling factors (household wealth quintile, residences, distance barriers, and Divisions), and need-based factor (number of ANC visits).

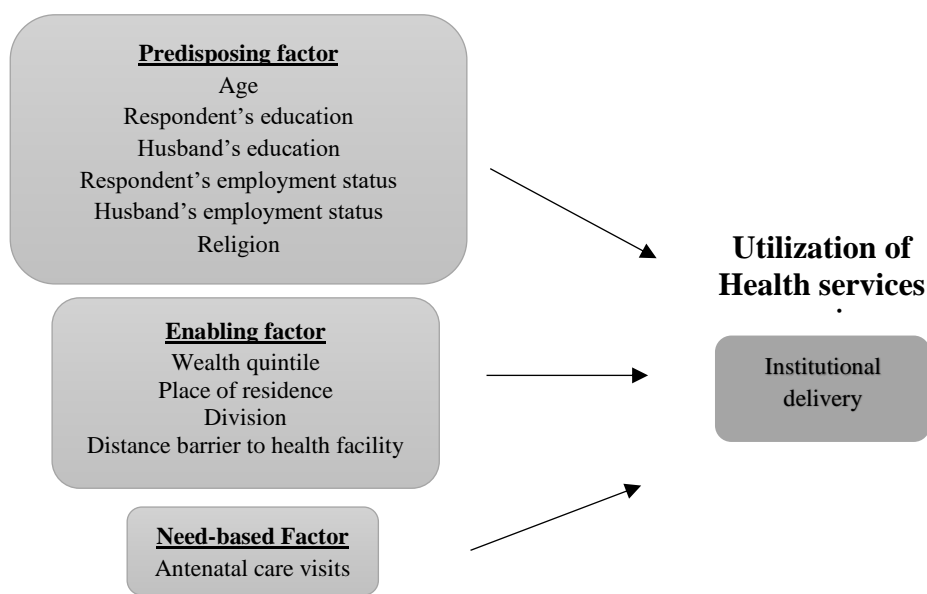


Figure 2 Conceptual Framework
Andersen's Model for Institutional Delivery

RESULTS

Table 1 Descriptive Statistics of explanatory variables

Variables Categories	Home Delivery N=1335 N (%)	Institutional Delivery N=2882 N (%)	p-values
Age			0.067
Mean	24.66	24.59	
SD	5.73	5.40	
Place of residence			0.000
Urban	321 (22.28)	1,120 (77.72)	
Rural	1,014 (36.53)	1,762 (63.47)	
Division			0.000
Barishal	192 (38.79)	303 (61.21)	
Chattogram	247 (34.84)	462 (65.16)	
Dhaka	172 (27.34)	457 (72.66)	
Khulna	79 (15.25)	439 (84.75)	
Mymensingh	193 (40.38)	285 (59.62)	
Rajshahi	103 (23.68)	332 (76.32)	
Rangpur	155 (32.22)	326 (67.78)	
Sylhet	194 (41.10)	278 (58.90)	
Respondent's employment status			0.000
Unemployed	952 (29.97)	2,224 (70.03)	
Employed	383 (36.79)	658 (63.21)	
Husband's employment status			0.115
Unemployed	18 (23.38)	59 (76.62)	

Variables Categories	Home Delivery N=1335 N (%)	Institutional Delivery N=2882 N (%)	p-values
Employed	1,317 (31.81)	2,823 (68.19)	
Respondent's education			0.000
No education	56 (56.57)	43 (43.43)	
Primary	416 (49.46)	425 (50.54)	
Secondary	750 (32.05)	1,590 (67.95)	
Higher	113 (12.06)	824 (87.94)	
Husband's education			0.000
Primary	697 (47.35)	775 (52.65)	
Secondary	508 (29.57)	1,210 (70.43)	
Higher	130 (12.66)	897 (87.34)	
Wealth Quintile			0.000
Poor	740 (48.27)	793 (51.73)	
Middle	280 (32.79)	574 (67.21)	
Rich	315 (17.21)	1,515 (82.79)	
Religion			0.000
Muslim	1,285 (33.39)	2,563 (66.61)	
Others	50 (13.55)	319 (86.45)	
Problem with the distance to health facility			0.000
No	687 (28.87)	1,693 (71.13)	
Yes	648 (35.27)	1,189 (64.73)	
Antenatal Care Visits			0.000
0-3 visits	1,028 (43.08)	1,358 (56.92)	
4 and more	307 (16.77)	1,524 (83.23)	

Note: Values are presented as frequency and percentage for categorical variables and mean and standard deviation for continuous variables, with percentages shown for each delivery type; p-values were obtained from Chi-square tests.

According to Table 1, Urban women show a higher chance of utilizing institutional delivery (77.72%) than home delivery (22.28%) ($p < 0.001$). In addition, a significant portion of home births occur in rural settings, with 36.53%. The distribution of Facility delivery is correlated with delivery location ($p < 0.001$), and the highest rate is seen in Khulna (84.75%), followed by Rajshahi (76.32%) and Dhaka (72.66%), respectively.

Among the unemployed, 29.97% utilized home delivery while 70.03% delivered in institutions ($p < 0.001$).

Mothers with secondary and higher educational attainment are highly associated with the use of institutional delivery, accounting for 67.95% and 87.94%, respectively ($p < 0.001$). Similar to women's education, secondary and

higher educated husbands also show higher institutional delivery services with respective proportions of 70.43% and 87.34% ($p < 0.001$).

Concerning wealth, a significantly higher proportion of institutional deliveries occurred among women in the middle (67.21%) and richest group (82.79%) ($p < 0.001$). In case of problems with distance to health facilities, among those who reported having distance as a problem, 35.27% gave birth at home ($p < 0.001$).

Religion was also a significant factor ($p < 0.001$); 66.61% of Muslim women utilized institutional delivery, and 33.39% of Muslim women gave birth at home. Regarding the number of ANC visits, respondents with 4 or more visits for antenatal care contribute a higher percentage to institutional deliveries with 83.23% ($p < 0.001$).

Table 2 Multivariable logistic regression for factors associated with institutional delivery

Variables	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Division		
Barishal	Ref	Ref
Chattogram	1.14 (0.90 - 1.45)	1.03 (0.79 - 1.34)
Dhaka	1.52***(1.17 - 1.95)	1.27 (0.96 - 1.68)
Khulna	3.57***(2.65 - 4.82)	3.12***(2.25 - 4.33)
Mymensingh	0.998 (0.77 - 1.29)	0.89 (0.67 - 1.19)
Rajshahi	2.06*** (1.55 - 2.73)	1.87***(1.36 - 2.57)
Rangpur	1.39* (1.07 - 1.81)	1.29 (0.96 - 1.73)
Sylhet	0.95 (0.73 - 1.23)	0.84 (0.63 - 1.12)
Residence		
Urban	Ref	Ref
Rural	0.51*** (0.44 - 0.59)	0.84* (0.71 - 1.00)
Distance Barriers		
No	Ref	Ref
Yes	0.80** (0.70 - 0.21)	0.94 (0.81 - 1.09)
Wealth quintile		
Poor		Ref
Middle		1.43*** (1.18 - 1.74)
Rich		2.22*** (1.82 - 2.69)
Age		
		0.99 (0.97 - 1.00)
Respondent's Education		
No education		Ref
Primary		1.38 (0.85 - 2.08)
Secondary		1.74** (1.12 - 2.70)
Higher		3.22*** (1.97 - 5.26)
Husband's Education		
Primary		Ref
Secondary		1.39*** (1.17 - 1.64)
Higher		2.11*** (1.63 - 2.73)
Respondent's Employment Status		
Unemployed		Ref
Employed		0.77** (0.64 - 0.91)
Husband's Employment Status		
Unemployed		Ref
Employed		0.84 (0.48 - 1.47)
Religion		
Muslim		Ref
Non-Muslim		3.35*** (2.43 - 4.63)
ANC visits		

Variables	Model 1 OR (95% CI)	Model 2 OR (95% CI)
0-3 visits		Ref
4 and more		2.58*** (2.20 - 3.03)
Change in R2	0.044	0.17
Prob > chi2	0.0000	0.0000
Observation (N)	4217	4217

Significant at *** = $p < 0.001$, ** = $p < 0.01$, * = $p < 0.05$

Table 2 presents the results of the two models. In model (1), where only specific contextual enabling factors are included to assess the independent influence of geographic and service access factors, such as problems with the distance to health facilities, division, and residence, were mainly focused, whereas model (2) included all population characteristics in Andersen's models.

In model (1), before adjusting for all population characteristics, women residing in rural areas are 49% less likely to utilize institutional delivery than urban residents. Women who had problems with distance to the healthcare facilities have a 20% reduced chance of having a delivery at an institution. Compared to respondents from Barishal, respondents from Dhaka, Khulna, Rajshahi, and Rangpur have 1.52, 3.57, 2.06, and 1.39 times higher odds of utilizing institutional delivery.

In model (2), among the predisposing factors, women with a higher education level have the highest odds with a 3.22 times increased chance of utilizing institutional delivery than women with no education, followed by women with secondary education with 1.74 times higher chance than no education women group. For husbands' education, women with husbands of higher education level and secondary education level were 2.11 and 1.39 times more likely to deliver at a healthcare institution, respectively. Employed women were 23% less likely to give birth at institutions. Concerning religion, non-Muslim women were 3.35 times more likely to deliver at institutions than Muslim women.

Regarding the need-based factor, women who had 4 or more ANC visits were 2.58 times more likely to utilize institutional delivery. For the enabling factors, women from the rich household and middle-class household had 2.22

and 1.43 times higher odds of utilizing institutional delivery. Women residing in Khulna and Rajshahi have 3.12 and 1.87 times increased odds of delivering at institutions than in Barishal. Women residing in rural regions are 0.16 times less likely to use institutional delivery.

DISCUSSION

In case of educational attainment, respondents with secondary and higher education are more likely to utilize institutional delivery, which aligns with the findings from Tharaka Nithi country, Kenya (8). Education empowers women to better understand the possible risks associated with home deliveries (9). Similarly, the finding suggests that women with husbands of secondary and higher education levels have an increased chance of delivery at healthcare facilities. Husbands with advanced education actively support their wives in accessing reproductive health services, as they possess greater health awareness (10). On that account, positive attitudes of husbands towards healthcare could likely result in a higher rate of health service use among women (11). This study found a higher likelihood of institutional delivery among non-Muslim women. Some pregnant mothers feel uncomfortable sharing their health concerns with male doctors also contributes to their reluctance in seeking facility-based delivery (12).

Interestingly, this study reveals that employed women had a lower chance of utilizing institutional delivery services. This result is similar to the other study, which revealed that home births were more common among working mothers than non-working mothers in Bangladesh (13). As employment opportunities are more concentrated in urban areas, rural women migrate to urban areas for more job

opportunities, mostly entering labor-intensive informal sectors. This is worsened by the disparities in wages and earnings based on gender (14). When women work as a consequence of resource limitation and poverty, it may hinder women's access to healthcare services (15).

In this study, it was found that women from the rich and middle-class households have increased odds of utilizing institutional delivery services. This result is in line with the findings from India (16) that suggests utilization of institutional delivery was more common among socioeconomically advantaged women. A probable explanation is that wealth improves women's accessibility to maternal health by primarily providing the resources necessary for healthcare services and transportation.

Women with 4 or more ANC visits have a higher chance of delivering at an institutional delivery. One study suggests that it is related to the health education mothers receive during adequate antenatal care visits, which enhances awareness about the benefits of delivering at healthcare facilities and the presence of skilled health professionals (17). The finding also aligns with a study from Bhutan (18).

Disparities in healthcare infrastructure and accessibility have a significant impact on the health service utilization across different regions. The finding suggests Khulna and Rajshahi have a higher chance of delivering at hospital institutions compared to that of Barishal. A study in (19) Bangladesh also found a similar finding that women residing in the Khulna and Rajshahi divisions had significantly greater access to delivery care facilities. One study (20) suggested that distance, road conditions, and availability of communication to the closest healthcare facility are considered when choosing health service utilization. This study found that urban women have higher odds of delivering at institutions compared to rural women. A study in Uganda (21) also revealed that being a woman from an urban area increased the odds of having a facility-delivery than rural populations.

CONCLUSION

This study has examined the determinants of institutional delivery utilization, which is significantly influenced by women's and husbands' education, religion, household wealth,

women's employment status, residence, and antenatal care visits. Higher education for both women and husbands affects the utilization of institutional delivery positively. In case of employment status, employed women have less access to health services. Wealth quintile and adequate ANC visits were positively correlated with health service-seeking behavior. By targeting these necessary areas with effective policies, Bangladesh will be able to reduce the maternal mortality rate and improve the overall maternal health outcome of the country.

POLICY RECOMMENDATIONS

- Developing healthcare infrastructure in rural areas, as rural residents face more difficulties in healthcare access compared to urban populations.
- As the wealth index of households is a strong determinant of institutional delivery, the government should implement financing programs for low-income households to overcome the financial barriers.
- The government should promote the continuation of children's education after primary school, as a higher education level has a profound influence on the decisions relating to the delivery at the institutions.
- Promoting maternal health education and empowering women to seek healthcare during pregnancy and childbirth.

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FLOOD PREPAREDNESS AMONG MYANMAR MIGRANTS IN MAE SAI DISTRICT, CHIANG RAI PROVINCE, THAILAND

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ABSTRACT

Introduction: Climate change has increased the frequency and severity of extreme weather events, leading to more frequent and intense floods worldwide. Between 2003 and 2023, floods contributed more than 40% of global disasters and Mae Sai District experienced its worst flood in 2024. This severest flood in Mae Sai district resulted in 12 fatalities, affected approximately 3,000 families including migrants and caused an estimated 4 billion baht in damages. Migrant populations are more vulnerable to floods due to limited access to early warning systems and exclusion from local disaster planning.

Objectives: This study aims to explore level of flood preparedness and determinate factors associated with the levels of flood preparedness among Myanmar migrants.

Methodology: A cross-sectional survey was conducted among 430 Myanmar migrants from three sub-districts of Mae Sai District in June 2025. The pre-defined questionnaires via Kobo Toolbox were administered in Burmese, collecting data on socio-demographics, contextual, risk perception factors, and flood preparedness actions. Descriptive statistics, chi-square tests, and logistic regression were used to analyze associations between variables and flood preparedness levels.

Results: Among the 430 surveyed participants, the average age was 38 years, and 54% were female. All respondents had experienced flooding at least once, yet only 46% demonstrated good flood preparedness. The significant predictors of study outcome included higher education (AOR=3.18, p=0.001), unstable/stable employment (AOR=2.76 and 2.06, respectively), registered migration status (AOR=1.69, p=0.030), greater flood experience (AOR=3.96, p=0.001), language proficiency (AOR=1.99, p=0.023), high perceived vulnerability (AOR=2.29, p=0.001), and lower perceived response cost (AOR=1.85, p=0.011). Flood knowledge was not significantly associated with the levels of flood preparedness.

Conclusion: Despite repeated flood exposure, many Myanmar migrants remain underprepared, particularly in terms of financial and material readiness. Policies should prioritize inclusive disaster strategies, financial support for preparedness supplies, and culturally tailored flood risk communication to empower migrant communities.

Keywords: Disasters, Flooding, Flood Preparedness, Myanmar Migrants, Mae Sai District

INTRODUCTION

Climate change has increased the frequency and severity of extreme weather events, leading to more frequent and intense floods worldwide. According to emergency event database (1970-2024) analyzed by the Economic and Social Commission for Asia and the Pacific (ESCAP), it highlighted that an average of around two million people in Thailand are affected by disasters each year.

Among them, the flood mainly affected over 170 million, particularly in Thailand.

Thailand is one of the top destinations for migrants in Southeast Asia, attracting millions of workers from neighboring countries (1, 2). Based on Thailand's Ministry of Labor statistics, there were 2.3 million documented migrants in October 2023; 1.7 million (74%) came from Myanmar. Mae Sai district is one of border trade zone between Thailand and

Myanmar, and there were an estimated 32,000 Myanmar migrants residing in Mae Sai district under Chiang Rai Province (3).

Mae Sai was one of the most affected areas by widespread flooding during 2024. The 2024-year flood was described as "the severest disaster in almost 100 years," impacting around 12 deaths and 3,200 households and causing damages estimated at 4 billion baht (4, 5). The flooding events significantly worsened the situation for both local residents and Myanmar migrants residing in that area.

Many migrants from low-income communities face serious difficulties in preparing for and recovering from floods due to limited access to essential resources and information (6, 7). This makes the migrant populations harder to protect themselves and rebuild after flood disaster. Newly arrived migrants often lack knowledge of flood-prone areas, seasonal risks, and local response procedures due to the language variation. They are also commonly excluded from early warning systems because of migration status, economic hardship, cultural barriers, or poor integration into disaster planning, leaving them less informed and more vulnerable (8, 9).

By applying Protection Motivation Theory (PMT) and the Theory of Planned Behavior (TPB), this study examined how socio-demographic, contextual and risk perception factors affect the levels of flood preparedness among Myanmar migrants in Mae Sai district (10, 11). The study outcome of this research is to provide actionable insights for local interventions, enhance flood risk communication strategies for migrants, and fortify emergency planning for the future floods.

METHODOLOGY

Study Design

A community-based cross-sectional study was conducted among Myanmar Migrants in Mae Sai District in Chiang Rai Province, Thailand. The actual data collection took place in three sub-districts, namely Wiang Phang Kham, Mae Sai and Ko Chang sub-districts. Four main sections of the instrument such as socio-demographic (8 variables, 8 questions), contextual factors (5 variables, 18 questions),

risk perception (3 variables, 10 questions), and flood preparedness (1 variable, 8 questions) were applied for this study. A questionnaire reliability test involving 30 participants was separately done with similar characteristics of flood experienced Myanmar migrants located in Chiang Mai Province. Cronbach's alpha values for flood knowledge, attitude, perceived severity, perceived vulnerability, response costs and flood preparedness questions were 0.75, 0.71, 0.83, 0.76, 0.86 and 0.93 respectively. The survey data were collected using an interview-administered questionnaire in Burmese using the mobile data collection form (KoboToolbox).

Research Instrument

The research instrument used in this study was a structured, interviewer-administered questionnaire designed to assess flood preparedness among Myanmar migrants in Mae Sai District. The questionnaire consisted of selected variables covering socio-demographic characteristics, flood experience, knowledge, attitudes, perception factors and flood preparedness actions. Items were adapted from the international standard checklists and disaster preparedness literature, and were reviewed by three experts for content validity. The instrument was developed in English, translated into Burmese, and back-translated to ensure linguistic accuracy. A pilot test was conducted with 30 migrants of similar characteristics to refine wording, improve clarity, and confirm cultural appropriateness before full data collection.

Under the category of socio-demographic factors, the general characteristics of the participants were collected, including age, gender, education, occupation, monthly income, household size, migration status, length of stay and language skill. According to existing literature, eight flood knowledge questions with three possible statements: "True", "False" or "Not sure" in relevant to migrant setting were asked to evaluate the knowledge level of respondents. Based on the number of correct answers, the maximum score would be 8, which is then categorized as either poor or good based on the median value (12). The attitude-related questions were measured using a Likert scale

from 1 (Strongly Disagree) to 5 (Strongly Agree), where higher scores indicate a more positive attitude, then categorized as negative and positive based on the median value (10, 13). The perceived severity and vulnerability questions were measured using a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), with higher scores indicating a stronger belief in the seriousness of flood impacts (10, 14). The variable of response costs was measured by 3 question sets using a Likert scale with reverse coding order from 5 (Strongly Disagree) to 1 (Strongly Agree) (15, 16). In term of study outcome, the flood preparedness refers to the respondent's readiness for potential flood events. It included 8 standard questions adapted from the flood safety checklists and emergency preparedness guide developed by American Red Cross and Public Safety Canada (17, 18), as well as recent research papers (19-21) to evaluate the flood preparedness level of Myanmar migrants in Mae Sai District. The scores for study outcome were given according to three possible categories 0. No (not started); 1. Yes (In progress); 2. Yes (completeness). The overall score was calculated for each participant, and a median cutoff point was used to differentiate between "poor" and "good" levels of flood preparedness.

Data Collection Procedures

The data collection took place from 11 to 26 June 2025, following approval from the Mahidol University–Central Institutional Review Board (MUCIRB). Community leaders from three sub-districts were informed about the study’s objectives and procedures, and participant consent was obtained for field data collection. Two data collectors were recruited and trained. Based on respondent availability, the research team collected data with active support from a migrant representative, using

face-to-face interviews and a mobile data collection form powered by KoBo Toolbox.

Statistical Analysis

430 participants were included in the data analysis, and IBM Statistical Package for Social Science (SPSS) version 26 was used to analyze the data. Descriptive analyses were employed to describe the characteristics of respondents. Chi-square tests were also performed to examine the associations between independent variables and flood preparedness with a p-value < 0.05. Additionally, variables with a p-value < 0.25 were further analyzed binary logistic regression and multiple logistic regression to identify predictors of study outcome, controlling for potential confounding factors.

Ethical Considerations

The protocol was approved by the Mahidol University Central Institutional Review Board (MU-CIRB) on 11 June 2025 and the Certificate of Approval number was MU-CIRB 2025/207.1106.

RESULTS

A total of 430 Myanmar migrants participated in the study, with nearly equal proportions aged 18–35 years (49.1%) and ≥36 years (50.9%). Most respondents were female (54.0%) and had completed middle school (38.6%) or primary school and below (31.4%). A majority were engaged in unstable employment (43.3%) or stable work (41.6%), while 15.1% were unemployed. The income profile showed 68.6% earned 10,000 THB or less per month. Over half lived in households of four or more members (54.0%). Most were irregular or temporary migrants (63.7%), with 51.6% residing in Thailand for four years or more.

Table 1 Socio-demographic characteristics of respondents (n=430)

Variable	Number (n)	Percent (%)
Age (in years)		
18 – 35	211	49.1
≥ 36	219	50.9
(Median = 36; Q.D = 8.5; Min = 18; Max = 78)		

Variable	Number (n)	Percent (%)
Gender		
Male	198	46.0
Female	232	54.0
Education		
Primary school and lower	135	31.4
Middle school	166	38.6
High school and above	129	30.0
Occupation		
Unemployed	65	15.1
Unstable employment	186	43.3
Stable employment	179	41.6
Monthly income		
≤10,000 THB	295	68.6
> 10,000 THB	135	31.4
Number of households		
1-3	198	46.0
≥ 4	232	54.0
(Median = 4; Q.D = 1; Min = 1; Max = 8)		
Migration status		
Irregular or temporary migrants	274	63.7
Registered migrants	156	36.3
Length of stay		
< 4 Years	208	48.4
≥ 4 Years	222	51.6
(Median = 4; Q.D = 4.4; Min = 1; Max = 37)		

Regarding contextual and perception-related factors, 55.8% had experienced two or more flood events. The majority had access to at least one information source (88.6%) and their proficient skills of Thai language were (77.9%). Good flood knowledge was found in

62.8%, and 52.3% showed a positive attitude toward flood preparedness. High perceived severity and vulnerability were reported by 80.9% and 63.7% of respondents, respectively. However, 64.9% perceived flood preparedness to be costly in terms of time, effort, or finances.

Table 2 Description of contextual and risk perception factors (n=430)

Variable	Number (n)	Percent (%)
Number of past flood experiences		
< 2 times	190	44.2
≥ 2 times	240	55.8
(Median = 2; Q.D = 1; Min = 1; Max = 15)		
Access to information sources		
Don't know or never receive	49	11.4
Received from ≥ 1 source	381	88.6

Variable	Number (n)	Percent (%)
Thai Language skill		
Not proficient	95	22.1
Proficient	335	77.9
(Median = 6; Q.D = 1; Min = 4; Max = 16)		
Flood knowledge		
Poor (< median)	160	37.2
Good (\geq median)	270	62.8
(Median = 6; Q.D = 1; Min = 0; Max = 8)		
Attitude toward behaviour		
Negative attitude (< median)	205	47.7
Positive attitude (\geq median)	225	52.3
(Median = 16; Q.D = 1; Min = 7; Max = 20)		
Perceived severity		
Low (< median)	82	19.1
High (\geq median)	348	80.9
(Median = 12; Q.D = 1; Min = 8; Max = 15)		
Perceived vulnerability		
Low (< median)	156	36.3
High (\geq median)	274	63.7
(Median = 16; Q.D = 0.5; Min = 8; Max = 20)		
Response cost		
High (< median)	151	35.1
Low (\geq median)	279	64.9
(Median = 8; Q.D = 1; Min = 3; Max = 13)		

Out of 430 Myanmar migrants, 54.4% (n = 234) were classified as having poor flood preparedness (score \leq 11), while 45.6% (n = 196) demonstrated good preparedness (score \geq 12), with a median of 11 and a quartile deviation of 2.5. Moreover, the figure 1 illustrates the levels of flood preparedness actions among respondents across eight key components. The highest level of complete preparedness was observed for having an Emergency Evacuation Plan (62%), followed by availability of Safe Drinking Water for 3 days (58%) and Communication of the Plan with household members (48%). In contrast, preparedness was notably lower in financial and logistical aspects. Only 20% of respondents had savings specifically for flood in emergency

situations, while 60% reported being in progress and 20% had not started at all. Similarly, transportation arrangements were complete in only 30% of cases, with 59% still in progress and 11% not started yet. Regarding food and non-food items (NFIs), 47% had fully prepared a 3-day stock of food, while 37% had complete NFIs (e.g., flashlight, batteries, power bank, etc). Only 38% completed their preparedness for the emergency first aid kit, including essential medicines and medical supplies. Overall, the figure reveals that while awareness and planning elements (e.g., evacuation plans) are relatively well adopted, critical gaps remain in economic and material preparedness, particularly emergency savings and access to complete kits.

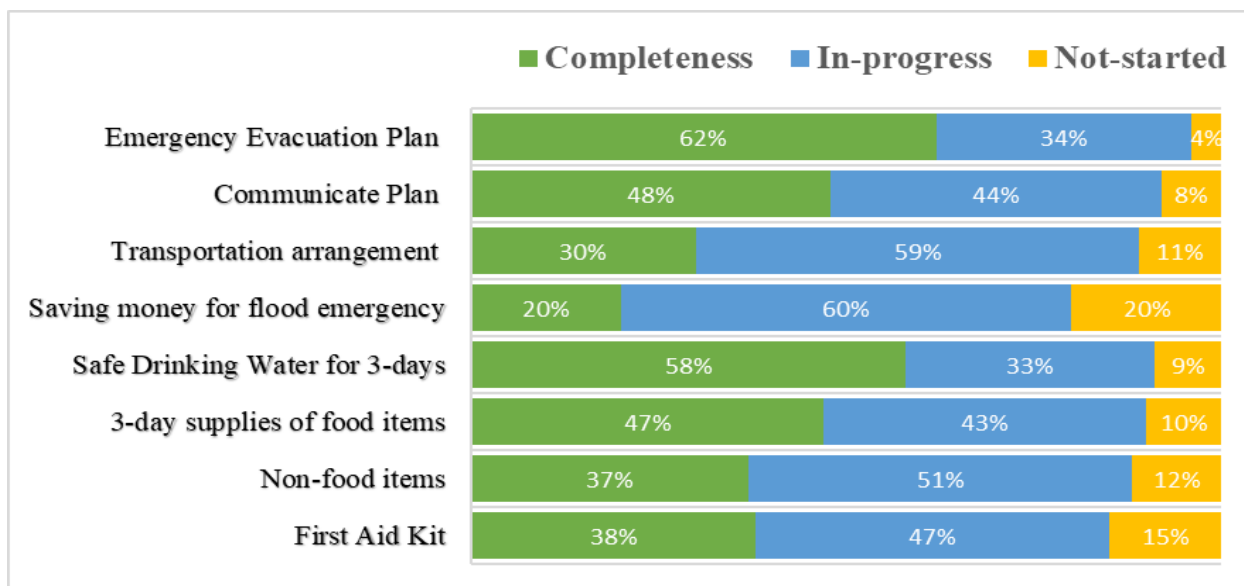


Figure 1 Distribution of respondents by level of preparedness across eight key indicators

Bivariate analysis using Pearson’s chi-square test revealed several statistically significant associations between socio-demographic, contextual, and perception-related factors and the level of flood preparedness among Myanmar migrants. The flood preparedness was significantly associated with those variables of age, education, occupation, monthly income,

household size, migration status, length of stay, past flood experiences, information access, Thai language skill, attitude, perceived severity and vulnerability ($p < 0.05$) and also with response cost with the p -value of < 0.25 . However, gender ($p=0.890$) and flood knowledge ($p=0.678$) were not significantly associated with preparedness.

Table 3 Association between independent variables and level of flood preparedness (N=430)

Independent Variables	Level of Flood Preparedness		Pearson Chi-square	p-value
	Poor, n (%)	Good, n (%)		
Age (in years)			4.686	0.030
18 – 35	126 (59.7)	85 (40.3)		
≥ 36	108 (49.3)	111 (50.7)		
Gender			2.889	0.890
Male	99 (50.0)	99 (50.0)		
Female	135 (58.2)	97 (41.8)		
Education			25.102	0.000
Primary school and lower	96 (71.1)	39 (28.9)		
Middle school	85 (51.2)	81 (48.8)		
High school and above	53 (41.1)	76 (58.9)		
Occupation			13.230	0.001
Unemployed	47 (72.3)	18 (27.7)		
Unstable employment	104 (55.9)	82 (44.1)		
Stable employment	83 (46.4)	96 (53.6)		

Independent Variables	Level of Flood Preparedness		Pearson Chi-square	p-value
	Poor, n (%)	Good, n (%)		
Monthly income			4.767	0.029
≤10,000 THB	171 (58.0)	124 (42.0)		
> 10,000 THB	63 (46.7)	72 (53.3)		
Number of households			7.664	0.006
1-3	122 (61.6)	76 (38.4)		
≥ 4	112 (48.3)	120 (51.7)		
Migration status			23.153	0.000
Irregular or Temp; migrants	173 (63.1)	101 (36.9)		
Registered migrants	61 (39.1)	95 (60.9)		
Length of stay			13.282	0.000
< 4 Years	132 (63.5)	76 (36.5)		
≥ 4 Years	102 (45.9)	120 (54.1)		
Number of past flood experiences			59.629	0.000
< 2 times	143 (75.3)	47 (24.7)		
≥ 2 times	91 (37.9)	149 (62.1)		
Access to information sources			14.128	0.000
Don't know or never receive	39 (79.6)	10 (20.4)		
Received from ≥ 1 source	195 (51.2)	186 (48.8)		
Thai Language skill			24.718	0.000
Not proficient	73 (76.8)	22 (23.2)		
Proficient	161 (48.1)	174 (51.9)		
Flood knowledge			0.172	0.678
Poor (< median)	85 (53.1)	75 (46.9)		
Good (≥ median)	149 (55.2)	121 (44.8)		
Attitude toward behaviour			4.098	0.043
Negative attitude (< median)	122 (59.5)	83 (40.5)		
Positive attitude (≥ median)	112 (49.8)	113 (50.2)		
Perceived severity			5.341	0.021
Low (< median)	54 (65.9)	28 (34.1)		
High (≥ median)	180 (51.7)	168 (48.3)		
Perceived vulnerability			16.397	0.000
Low (< median)	105 (67.3)	51 (32.7)		
High (≥ median)	129 (47.1)	145 (52.9)		
Response cost			1.918	0.166
High (< median)	89 (58.9)	62 (41.1)		
Low (≥ median)	145 (52.0)	134 (48.0)		

Note: *p-value < 0.05, **p-value < 0.01, ***p-value < 0.001

According to table 4, multivariate logistic regression identified several independent predictors of good flood preparedness among Myanmar migrants. Higher education levels significantly increased preparedness, with middle school (AOR=2.18), and high school & above (AOR=3.18), respectively. Migrants with unstable jobs (AOR=2.76) were more likely to be prepared than the unemployed, while stable employment showed a positive but non-significant trend.

Registered migrants had higher odds (AOR=1.69) of preparedness than irregular ones. Prior flood experience (AOR=3.96), language proficiency (AOR=1.99), high perceived vulnerability (AOR=2.29), and lower perceived response cost (AOR=1.85) were also significantly associated with better preparedness. These results highlight the importance of both structural and psychosocial factors in shaping flood readiness among migrant communities.

Table 4 Multivariate logistic regression results for Flood Preparedness

Variables (Predictor of Study Outcome)	AOR (95% CI)	p-value
Education		
Primary school and lower	Reference	
Middle school	2.176 (1.249-3.790)	0.006
High school and above	3.177 (1.762-5.729)	0.000
Employment		
Unemployed	Reference	
Unstable employment	2.764 (1.330-5.745)	0.006
Stable employment	2.057 (0.970-4.362)	0.060
Migration status		
Irregular or Temp; migrants	Reference	
Registered migrants	1.694 (1.054-2.724)	0.030
No. of past flood experiences		
< 2 times	Reference	
≥ 2 times	3.961 (2.443-6.423)	0.000
Thai language proficiency		
Not proficient	Reference	
Proficient	1.988 (1.098-3.597)	0.023
Perceived vulnerability		
Low (< median)	Reference	
High (≥ median)	2.290 (1.408-3.723)	0.001
Response cost		
High (< median)	Reference	
Low (≥ median)	1.846 (1.148-2.969)	0.011

Note: AOR= Adjusted Odd Ration, CI= Confidence Interval, *p-value < 0.05, **p-value <0.01, ***p-value < 0.001

DISCUSSION

The findings of this study highlight critical insights into the flood preparedness status of Myanmar migrants in Mae Sai District. While the majority of respondents demonstrated good knowledge and positive attitudes, these cognitive factors did not consistently translate

into effective flood preparedness, as compared with findings in previous literature (22-25). Although many respondents had experienced multiple floods and high perceptions of risk, only 45.6% demonstrated good preparedness. This finding highlights a common disconnect between awareness and action, especially where

structural and contextual barriers exist (26). The results showed that education emerged as a strong predictor of preparedness, aligning with literature that suggests formal education enhances individuals' capacity to process risk information and adopt protective behaviors (27). Similarly, employment, especially stable or semi-stable work, appears to facilitate access to resources and support the readiness of flood preparedness (28). Moreover, the migration status played a critical role. Registered migrants were significantly more prepared, likely due to better access to public services and legal protections (29).

Language proficiency further influenced the preparedness level, suggesting that linguistic barriers hinder access to early warnings, education campaigns, and administrative support (26). Past flood experiences in Mae Sai also significantly influenced on the migrants' flood preparedness, confirming that direct exposure can be a motivating factor for future readiness (22). Furthermore, perceived vulnerability and response cost shaped preparedness actions. Those who felt more at risk and those who perceived preparedness as less burdensome were more likely to act (24, 25).

Interestingly, gender and knowledge level were not significantly linked to preparedness, indicating that awareness alone may not be sufficient to drive action without addressing other structural or motivational barriers. Hence, the preparedness gaps were most evident in economic readiness, as reflected in the low completeness of emergency savings and first aid kits. These results align with prior research (22, 30), emphasizing the role of perceived risk and cost-benefit tradeoffs in disaster behavior, underscoring the importance of reducing financial and logistical barriers in preparedness programming.

CONCLUSION

In this study, more than half of respondents (62.8%) reported having good flood knowledge, positive attitude (52.3%), and perceived high severity (80.9%). Key enablers of preparedness include education, employment, migration status, Thai language proficiency, past flood experiences, perceived vulnerability, and response cost, but not with

sex, knowledge and attitude. Conversely, economic limitations and perceived burdens of completeness of essential commodities such as food, NFIs, and first aid kits inhibit flood preparedness actions, particularly among those Myanmar migrants.

RECOMMENDATION

According to the finding results, a combination of practical interventions and policy measures is highly recommended to enhance flood resilience among Myanmar migrants. Practical interventions include developing multilingual flood preparedness campaigns through culturally appropriate channels, providing micro-grants or subsidies for essential emergency items such as first aid kits and other equipment, and conducting community-based training sessions tailored to migrants with lower education or limited language proficiency. On the policy side, it is crucial to ensure the inclusion of irregular migrants in local disaster risk reduction planning and community drills, and to establish a participatory learning or monitoring system on flood preparedness actions among the migrants residing in flood prone area like Mae Sai district. Together, these strategies address both informational and structural barriers, promoting equitable and effective disaster preparedness for migrant populations.

ETHICAL DECLARATION

This study ensures voluntary participation, anonymity, and confidentiality for all respondents. Participants were also informed of the purpose and estimated duration of the survey, and no personally identifiable information were not be collected. After obtaining consent prior to data collection, these ethical declarations helped build trust within the study population.

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WHITE COATS IN WAR ZONES: THE UNSEEN BATTLE OF KARENNI HEALTHCARE HEROES

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ABSTRACT

Background: Since the coup 2021 in Myanmar, there has been persistent violence which has entailed aerial bombing, territorial fragmentation, and forced displacement within Karenni State. Healthcare providers are exposed to hazardous conditions, and their perceptions are hence critical for an understanding of how armed conflicts shape health systems and frontline response.

Objective: The objective of this study is to analyze how healthcare providers from Karenni State perceive the conflict and how these perceptions affect their professional roles, safety, education, and welfare.

Method: A qualitative approach was used, in which semi-structured interviews with 13 frontline healthcare providers namely 3 physicians, 3 nurses, 2 midwives, 2 health assistants, and 3 medical students were undertaken over 60 to 90 minutes via online platforms (Zoom Application). Participants were purposively selected because of their direct involvement in healthcare delivery in conflict zones. Data was analyzed using thematic analysis. Both deductive and inductive coding methods were employed. Some codes were derived directly from the data, whereas others were influenced by predetermined themes based on theoretical understandings of resilience and localization. Nevertheless, the analytical procedure was informed by principles more traditionally linked with grounded theory, including constant comparison and sensitivity to participant interpretation.

Results: From the overall theme Perception of Conflict, three sub-themes resulted.

Conflict Situation: The bulk of ground territories were in control of rebel groups until 2025, and the military had control of airspace. Frequent clinic relocations due to airstrikes, artillery shelling, and insecurity conditions led to instability of health delivery.

Intensity of Conflict: Ongoing and intensifying violence included selective attacks on health facilities and IDP camps. These involved weapons such as cluster bombs and incendiary bombs, and these ended up causing huge civilian casualties and infrastructural destruction.

Impact of conflict: Learning of students got interrupted through airstrikes, displacement, unpredictable connectivity over the internet, and electricity outages. Regular interruption of courses and tests and physical and mental fatigue through oscillation between frontline responsibility and academics occurred.

Conclusion: Healthcare Service Providers in Karenni State perceive that conflict affects their professional and personal lives. The general conclusion of these themes shows how pervasive insecurity has reshaped health provision and medical education and has long-term implications for workforce development. Some key actions are suggested to support healthcare providers in conflict zones. They are enforcing international humanitarian law to protect health workers and health facilities, strengthening mobile and adaptive health systems, ensuring uninterrupted medical education using conflict-sensitive techniques, provision of psychosocial care for frontline workers and empowering local stakeholders through funding and leadership positions. These actions create a more resilient, locally appropriate, and patient-focused health system.

Keywords: Perception, Conflict, Healthcare Providers, Karenni State, Myanmar, Aerial bombing, disruption of education.

INTRODUCTION

According to Pre-conflict profile of Healthcare System in Myanmar, the healthcare system prior to 2021 operated under a semi-decentralized structure in support of improved accessibility, equity, and delivery of services. The healthcare system aims at increasing healthcare workforce capacity and the development of infrastructures, particularly in hard-to-reach and rural areas. Community-based services and integration with non-governmental and ethnic health institutions were also the gateway to improving healthcare delivery among diverse groups (1).

Regarding to Governance collapse and health system disruption, Myanmar military government made health system in a drastically new direction since the February 1, 2021, coup by the military. Overthrowing the democratically elected government introduced mass civil unrest, such as the Civil Disobedience Movement (CDM), in which thousands of health workers resigned from state-run institutions in protest (2). To address repression and threat, some healthcare providers started providing medical care in secret networks, improvised clinics, and clandestine hospitals. This resulted in scattered, under-equipped provision of medicine, particularly in areas most exposed to civil war.

Escalation of Armed Conflict in Karenni State (previously Kayah State) is currently among the most militarized and conflict-torn areas since the coup. The region is defined by border tensions, aerial bombings, and large-scale internal displacement. Clinics and hospitals have been bombed or destroyed. Such activities cause serious obstructions in the provision of health care services, especially to vulnerable populations like women, children, and the elderly (3, 4). Increasing insecurity also restricts transport, supply chains, and communications networks increasing more barriers to seeking care.

Regarding the role of Non-State Actors and Localization Efforts, as the state system collapsed, non-state actors in this instance, ethnic and community-based health organizations, have taken on the responsibility of playing the primary role in ensuring health services. The actors utilize mobile outreach, localized supply, and community-based models of care. Localization

tactics aim at redistributing decision-making and resources among frontline providers with the capacity to enhance responsiveness in real time to changing needs (5, 6).

As the national health system weakened, non-state actors primarily ethnic and community-based health organizations began to play a dominant role in health service delivery. These actors adopted mobile outreach, community-based, and localized supply chain approaches. This shift is consistent with a broader localization strategy, which involves transferring decision-making power and resources to frontline responders who are more attuned to local needs (5, 6).

To learn how health workers adapt and survive in such complicated environments, resiliency theory is also applied in this study. Resiliency theory concentrates on how systems and individuals resist, adapt to, and recover from adversity. Within the situation of long-term armed conflict, healthcare professionals are required to cope with not just physical risk but also institutional breakdown and psychological distress. Resiliency theory illuminates how they deal with uncertainty, continue service provision, and preserve professional identity (11).

The intersection of these two theories, namely resiliency and localization, provides an explanatory framework for frontline healthcare during war. Where localization explains the structural and functional transformations within health governance, resiliency focuses on the human capacity for adaptability in the face of chronic crisis. Together, these theories guide the research in its examination of how conflict is experienced by healthcare workers in Karenni State, how it affects their professional and personal lives, and how they manage in the face of a crumbling health infrastructure.

This research aims to explore and analyze how healthcare providers from Karenni State perceive conflict and how these perceptions affect their professional roles, safety, education, and welfare.

METHODS

Study Design

This study applied a qualitative study design of in-depth interviews, guided by resiliency theory and localization theory as

theoretical underpinnings. These theories informed both the development of the interview guide and findings analysis. Resiliency theory was used to understand healthcare providers' adjustment to chronic instability and personal adversity, while localization theory informed the focus on frontline agency, decentralized decision-making, and community-based responses in conflict settings. Together, these theories provided a conceptual basis for examining healthcare providers lived experiences, coping strategies, and navigation of the health system during a fragmented health system.

Study Area and Population

The research was conducted in Karenni State, Myanmar, which was one of the most affected areas by prolonged armed conflict since the 2021 military coup. The participants were health service providers like doctors, nurses, midwives, health assistants, and medical students who have been engaged in healthcare provision for at least a year under conflict in Karenni State, Myanmar. 13 participants were selected purposively with variation by professional roles and on the site of healthcare facilities.

Data Collection

Data was gathered through in-depth, semi-structured interviews in May 2025. Interviews were conducted in Burmese with predetermined interview guideline shown in appendix. Each interview took about 60–90

minutes by secure online channels. A study guide for interviews was created based on study objectives. Interviews were tape-recorded with informed consent and then transcribed verbatim.

Data Analysis

Thematic analysis was used. Transcripts were familiarized to identify codes, which were then categorized into 3 themes. Manual coding was conducted. Member checking and triangulation against secondary sources (references from literature review) were used to increase credibility and validity.

The transcribed texts were read several times to achieve familiarization. Manual coding of the significant phrases, sentences, and quotes, and their compilation into emerging sub-themes and themes, in line with the research questions, were conducted. The codes were subsequently grouped into categories based on systematic thematic analysis. To encourage transparency and rigor in the manual coding process, transcripts were analyzed using Microsoft Word and Excel. Notable phrases and quotes were recorded in the Word comment space to help distinguish between thematic categories; however, an Excel tracking matrix was utilized to maintain consistency in coding. Each row in the matrix included the theme found, issues code, participant's name and role, relevant quotes, and findings summary including the related sub-theme. This method created an audit trail and allowed comparisons between roles during theme development.

Table 1 Data Analysis Flowchart

Step 1	Transcription of audio recordings
Audio recordings from interviews were transcribed verbatim in the Burmese language to capture full meaning and nuances.	
Step 2	Organization and revision of notes
Interview notes and transcripts were reviewed, cleaned, and organized; transcripts were read multiple times to ensure familiarization.	
Step 3	Identification of Data Saturation
Ongoing review of interviews to determine when no new information or themes emerging, indicating saturation by using excel sheet to divide namely Issues, Participants and Quotes. num	
Step 4	Coding and theming into categories
Manual coding of significant phrases, sentences, and quotes was carried out using Microsoft Word comments; codes were aligned with research questions, objectives and predetermined interview guidelines.	
Step 5	Grouping similar codes
Related codes were compiled into categories and emerging sub-themes using an Excel.	

Step 6	Interpretation and verification
Coded data were reviewed for accuracy, translated into English language and verified through participants.	
Step 7	Summary of findings with participant quotes
Notable quotes were selected to illustrate each sub-theme, ensuring representation of various participant roles.	
Step 8	Report writing
Thematic findings and supporting quotations were integrated into the results and discussion sections, linked to research objectives and literature.	

To provide credibility, triangulation was used by cross-checking data between various secondary sources (i.e., reports and case studies). Interviews from different roles (doctors, nurses, midwives, health assistants, students) enabled a multi-perspective understanding of healthcare in conflict. Participants represented different healthcare organizations, each with unique administrative and operational models. Interview data were supplemented with secondary sources, including international conflict and health

journals or previous Myanmar conflict reports. Comparative analysis between participants' roles and quotes was conducted to identify cross-role patterns and contradictions. A Member checking consisted of feeding back initial findings to a subset of participants for validation. If the data saturation did not occur, more participants from the groups concerned would have been interviewed. Simultaneous analysis with data collection enabled real-time adjustment and determination of gaps in the data.

Table 1 Thematic Saturation Map

Theme No.	Theme Title	Overall Theme Saturation	Notes
1	Perceptions of Conflict	Mostly to Fully Saturated	One sub-theme (Conflict Situation) had midwives only partially contributing.

RESULTS

Table 2 General Characteristics of Participants

Participants	Alias Name	Category of Organization	Age range	Duration of working in conflict areas
Doctor	Jame (M)	Freelance Provider	30-40	Over 4 years
	Moana (F)	Charity based Hospital	35-45	1 year and 6 months
	Smith (M)	Charity based Hospital	30-40	Over 4 years
Nurses	Helen (F)	Professional Association/ Clinic	45-55	Over 4 years
	Beatrice (F)	Professional Association/ Clinic	30-40	Over 4 years
	Ellen (F)	Professional Association/ Clinic	30-40	Over 4 years
Midwives	Loreal (F)	Professional Association/ Clinic	30-40	Over 4 years
	Mabel (F)	Professional Association/ Clinic	30-40	Over 4 years

Health Assistants	Linda (F)	Ethnic Health Organization/ Hospital	30-40	Over 4 years
	Egor (M)	Frontline Mobile Team/ Clinic	30-40	Over 4 years
Medical Students	Bolivia (F)	Charity Based Hospital	20-30	Over 4 years
	Alice (F)	Charity Based Hospital	20-30	Over 4 years
	Henry (M)	Charity Based Hospital	20-30	Over 4 years
Total	13			

Theme 1: Perceptions of Conflict

Overall, participants described a highly unstable and dangerous environment where conflict has disrupted their professional duties, living conditions, and educational pathways. The findings are divided into three main sub-themes: Conflict Situation, Intensity of Conflict, and Impact of Conflict. These findings highlight the overview of conflict experienced by healthcare providers who work in quickly changing war zones, subject to direct attacks from airstrikes and artillery, yet attempt to pursue professional growth under constant attacks. This theme highlights the psychological, functional, and structural effects of the war on healthcare professionals both in frontline and educational levels.

Sub-theme 1.1: Conflict Situation

Participants described the conflict environment in Karenni State as characterized by changing structures of administration, intermittent armed conflict, and deepening militarization. Many participants reported that by the year 2025, the revolutionary groups controlled large areas of the territories; however, the Myanmar military still controlled the airspace.

“At the beginning of the coup, it was the usual chaos and unrest... By 2025, the resistance forces have managed to take control of about 75% of Karenni State... On the ground, we (revolutionary forces) are already running administrative operations in about 75% of the area.” (Dr. James)

“Back in the early days, the intensity of the fighting was higher. Lately, it’s eased up a bit

mostly because our (revolutionary forces) side has gained control over more territory” (MS Bolivia)

In addition, participants outlined how the complex dynamics of the war directly impact accessibility to healthcare, the safety of healthcare facilities, and the requirement for population relocation, while paying consideration to their own personal growth as frontline healthcare professionals.

“I had to come to Karenni because they (Military) started arresting people running clinics in the cities... Lately, even though it’s not my specialty, I’ve ended up dealing with all sorts of illnesses and even surgeries.” (Dr. Moana)

“Around November after the coup, our (clinic team) clinic ended up close to the military... So, we (clinic team) had no choice but to relocate... and set up a whole new one.” (Nurse Helen)

“When the coup first started, COVID was still going around... all the hospitals ended up shutting down. Everything just turned into chaos after that.” (Nurse Beatrice)

Stability was reported to be present in some places, while others were stuck in a state of instability, suffering from ongoing artillery and aerial attacks.

“To be honest, in terms of the conflict, things were better in 2023 and 2024... But still, there were some damages and destruction here and there.” (Nurse Ellen)

“In the past, it was mainly heavy artillery attacks. But now, with the use of airplanes and aerial attacks, the fear and anxiety among civilians have increased significantly.” (MW Loreal)

“In Karenni State, there’s fighting going on every single day.” (MS Henry)

Key findings include territorial control more by revolutionary forces though military owns the airspace, clinics relocation due to airstrikes and other attacks by military, conflict led to chaos, increased tension and uncertainties within service provision, and intensity variation according to region and time.

Sub-theme 1.2: Intensity of Conflict

Participants reported sharply escalated armed clashes in Karenni State after the military takeover, mainly due to continuous airstrikes, heightened militarization, and indiscriminate attacks on civilians and healthcare facilities. Several respondents reported frequent engagements with aircraft, drones, artillery, and explosive devices, which were often close to hospitals and IDP camps.

“The fighting never really stops... Compared to the early days of the coup, this is the most intense phase of airstrikes... They (Military) keep launching brutal aerial attacks.” (Dr. Jame)

“The most intense was the battle for Loikaw... In February 2022, two fighter jets dropped 500-pound bombs on us (Hospital)... The craters were massive 10 feet deep and 20 feet wide.” (Dr. Smith)

Participants expressed that the occurrence and intensity of these attacks worsened over time, progressing from occasional ground battles to planned and systematic aerial attacks, hence violating international humanitarian principles. As such, it has led to frequent displacements, discontinuities in basic services, and elevated levels of psychological distress among healthcare practitioners.

“These days, it’s non-stop. Planes, drones, artillery, big weapons, small ones... literally every day.” (Nurse Helen)

“Now that airplanes are being used, any location can become a target... It becomes very challenging to properly store and preserve medical supply records.” (MW Loreal)

“We (Clinic Team) are more afraid of airstrikes now than ever before... They (Military) target IDP camps, schools, hospitals... it’s deliberate.” (MW Mabel)

“The attacks have gotten more advanced... They (Military) have started using cluster bombs, poison gas, and incendiary bombs... These airstrikes are ongoing.” (HA Egor)

The main findings are airstrikes and aerial surveillances becoming common, intentional target to health facilities and IDP camps, usage of advanced weapons such as cluster bombs, incendiary weapons increased, extensive loss of civilians becoming the norm.

Sub-theme 1.3: Impact of Conflict

Respondents of all occupational grades within the five occupational groups explained the enduring impact of conflict on work, accommodation, and health. Most explained being displaced because of insecurity, repeated threat of insult/injury and reorganization of work on changing fronts. Health care services provisioning was routinely interrupted through violence, roadblocks, and unavailability of health kits, while personal lives were impacted through separation from families, insecure accommodation, and financial pressure. Emotional repercussions including enhanced nervousness, chronic fear, and inability to focus on work characterized all cadres of respondents. Three of the medical college student respondents administered an additional questionnaire regarding the impact of conflict on studies and training. Participants, especially medical students seeking further education amidst the background of prolonged war, face ongoing challenges that negatively affect both their educational progress and physical well-being. Despite advances in internet access, through internet devices such as Starlink, respondents reported how inconsistent connectivity, erratic power supplies, and frequent airstrikes continue to stop coursework, interfere with examinations, and hinder academic progress.

“Now that this side has Starlink internet, we (Medical Students) can go online and study... But at the beginning, we had to go to places just to get a line... Downloading materials took all night.” (MS Bolivia)

Concurrent pressures from frontline healthcare responsibilities and chronic insecurity always make it necessary for students to compromise their own safety in their quest for higher learning. Even though they dream about acquiring knowledge and self-development, the instability of the infrastructure, forced displacement, and mental distress critically hinder their achievements.

“Even though we (Medical Students) have Starlink, it’s not accessible everywhere or all the time... During my final exam for midwifery, a plane dropped bombs nearby... I had to leave the exam hall in the middle of the test because of the bombing.” (MS Alice)

The main challenges are unstable internet accessibility due to power outages and blocked by military, explosions and air threats to disrupt their learning process, emotional and physical exhaustion from dual tasks and disrupted learning timelines and vulnerable learning environments.

“Because of the airstrikes, we (Medical Students) don’t feel safe to study... Internet access is also unreliable... When solar power or generators fail during storms, we lose electricity and can’t connect to internet.” (MS Henry)

Theme 1: Perceptions of Conflict - Comparative Reflection

The doctors described territorial control dynamics and system failure on the leadership in services. The nurses described clinic relocation and disruption of routine services usually bartered with emotional cost. The midwives described the burden of maintaining maternal services in an area of uncertainty, particularly aerial bombardment. The health assistants described mobility challenges and intensity variations by region, particularly frontline zones. The medical students were unique in expressing the impact on studies, postponed exams, and trauma in learning in an endangered setting but continuing to study. These differences indicate

how conflict affects each profession uniquely while being part of the same general crisis.

DISCUSSION

Theme 1: Perceptions of Conflict

This theme summarizes the perception of healthcare providers regarding the state of the conflict and how it affects their delivery of healthcare services. Conflict Situation Intensity of Conflict and Impact of Conflict on Medical Education are the sub-themes that bring to the surface the reality experienced by healthcare providers who can deliver care under strained conditions. These findings are compared to regional and international literature on healthcare settings in conflict zones.

Subtheme 1.1: Conflict Situation

Respondents to the study all described a worsening security situation marked by political fragmentation, air bombardment, and the deliberate targeting of civilian infrastructure like health facilities. The testimonies reveal that providers are not just providing services in physically dangerous conditions but also operating in a moral and psychological war zone. These observations are generally in agreement with what was documented by Abbara and Debarre (Abbara et al., 2015; Debarre, 2022b), who described the identical challenges in war-torn nations such as Syria and Africa. Abbara et al. outlined how fluid frontlines, the breakdown of public health infrastructure, and militarization of health zones presented a direct risk to health workers and patients. In the Karenni State, though, providers must navigate one especially uncommon situation such as the existence of dual governance. Although ethnic resistance forces usually hold territory on the ground, the Myanmar military continues to dominate the airspace, regularly using airstrikes against civilian and strategic targets.

This land/air dualism is a factor less well documented in the literature. It means that even in areas generally considered to be comparatively secure on the ground, the constant threat of air surveillance and drone bombing substantially hinders healthcare planning and provision. Some respondents explained the necessity of being in continuous motion, moving clinics at short notice or halting services altogether because of

perceived threats from the air. This is supported by a study by Dafallah (Dafallah et al., 2023), which also witnessed the same disruption in Sudan, however its extent and psychological impact in Karenni appear worse.

Furthermore, the interviewees expressed a powerful feeling of abandonment and suspicion not only toward state institutions, but also toward international actors, who were perceived as having been slow to acknowledge the gravity of their situation. Such perceptions contradict the premise in much humanitarian discussion that local actors are passive beneficiaries of aid and are not themselves agents in conflict discourse. Healthcare Providers in Karenni State are highly politicized actors who view their activities as a normative responsibility and as a form of resistance against oppression. This is a useful addition to the literature that has generally neglected the political agency of frontline workers in conflict settings.

Subtheme 1.2: Intensity of Conflict

Providers reported the war in Karenni State to be highly intense and escalating. A reflection is provided through the evidence regarding the shift in the kind of tactics published by the military post the 2021 coup, such as increased usage of air power and distant artillery. Testimony was obvious from witnesses regarding physical and emotional damage due to intensive shelling, forced relocation, and civilian fatalities. This is concurring with the studies by Than and Lohana (Lohana et al., 2024; Than et al., 2024a), reporting effects in Myanmar and in Gaza, respectively, due to such tactics.

What is interesting in this study is the mental dimension of experienced intensity. Participants did not simply describe conflict as a space or time issue but as an ongoing state that is impacting decision making, planning, and emotional stability. Resilience theory by Carlson (Carlson et al., 2012) refers to this, stating that people and systems under prolonged crises become accustomed to chronic stressors more than to discrete events. Health workers are making choices under hyper-vigilance patient care choices, clinic hours, and bodily movement, all based on an ever-changing threat environment. In contrast to standard emergency response scenarios based on assumed temporary

interruptions, Karenni providers have institutionalized chronic crisis thinking.

A central discovery under this sub-theme is how the threat of war has brought about a sense of "normalized insecurity." Caregivers did not wonder if there would be an attack, but when. Such constant anticipation affects their psyche and stability in service delivery. Even the same sentiment was noted in studies conducted in Iraq and Palestine by Farsi et al. and Mosleh et al. (Farsi, 2017; Mosleh et al., 2020), the Karenni case highlights the emotional numbing and survivalist state that has now become common place due to prolonged war.

Subtheme 1.3: Impact of Conflict

The war has also had a profound impact on medical education. Medical students reported disrupted learning, postponed exams, restricted access to online resources, and psychological trauma due to displacement and personal losses. These observations are consistent with Gutema and Al-Ashwal (Al-Ashwal et al., 2020; Gutema et al., 2023), who reported such disruptions in Ethiopia and Yemen, respectively. This study takes this a step further by demonstrating the innovative resilience of medical students.

Over a series of interviews, students explained how they studied in bomb shelters, accessed Starlink internet in rural areas for online lectures, and initiated peer-learning groups to make up for missed class time. These improvisational measures point to the fact that medical education during war is not merely feasible but is already being reimaged through unofficial, localized networks. This is consistent with the localization theory upheld by Kramer & MacKinnon (Kramer & MacKinnon, 1993), where community-based and local ownership solutions are favored over institutionalized models.

Nonetheless, the research also warns that without structured support, such educational resilience can become an additional burden. Students were forced to balance caregiving duties, emotional trauma, and academic demands. Some also commented that the prospect of graduating and serving the community brought up feelings of inadequacy, imposter syndrome, and burnout particularly when their training was shortened due to war circumstances.

CONCLUSION

Healthcare providers report that the armed conflict is widespread in their professional life as well as personal life. The interference does not stop at health services but carries on to the daily routines, mental stability, and educational progress of them stationed in the area. From regular aerial bombing to clinic destruction, health workers live under danger, constantly changing positions and relocating services to remain alive. Besides putting lives at risk, these experiences overburden already vulnerable systems, producing discontinuity of care and fragmentation of care provision. Medical students' education has also been severely affected; e-learning is undermined by power outage, blocked internet connectivity, and trauma of residing in zones of conflict. The report says that conflict has disrupted the whole health system, devastated not just present service delivery but undermined also the foundation of a sustainable and skilled healthcare workforce for the future. Amidst this fragile context, health workers' resilience is in display, yet without structural support and consistent focus from policymakers and the global community, their efforts are prone to breakdown. The analysis finally stresses the absolute necessity for conflict-sensitive health system responses and specific protection of healthcare service providers.

Research findings unveil the way healthcare professionals have labored in a situation of complete insecurity defined by aerial bombing, population displacements under duress of weapons, and breakdown of systems. It has severely compromised health facility accessibility with frontline health professionals frequently threatened with violence, exposed regularly to ethical challenges in the delivery of health care, being frequently displaced with facilities such as hospitals and clinics. These institutional challenges have been complemented with mental agony and mental distress with the resultant being a state of permanent vigilance and moral burnout.

At a professional level, clinicians, nurses, midwives, and health assistants indicate being stretched at their level of education for quick repairs with limited resources. Medical students were uniquely in a classic double-bind between

learning and caring roles with issues of keeping education with power loss, broken internet, and psychiatric trauma. Through these difficulties all these health practitioners showed a kind of adaptive resilience, mobile modes of caring, self-styled education, or casual peer networks that indicate individual and community coping methods.

These findings foreshadow the need for health workers to be perceived not only as innocent bystanders but more so as synergistic agents with twin imperatives of survival and caring. Application of resiliency theory has managed to demystify these caregivers' mental adaptations and inbuilt resourcefulness, with localization theory highlighting the reality that this decentralized community-based system exists wherever there is no official government. In brief, the existing conflict in Karenni state has restructured the health system at operational levels and at human levels. Without specific enabling assistance, there is a risk for the long-term cannibalization of health capacity, an instance of loss of skilled health professionals in addition to disruption of learning pipeline cadres. It is not merely a humanitarian necessity for saving and energizing these frontline professionals with policy support, funds, along with mental health attention but also a necessity for saving the future of conflict Myanmar's health.

RECOMMENDATION

To address the immediate demands of healthcare providers in Karenni State, a few important steps are suggested. First, greater protection for healthcare providers and facilities must be realized through the implementation of international humanitarian law. This involves reporting abuses e.g., aerial bombing of clinics and IDP campsites and advocating for them. Second, assistance for mobile and adaptable healthcare systems is required and given the volatility of the conflict, mobile clinics, decentralized services, and flexible supply chains should be the focus of fundraising efforts to enable ongoing care. Third, disruptions to medical education require urgent attention. Conflict-sensitive training models, secure examination centers, and alternative learning platforms should be established to ensure

continuity for students and young professionals. Fourth, psychosocial support for frontline workers should be incorporated. Mental health services, counseling services, and peer support groups will address burnout and trauma. Lastly, empowering local actors, namely community-based networks and ethnic health organizations through direct decision-making positions and funding will enhance localized response. These actions cumulatively make the healthcare system stronger, more context-sensitive, and more patient-centered, according to the lived experiences of healthcare providers in Karenni State.

To strengthen health service delivery and workforce resilience in conflict-affected areas like Karenni State, several key actions are recommended. First, healthcare providers and facilities must be protected through the enforcement of international humanitarian law, with urgent attention to documenting and addressing violations such as aerial attacks on clinics and IDP camps. Second, mobile, decentralized, and adaptive healthcare systems should be prioritized, as they allow flexibility and continuity of care amidst volatile security conditions. Third, the disruption to medical education demands the creation of conflict-sensitive learning models, secure and mobile examination centers, and resilient e-learning

platforms that enable students to continue training despite displacement and instability. Fourth, psychosocial support must be embedded in all levels of response to address the trauma, burnout, and emotional exhaustion experienced by frontline healthcare workers. Finally, local health actors, including ethnic health organizations and community-based networks, should be empowered through direct funding, leadership roles, and decision-making authority. These actions collectively support the development of a more resilient, equitable, and context-responsive health system rooted in localization and sustained by the adaptive capacity of its healthcare providers.

ETHICAL DECLARATION

This study was approved for ethics by the Institutional Review Board of the College of Public Health Sciences, Chulalongkorn University. We obtained informed consent from all the participants. Data were de-identified and stored confidentially in a secure place.

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Appendix

Theme and No.	Questions
Introduction	
1.1	Introduce myself as an interviewer.
1.2	Explain about the study in brief to get consent.
1.3	Is it OK to audio-record this conversion?
Background information of the participants	
2.1	Tell me about yourself and your role as a healthcare provider. For Doctors: What is your specialization? How long have you been practicing in Karenni State?

Theme and No.	Questions
	<p>For Nurses: What is your area of training, and how long have you been working in this setting?</p> <p>For Midwives: What are the common maternal and child health challenges in this conflict setting?</p> <p>For Health Assistants: What kinds of healthcare services do you provide? How many years have you been providing services in Karenni State?</p> <p>For Medical Students: How does your training differ in a conflict zone compared to other areas? Which role do you provide services and how many years have you been learning and providing services under conflict in Karenni State?</p>
Background Information of conflict in KARENNI State, Myanmar	
3.1	Can you share your experiences in providing healthcare services under conflict situations in Karenni State? And any other experiences except service provision? If yes, please share.
3.2	How does conflict evolve over time and what major changes do you observe?
Perceptions of conflict	
4.1	<p>How has conflict affected your healthcare work and your ability?</p> <p>For Doctors & Nurses: How have patient numbers and types of illnesses changed?</p> <p>For Midwives: Have there been increased risks or complications in deliveries?</p> <p>For Health Assistants: How has the conflict impacted on your work with patients and access to medical resources?</p> <p>For Medical Students: How has conflict affected your learning and training opportunities?</p>
4.2	How do you think which ways this conflict affected overall Healthcare system in KARENNI State?

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ASSOCIATION BETWEEN INFLUENCING FACTORS AND STRESS AMONG MYANMAR MIGRANTS IN THAILAND DURING MULTIPLE CRISES IN THEIR HOME COUNTRY

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ABSTRACT

Introduction: Myanmar migrants in Thailand face a high mental health burden, not only from displacement related challenges but also from the persistent political, humanitarian, and security crises in Myanmar. Stress, as defined by the WHO, is a state of mental strain resulting from adverse circumstances, and prolonged exposure can ultimately lead to serious mental health issues. Despite this, limited data exist on stress among Myanmar migrants, hindering evidence-based interventions and support mechanisms.

Objectives: To examine the association between influencing factors and stress among Myanmar migrants currently residing in Thailand.

Methodology: Cross-sectional study was conducted from May to June 2025 using an online self-administered questionnaire distributed through social networks. A convenience sampling method yielded 324 participants. A validated stress assessment tool (DASS-21) was used. Logistic regression was employed to investigate associations between stress and influencing factors. This survey had potential limitations related to selection bias, and generalizability.

Results: Among 324 Myanmar migrants, most were male (54.3%), aged 25-35 (56.5%), and single (54.6%). Stress prevalence was 31.5%. Females were 1.93 times more likely to experience stress compared to males (OR=1.93, 95% CI:1.20-3.11, p=0.006). Those with a bachelor's degree (OR=2.23, 95% CI: 1.24 – 4.00, p=0.008) and master's degree or above (OR=3.04, 95% CI: 1.63-5.66, p<0.001) reported significantly higher stress levels. Participants who had stayed in Thailand for ≤ 1 year had increased stress compared to those residing for over two years (OR=1.70, 95% CI: 1.02-2.84, p=0.04). Concern for family safety was the strongest predictor (OR=4.59, 95% CI: 1.58-13.28, p=0.005).

Conclusion: This study highlights gender, educational attainment, duration of stay, and fear for family safety in Myanmar are key stress-related factors. These findings underscore the need for targeted psychosocial support programs and culturally sensitive mental health services to mitigate the psychological impact on this at-risk population.

Keywords: Crises, Factors, Myanmar migrants, Stress, Thailand

INTRODUCTION

Myanmar has been facing multiple crises including political instability, armed conflicts, economic decline and humanitarian emergencies since the military coup 2021. According to the United Nations Development Programme, the country is encountering poly-crisis indicated by intensifying conflicts, economic decline, severe climate hazards, and worsening poverty leading to humanitarian emergencies. Such compounding

crises have contributed to a surge in displacement leading to migration of 3.7 million people to Thailand in 2023 (1).

Thailand is the main destination country for Myanmar migrants due to the geographic proximity and the long-standing economic ties between the two countries. The Thailand-Myanmar border, stretching over 2400 kilometers, constitutes the largest migration corridor in Southeast Asia and one of the top 20

globally. As of March 2024, the Thai Department of Employment recorded 2,308,166 registered Myanmar migrant workers representing 70% of total registered migrants in Thailand and this is the highest number in recent years (2).

A migrant may encounter barriers including communication, accessing health care and other basic services, support networks, poor living conditions, and separation from family members. These challenges are further exacerbated by work and legal uncertainty and in extreme cases, the threat of immigration detention (3).

Given this context of ongoing socio-political turmoil, natural disasters, economic collapse, fear for safety of family in Myanmar, legal vulnerability and under-resourced supporting systems are under unprecedented multi-layered stress. Stress refers to a period of mental strain triggered by challenging or demanding situations. It is a normal and instinctive reaction that helps individuals confront and adapt to difficulties or threat encountered in daily life. Everyone experiences stress at some point, but how one manages and reacts to it significantly impacts on their overall health and well-being (4). Stress is a major public health concern leading to various mental health problems such as depression, anxiety, and physical health problems such as weak immune system, gastrointestinal problems, headache and cardiovascular problems (5,6). Globally, an estimated 35.1% of people experienced stress (7) and a study among female migrant workers in Singapore reported a stress prevalence of 52.5% (8).

Emerging literatures indicate that sociodemographic factors, including gender, education and employment status play a significant role in shaping psychological stress among migrants. Many studies showed that women are more susceptible to psychological distress compared to men, with a study on humanitarian migrants in Australia reporting significantly higher distress levels among females (9). Regarding education, individuals with higher educational attainment may experience elevated stress, particularly when facing job insecurity (10). Conversely, greater resilience has been observed among those with lower education levels (11). Employment status

is another determinant of mental health. Unemployment has been strongly linked to deterioration in mental well-being (12) while those who are employed may still experience high levels of stress due to poor working conditions and job-related pressures (13). In addition to that, fear for the safety of family members, especially among migrants fleeing conflict or persecution, is a well-documented source of psychological burden (14). Finally, legal status has also emerged as a critical factor, with legal precarity exacerbating mental health outcome (15).

However, there are limited studies to systematically examine how individual, crisis and migration related factors influence stress among Myanmar migrants in Thailand. Understanding stress prevalence and its importance within this vulnerable population is vital. Insights from this study aim to illuminate structural and psychosocial determinants of stress, thereby informing culturally sensitive interventions, policy reform and targeted mental health services to bolster resilience among Myanmar migrants facing multi-layered stress.

METHODOLOGY

Cross-sectional quantitative study design was adopted in this study targeting Myanmar migrants in Thailand who were more than 18 years old and arrived in Thailand after 2021, currently living in Thailand. This also included people who travelled back-and-forth to Myanmar. However, those who had been diagnosed by a medical doctor with any mental diseases such as bipolar disorders and schizophrenia before, and those who felt uncomfortable while they were answering online questionnaires were excluded. This study used convenience sampling method, one of the non-probability sampling techniques, in which the participants were selected from the target population based on ease of access. 324 participants conducted from May to June 2025 through online questionnaires using Google form. The participants' email addresses, names and their detailed personal information were not collected, prioritizing privacy. Participants were also informed that their confidentiality and anonymity will be preserved in the process of data collection, data processing and analysis. To minimize the risk of participants experiencing

further psychological distress or unnecessary stress due to the nature of the questions, informed consent with full disclosure stating that participants can withdraw at any time without penalty and there may have potential risks to your mental health because some questions may touch on sensitive topics related to experiences. The internet links were stated for participants to seek help related to physical and mental health if a potential participant does not meet the inclusion criteria but exhibits serious mental health concerns or symptoms.

The questionnaires were constructed to evaluate key variables including 1) age, 2) sex, 3) education level, 4) marital status, 5) ethnicity, 6) employment condition, 7) year of arrival in Thailand, 8) fear of family safety, and 9) legal status. The outcome is stress and standardized questionnaires DASS-21 was used. It was rated on a 4-point Likert scale: 0 = Did not apply to me at all, 1= Applied to me to some degree, or some of the time, 2 = Applied to me much of the time and 3= Applied to me most of the time. The scores were summed and multiplied by two to get result. The scores of 0-14 is normal, 15-18 = mild, 19-25=moderate, 26-33=severe and more than 34 is assumed as extremely severe (16).

The research instruments, integrated from the previous studies were translated into Myanmar Language by professionals who have competency in English and Myanmar language

and knowledge on mental health vocabulary to ensure the credibility and robustness. For content validity, item-objective congruence (IOC) was done by 3 experts and the score was 0.66. A pilot test was done to ascertain its reliability yielding a Cronbach’s alpha value of 0.9.

The data analysis process was done by using SPSS version 29 including descriptive and inferential statistical analysis with logistic regression test. Findings with a *p*-value below 0.05 was treated as statistically significant, providing understanding of factors influencing stress among Myanmar migrants in Thailand while there were many crises happening in their home country.

RESULTS

Table 1 showed that over half of the participants were between 25 and 35 age group, n=183 (56.5%) with a mean age of 2.04, SD=0.66 and normally distributed. 62.3% of participants had occupations and half of them finished high school level education. The data showed that legal participants accounted for 78.7% of the total participants while 13.6% preferred not to say their status. Also, over half of the participants were male and single. The prevalence of stress was 31.5%. 88% of participants had impact of fear for family safety indicating that most participants were worried for their family left in Myanmar.

Table 1 Demographic Characteristics (n=324)

Demographic Characteristic	N (%)
Age	
19-24	64(19.8)
25-35	183(56.5)
≥ 36	77(23.8)
Gender	
Male	176(54.3)
Female	148(45.7)
Education	
≤ High School Level	150(46.3)
Diploma	26(8.0)
Bachelor	83(25.6)
Master and Higher Level	65(20.1)
Marital Status	
Single	177(54.6)
Married & Other	147(45.4)

Demographic Characteristic	N (%)
Ethnic	
Burmese	224(69.1)
Other	100(30.9)
Year of Arrival	
≤ 1 year	138(42.6)
2 years	52(16.0)
>2 years	134(41.4)
Occupation	
Yes	202(62.3)
No	122(37.7)
Fear of Family Safety	
Yes	285(88.0)
No	39(12.0)
Legal Status	
Yes	255(78.7)
No	25(7.7)
Prefer not to say	44(13.6)
Stress Status	
Yes	102(31.5)
No	222(68.5)

In logistic regression analysis accessing the association between demographic characteristics and stress among Myanmar migrants in Thailand, as shown in table 2, females were 1.93 times more likely to experience stress compared to males (OR=1.93, 95% CI: 1.20-3.11, $p=0.006$). People with bachelor's degree were 2.23 times more likely to experience stress (OR=2.23, 95% CI: 1.24-4.00, $p=0.008$), and those with master's degree or higher were 3.04 times more likely to experience stress (OR=3.04, 95% CI: 1.63-5.66, $p<0.001$) compared to those who completed high school or lower levels of education. Singles were 1.95 times more likely to experience stress compared to married ones (OR=1.95, 95% CI: 1.20-3.17, $p=0.007$). The

findings also indicated that Myanmar migrants who had been staying in Thailand for more than 2 years was a protective factor for stress (OR=0.59, 95% CI: 0.35-0.98, $p=0.04$). There was a significant association between occupation and stress showing that employed migrants were 1.68 times more likely to have stress compared to those who did not have jobs (OR=1.68, 95% CI: 1.04-2.70, $p=0.04$). Respondents who were afraid for their family's safety were 4.59 times more likely to experience stress compared to those who did not worry about their families in Myanmar (OR=4.59, 95% CI: 1.58-13.28, $p=0.005$). While legal status influenced the occurrence of stress in previous studies, it was not statistically significant in this study.

Table 2 Association between influencing factors and stress analyzed through logistic regression (n=324)

Related Factor	OR	95% CI	p-value
Age			
19-24	Ref		
25-35	1.16	0.62-2.15	0.65
≥ 36	1.01	0.49-2.08	0.98
Gender			
Male	Ref		
Female	1.93	1.20-3.11	0.006*
Education			

Related Factor	OR	95% CI	p-value
≤ High School Level	Ref		
Diploma	1.31	0.51-3.37	0.58
Bachelor	2.23	1.24-4.00	0.008*
Master and Higher Level	3.04	1.63-5.66	<0.001*
Marital Status			
Married & Other	Ref		
Single	1.95	1.20-3.17	0.007*
Ethnic			
Myanmar	Ref		
Other	1.18	0.72-1.95	0.52
Year of First Arrival			
≤ 1 year	Ref		
2 years	0.54	0.26-1.09	0.09
>2 years	0.59	0.35-0.98	0.04*
Occupation			
Yes	Ref		
No	1.68	1.04-2.70	0.04*
Fear of Family Safety			
No	Ref		
Yes	4.59	1.58-13.28	0.005*
Legal Status			
No	Ref		
Yes	0.65	0.28-1.51	0.32
Prefer not to say	0.78	0.28-2.14	0.62

After adjusting for potential confounders, the following results highlight that gender and fear of family safety are key risk factors for stress among Myanmar migrants in Thailand. Females were 1.73 times more likely to experience stress compared to males (AOR=1.73,

95% CI: 1.03-2.89, $p=0.04$). Respondents who were afraid for their family's safety were 3.37 times more likely to experience stress compared to those who did not worry about their families in Myanmar (AOR=3.37, 95% CI: 1.12-10.10, $p=0.03$).

Table 3 Association between significant factors and stress analyzed through logistic regression (n=324)

Related Factor	AOR	95% CI	p-value
Gender			
Male	Ref		
Female	1.73	1.03-2.89	0.04*
Education			
≤ High School Level	Ref		
Diploma	1.17	0.43-3.21	0.76
Bachelor	1.76	0.93-3.34	0.08
Master and Higher Level	2.02	0.99-4.08	0.05
Marital Status			
Married & Other	Ref		
Single	1.56	0.92-2.67	0.1
Year of First Arrival			
≤ 1 year	Ref		
2 years	0.69	0.32-1.47	0.33

>2 years	0.80	0.45-1.43	0.45
Occupation			
No	Ref		
Yes	0.91	0.54-1.56	0.74
Fear of Family Safety			
No	Ref		
Yes	3.37	1.12-10.10	0.03*

DISCUSSION

This study was performed to investigate the association between influencing factors and stress among Myanmar migrants residing in Thailand during a time of compound crises in their home country. The findings revealed a stress prevalence of 31.5% among participants, a figure consistent with prior global prevalence but lower than compared to the research done on female migrant populations in Singapore (7,8). Nearly all participants (88%) had impact of fear for the safety of their family left in Myanmar. Persistent worrying about loved ones' wellbeing, particularly in conflict zone, is a well-established source of chronic psychological strain (14). This highlights the strong emotional ties maintained with families, which can hinder psychological adjustment in the host country.

Sociodemographic characteristics, including gender, education, marital status, duration of stay, and occupation, were found to significantly influence stress levels. Female participants were nearly twice as likely to encounter stress compared to their male counterparts. This aligns with existing literature suggesting that migrant women are particularly vulnerable to mental health problems due to gender-specific stressors, including caregiving roles, economic hardships, and no chance to choose (9). In terms of educational attainment, it was found that the higher the level of education, the higher the level of stress. This study is consistent with previous study showing highly educated individuals report lower overall stress but experience higher stress in the face of job insecurity (10, 11).

Marital status emerged as a strong determinant, with single people nearly twice as likely to report stress which is consistent with one study showing stress was associated with isolation (8). This could be attributed to the lack of emotional and social support that marriage often provides, especially during crises. Duration

of residency was also a contributing factor; those who had been in Thailand for less than or equal to one year reported significantly higher levels of stress compared to long-term residents. This aligns with the previous study that highlights the psychological burden associated with early stages of resettlement and the challenges of rapid adaptation to a new environment (11). Moreover, crises happening in Myanmar could also be a reinforcing factor for this condition.

Occupational status significantly can vary the outcomes of stress. Some studies pointed out that unemployment leads to deterioration in mental well-being (12). In this study, unemployed participants were more likely to experience stress than their employed counterparts, underscoring the importance of financial security and routine in maintaining mental well-being. Furthermore, one of the most notable findings was the significant impact of fear for family safety on stress levels. Participants who fear for their family members remained in Myanmar were more than four times more likely to experience stress. This result aligns with one study which showed that fear of the safety of family member left in dangerous setting represents powerful influence on mental health among refugees from Iraq (14). This highlights the transnational nature of migrant stress, where concerns about loved ones in conflict-affected areas exacerbate psychological distress (3). There was no statistically outstanding relationship with stress in this study. The reasons could be the sample composition or potential underreporting due to fear of discrimination or deportation.

There were many significant findings in this study. However, there are some limitations. This research cannot be representative of the total population and get the generalizability of the results beyond the sample because of convenient sampling method. This study focuses on a few stressors and further factors like childhood

trauma and migration related stressors are needed to involve.

CONCLUSION

The study provides critical insights into the stress levels experienced by Myanmar migrants in Thailand amidst ongoing turmoil in their home country. Key influencing factors include gender, education, marital status, duration of stay, occupation, and fear for family safety. These findings may help healthcare professionals and organizations understand the multifaceted nature of stress situations experienced by Myanmar migrants in Thailand and offer guidance for necessary public health interventions and policy in the future.

RECOMMENDATION

Future research should employ mixed methods designs, incorporating qualitative interviews to explore deeper psychological impacts and coping strategies, especially related to trauma and fear for family safety. It is necessary to expand mental health dimensions including broader psychosocial variables like experience of violence, trauma before or during migration, and social stigma. Although adding more variables can increase participant burden, using validated short-form tools or prioritizing key indicators may balance comprehensiveness and feasibility. Moreover, support systems are needed to strengthen social support networks through community-based organizations, peer groups, and outreach programs aimed at single and unemployed migrants.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University. (COA No. 150/68)

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HOUSEHOLD FOOD INSECURITY AND RELATED FACTORS ON UNDERNUTRITION AMONG UNDER 5 CHILDREN IN MIGRANT POPULATIONS ALONG THE THAILAND-MYANMAR BORDER

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ABSTRACT

Background: Malnutrition remains a major barrier to development, affecting the health and growth of children worldwide. In 2022, 22.3% of children under 5 were stunted and 6.8% wasted, with Asia bearing the highest burden. The ongoing conflict and instability in Myanmar since 2021 have further threatened child health and nutrition in the region.

Objective: This study aims to assess the impact of household food insecurity and related factors on undernutrition among under-5 children in migrant populations along the Thai-Myanmar border.

Methods: A community-based cross-sectional study was conducted among mothers of children aged 6–59 months in rural areas of Tak and Mae Hong Son provinces. Participants were selected using multistage sampling, and data were collected through face-to-face interviews and anthropometric measurements. Household food insecurity was assessed using the validated Household Food Insecurity Access Scale (HFIAS). Nutritional status was assessed using WHO Anthro software. Data analysis included descriptive statistics, Chi-square tests, binary logistic regression ($p < 0.25$ for selection), and multiple logistic regression ($p < 0.05$ for significance).

Results: Among surveyed households, 62.5% experienced food insecurity (17.2% mild, 20.8% moderate, 24.5% severe). The prevalence of stunting, wasting, and underweight in children under 5 was 18.0%, 19.8%, and 18.5%, respectively. Low birth weight (<2.5 kg) significantly increased the odds of stunting (AOR = 2.34, 95% CI 1.07–5.26) and underweight (AOR = 3.01, 95% CI 1.41–6.44). Similarly, incomplete immunization raised stunting risk (AOR = 2.26, 95% CI 1.26–4.07). Conversely, recent illness was linked to reduced odds of wasting (AOR = 0.24, 95% CI 0.13–0.46) and underweight (AOR = 0.43, 95% CI 0.24–0.79). Furthermore, household food insecurity showed strong associations with stunting across all severity levels: mild (AOR = 2.86, 95% CI 1.15–7.12), moderate (AOR = 3.42, 95% CI 1.50–7.82), and severe (AOR = 4.57, 95% CI 2.09–10.00). It was also significantly associated with underweight in moderate (AOR = 2.38, 95% CI 1.13–5.02) and severe (AOR = 2.63, 95% CI 1.26–5.50) cases.

Conclusions: Undernutrition impacts 37.0% of under-five children in Thai-Myanmar border migrant populations, with wasting exceeding regional averages. This widespread issue, coupled with nearly two-thirds of households facing food insecurity, is significantly linked to low birth weight, incomplete immunization, recent illness, and household food insecurity. Therefore, targeted interventions addressing food security, full immunization, and infection prevention are critical to improving nutritional outcomes in this vulnerable group.

Keyword: Undernutrition, Food insecurity, Children Under 5 years, Thailand- Myanmar border

INTRODUCTION

Malnutrition, encompassing undernutrition (wasting, stunting, underweight, and micronutrient deficiencies), overweight, and obesity, significantly hinders national progress and compromises the health and development of

present and future generations (1). Undernutrition makes children in particular much more vulnerable to disease and death (2). The UNICEF conceptual framework on Maternal and Child Nutrition identifies household food insecurity (HFI), inadequate childcare, and limited access to

health, safe water, and sanitation services as key underlying causes of child undernutrition (3).

Globally in 2022, an estimated 148.1 million (22.3%) children under 5 were stunted, 45 million (6.8%) wasted, and 37 million (5.6%) overweight. Least Developed Countries exhibited much higher stunting levels than the global average, though wasting prevalence was similar (1). Over half of stunted children and 70% of wasted children under 5 lived in Asia in 2022, with a significant proportion also in Africa, where two out of five children were stunted and more than one quarter were wasted (4). Despite notable declines since 1990, the WHO Southeast Asia Region (SEAR) continued to report the highest prevalence of wasting among all WHO regions in 2022 at 14.7% (down from 17.1%), affecting nearly one in five children, while stunting remained high at 30.1% (down from 60.5%), impacting three out of ten children (5). The world remains far from achieving Sustainable Development Goal 2 (Zero Hunger). In 2023, 2.33 billion people globally (28.9%) faced moderate or severe food insecurity. Asia bore the largest share, with 1.18 billion people (24.8%) moderately or severely food insecure and 467.3 million (9.8%) severely food insecure, significantly surpassing Africa's 847 million. Within Asia, Southeast Asia had the second-highest prevalence of moderate or severe food insecurity at 17.1%, affecting 117.7 million people (1).

In Myanmar, ongoing conflict and instability since February 2021 critically endanger children's lives, driven by economic hardship, a collapsing health system, and widespread violence (6). This has resulted in a high under 5 mortality rate of over 40 deaths per 1,000 live births in 2024 (7), with vulnerability highest among conflict-affected and poorer families. An estimated 8 million children are severely wasted, and 2.2 million conflict-affected children and women urgently require essential nutrition services (6). Compounding this, inadequate infant feeding practices are widespread in refugee and migrant communities along the Thailand-Myanmar border, contributing to elevated rates of stunting and underweight among infants in these populations (8).

The prevalence of malnutrition

among children along the Thailand-Myanmar border underscores an urgent public health concern. The Border Consortium's 2022 Nutrition Survey reported an average of 3.5% global acute malnutrition (wasting), with camp-level rates ranging from 1.3% to 4.7%. In contrast, 21.5% of children suffered from global chronic malnutrition (stunting), varying from 9.4% to 33.3% by camp (9). Another study focusing on refugee camps in the area reported wasting and stunting rates of 2.1% and 28.8%, respectively (10). These findings highlight an urgent need for targeted research, as reducing child undernutrition is vital for enhancing human capital, boosting economic growth, and alleviating poverty. The long-term consequences of undernutrition, lasting into adulthood, diminish individuals' potential to learn and contribute to society (11).

Despite the urgent need to address undernutrition in migrant households, comprehensive research on household food insecurity and its related factors along the Thailand-Myanmar border remains limited. Existing studies often focus narrowly on short-term hunger or dietary diversity, overlooking the cumulative impact of prolonged food insecurity on child nutrition. Moreover, much nutrition research within Myanmar is region-specific, failing to capture the unique socio-economic and environmental challenges faced by migrant populations. These critical gaps impede the development of effective, context-specific interventions. Therefore, this study aims to bridge these deficiencies by examining the complex relationship between household food insecurity and undernutrition among children under 5 in migrant households along the Thailand-Myanmar border.

METHODS

Study Design and Setting

This community-based cross-sectional study was conducted from May to June 2025, involving 384 child-mother pairs from migrant households. Data was collected through household surveys and anthropometric assessments in rural communities across Phop Phra and Mae Sot districts in Tak Province, and Sop Moei district in Mae Hong Son Province, along the Thailand-Myanmar border. Tak

Province (bordering Myanmar's Kayin State) is a primary hub for cross-border migration, with Phop Phra and Mae Sot hosting significant migrant and refugee populations. Mae Hong Son Province (bordering Shan, Kayah, and Kayin States) has long sheltered conflict-affected refugees, with Sop Moei being particularly remote and underserved.

Sampling and Participants

The study recruited 384 mothers of children aged 6 to 59 months. This sample size was calculated using Cochran's (1977) infinite population formula, based on an estimated proportion of participants. Eligibility criteria included migrant mothers who had resided in the study area for less than five years, provided informed consent, and had at least one child aged 6 to 59 months available for anthropometric assessment. Exclusion criteria encompassed children with major illnesses, congenital conditions, or physical/mental disabilities, as well as temporary visitors.

A multi-stage sampling approach was applied. First, Tak and Mae Hong Son Provinces were purposively selected due to their documented high rates of childhood stunting and wasting (9). In collaboration with local authorities and organizations, specific villages within these chosen districts were identified. Within these identified villages, participants were then recruited through a voluntary response sampling approach. Study team members approached households, explained the study, and invited eligible mothers to participate. Those who were available at the time of data collection and willing to engage were included in the study. Mothers of children under five years old were responsible for answering the survey questions, and informed consent was obtained prior to participation.

Data Collection Procedures

Data were collected using semi-structured questionnaires and anthropometric measurements. Three trained local-language research assistants conducted 30-minute face-to-face interviews using Kobo Collect, with daily on-site reviews to ensure data completeness. The principal researcher supervised the process, explained questions in simple language as

needed, and reviewed completed forms for accuracy before participants left the survey site. Mothers of children aged 6–59 months who provided informed consent were included in the study.

Research Instruments

The structured questionnaire included seven sections: maternal and child factors, health services, feeding and dietary practices, household and environmental contexts, socio-economic determinants, household food insecurity, and anthropometric measurements of the children. Anthropometric data were collected by measuring children's weight and height. Weight was measured with minimal clothing using a calibrated scale accurate to 0.1 kg. If a child refused to be weighed alone, the mother was weighed with and without the child, and the child's weight was calculated by subtraction. Height for children able to stand was measured without footwear using a standard height board accurate to 0.1 cm (12). For children able to stand, height was measured with five contact points (heels, calves, buttocks, shoulders, and back of the head) touching the vertical board. For those unable to stand, recumbent length was measured using the same board placed horizontally on a flat surface. The nutritional status of children under 5 was assessed using WHO Anthro software by comparing Z-scores for stunting (height-for-age), wasting (weight-for-height), and underweight (weight-for-age) (13). The cut-off for each undernutrition indicator was set at below -2 standard deviations (SD) from the WHO Child Growth Standards median. Household food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS), a tool with nine standardized questions about food availability, variety, and intake over the past four weeks (14). Each question was followed by a frequency-of-occurrence question with four response categories: "Never" (0), "Rarely" (1–2 times), "Sometimes" (3–10 times), and "Often" (>10 times). A sequential, hierarchical approach was used to classify households into four categories based on their most severe response, ensuring that they were assigned to the most critical level of food insecurity they experienced.

Validity and Reliability

The structured questionnaire was developed based on the conceptual framework, relevant literature, and expert input, then translated from English to Burmese. Content validity was assessed through expert review using the Item-Objective Congruence (IOC) method, with scores averaging 1.0 and a minimum of 0.7, exceeding the acceptable threshold of 0.5. A pilot test was conducted with 30 participants from a similar community, and the questionnaire was revised accordingly. Reliability was assessed using Cronbach's alpha, with the household food insecurity conditions showing strong internal consistency ($\alpha = 0.876$). To ensure data quality, three local research assistants were trained in interview techniques, research ethics, and WHO-standard anthropometric measurements. The principal investigator supervised daily data collection and reviewed completed questionnaires to ensure accuracy, completeness, and consistency.

Data Management and Analysis

Data were managed and analyzed using SPSS version 25. Descriptive statistics, including medians with interquartile ranges for continuous variables and frequencies with percentages for categorical variables, were used to summarize the data. Data cleaning involved checking for missing values, outliers, and consistency.

Anthropometric data were processed using WHO Anthro software to calculate Z-scores for height-for-age (stunting), weight-for-height (wasting), and weight-for-age (underweight) based on WHO Child Growth Standards. Children with Z-scores below -2 standard deviations were classified as undernourished. Chi-square tests examined associations between undernutrition and theoretically relevant categorical independent variables (maternal and child characteristics, household food insecurity, and access to health services). Factors independently associated with undernutrition outcomes were identified using logistic regression. Variables with an association at $p < 0.25$ in binary logistic regression were included in the multivariable model. Multiple logistic regression was then performed, with statistical significance set at $p < 0.05$.

RESULTS

A total of 384 children aged 6 to 59 months were included in the study. Table 1 shows the prevalence of undernutrition by sex: 18.0% were stunted (19.4% males, 16.4% females), 19.8% wasted (18.9% males, 20.8% females), and 18.5% underweight (16.4% males, 20.8% females). Overall, 37.0% of children were undernourished, with similar rates among males (36.8%) and females (37.2%).

Table 1 Prevalence of undernutrition status by child's sex (n=384)

Nutritional Status	Total (n=384), n (%)	Male (n=201), n (%)	Female (n=183), n (%)
Stunting	69 (18.0)	39 (19.4)	30 (16.4)
Wasting	76 (19.8)	38 (18.9)	38 (20.8)
Underweight	71 (18.5)	33 (16.4)	38 (20.8)
Undernutrition	142 (37.0)	74 (36.8)	68 (37.2)

Note: Some children have multiple forms of undernutrition; percentages are not mutually exclusive.

The study population displayed a range of maternal and child characteristics, as well as varied health service utilization patterns. Maternal education levels varied, with the largest groups having completed primary school (35.4%) or middle school (30.2%). Most households (85.7%) had only one child under five, and the majority of mothers (43.0%) were between 23 and 30 years old at the time of their child's birth. Children's ages were fairly distributed, with the

largest group (45.1%) being 36 months or older. The sex distribution was nearly equal (52.3% male, 47.7% female). Most children (89.8%) had a normal birth weight (≥ 2.5 kg), while 10.2% were born with low birth weight, and a similar proportion (10.2%) were preterm. The utilization of health services was high, with over 90% of mothers receiving adequate antenatal care (90.6%), delivering in a health facility (90.9%), and having their delivery attended by a health

professional (93.2%). Immunization coverage was also strong, with 73.7% of children fully vaccinated. However, a significant portion of

children (57.3%) had experienced a recent illness in the two weeks preceding the survey (Table 2).

Table 2 Distribution of Maternal and Child Characteristics and Health Service Access (n=384)

Variables	Frequency (n)	Percentage (%)
Mother's education		
Illiterate	24	6.3
Primary school	136	35.4
Middle school	116	30.2
High school	78	20.3
Graduated/higher	30	7.8
Number of under 5 children		
1	329	85.7
2	50	13.0
More than 3	5	1.3
Birth order		
1 st born	180	46.9
2 nd born	114	29.7
3 rd born	53	13.8
≥4 th born	37	9.6
(Median=2; QD=0.5; Min=1; Max=7)		
Mother's age at birth		
16-22 years	75	19.5
23-30 years	165	43.0
31-38 years	109	28.4
39-46 years	35	9.1
(Median=28; QD=4.875; Min=16; Max=46)		
Child's age		
6-11 months	66	17.2
12-23 months	78	20.3
24-35 months	67	17.4
≥36 months	173	45.1
(Median=32; QD=15.5; Min=6; Max=59)		
Child's sex		
Male	201	52.3
Female	183	47.7
Low birth weight		
Birth weight <2.5 kg	39	10.2
Birth weight ≥2.5 kg	345	89.8
Preterm birth		
Born <37 weeks	39	10.2
Born ≥37 weeks	345	89.8
Antenatal care		
Inadequate (<4 visits)	36	9.4
Adequate (≥4 visits)	348	90.6
Institutional delivery		
Health facility	349	90.9
Outside health facility	35	9.1
Delivery Attended By		
Health professional	358	93.2
Non-health professional	26	6.8

Variables	Frequency (n)	Percentage (%)
Routine immunization		
Fully vaccinated	283	73.7
Partially/no vaccination	101	26.3
Recent illness past 2 weeks		
Yes	220	57.3
No	164	42.7

The study revealed that 37.5% of households were food secure, while 62.5% experienced some level of food insecurity: 17.2% mildly, 20.8% moderately, and 24.5% severely. Undernutrition indicators varied across food access categories. Stunting was more prevalent in children from severely (28.7%) and moderately (23.8%) food-insecure households compared to those from food-secure households (7.6%). Conversely, wasting was most common in food-secure households

(24.3%). Underweight affected a similar proportion of children in moderately (25.0%) and severely (25.5%) food-insecure households, which was higher than in food-secure households (12.5%). Overall, undernutrition affected 45.0% of children from moderately food-insecure and 43.6% from severely food-insecure households, compared to 31.9% from food-secure households (**Table 3**).

Table 3 Prevalence of household food insecurity conditions and undernutrition among children (n=384)

Household Food Access Category	Prevalence, n (%)				
	Total (n=384)	Stunting (n=69)	Wasting (n=76)	Underweight (n=71)	Undernutrition (n=142)
Food secure	144 (37.5)	11 (7.6)	35 (24.3)	18 (12.5)	46 (31.9)
Mildly food insecure	66 (17.2)	12 (18.2)	9 (13.6)	9 (13.6)	19 (28.8)
Moderately food insecure	80 (20.8)	19 (23.8)	18 (22.5)	20 (25.0)	36 (45.0)
Severely food insecure	94 (24.5)	27 (28.7)	14 (14.9)	24 (25.5)	41 (43.6)

Note: Some children have multiple forms of undernutrition; percentages are not mutually exclusive.

Pearson's Chi-square tests revealed significant associations between undernutrition and several factors ($p < .05$). Low birth weight was linked to stunting ($p = .028$) and underweight ($p = .003$). Institutional delivery and skilled birth attendance were associated with reduced stunting ($p = .002$ and $p < .001$, respectively) and underweight ($p = .007$). Full

immunization was associated with lower stunting ($p = .001$), while the absence of recent illness was significantly linked to reduced wasting ($p < .001$). Finally, household food insecurity showed strong associations with both stunting ($p < .001$) and underweight ($p = .020$) (Table 4).

Table 4 Factors Associated with Undernutrition among children (n=384)

Independent Variables	Total (n=384) n (%)	Stunting (n=69) n (%)	P-Value	Wasting (n=76) n (%)	P-Value	Underweight (n=71) n (%)	P-Value
Low birth weight			.028*		.587		.003*
Birth weight <2.5 kg	39 (10.2)	12 (17.4)		9 (11.8)		14 (19.7)	
Birth weight ≥2.5 kg	345 (89.8)	57 (82.6)		67 (88.2)		57 (80.3)	

Independent Variables	Total (n=384) n (%)	Stunting (n=69) n (%)	P- Value	Wasting (n=76) n (%)	P- Value	Underwei ght (n=71) n (%)	P- Value
Institutional delivery			.002*		.633		.107
Health facility	349 (90.9)	56 (81.2)		68 (89.5)		61 (85.9)	
Outside health facility	35 (9.1)	13 (18.8)		8 (10.5)		10 (14.1)	
Delivery Attended By			.000*		.663		.007*
Health professional	358 (93.2)	57 (82.6)		70 (92.1)		61 (85.9)	
Non-health professional	26 (6.8)	12 (17.4)		6 (7.9)		10 (14.1)	
Routine immunization			.001*		.769		.112
Fully vaccinated	283 (73.7)	40 (58.0)		55 (72.4)		47 (66.2)	
Partially/no vaccination	101 (26.3)	29 (42.0)		21 (27.6)		24 (33.8)	
Recent illness past 2 weeks			.343		.000*		.093
Yes	220 (57.3)	36 (52.2)		61 (80.3)		47 (66.2)	
No	164 (42.7)	33 (47.8)		15 (19.7)		24 (33.8)	
Household food insecurity level			.000*		.157		.020*
Food secure	114 (37.5)	11 (15.9)		35 (46.1)		18 (25.4)	
Mild food insecure	66 (17.2)	12 (17.4)		9 (11.8)		9 (12.7)	
Moderate food insecure	80 (20.8)	19 (27.5)		18 (23.7)		20 (28.2)	
Severe food insecure	94 (24.5)	27 (39.1)		14 (18.4)		24 (33.8)	

Note: $p < .05$ indicated statistically significant (marked with *).

Multiple logistic regression identified several significant factors associated with childhood undernutrition.

Low birth weight (<2.5 kg) significantly increased the odds of stunting (AOR = 2.34, 95% CI 1.07–5.26, $p=.033$) and underweight (AOR = 3.01, 95% CI 1.41–6.44, $p=.004$). Children with partial or no vaccination had significantly higher odds of stunting (AOR = 2.26, 95% CI 1.26–4.07, $p=.006$). Interestingly, recent illness (past two weeks) was associated with lower odds of wasting (AOR = 0.24, 95% CI 0.13–0.46, $p<.001$) and underweight (AOR = 0.43, 95% CI 0.24–0.79, $p=.007$). Household food insecurity was

strongly linked to stunting and underweight. Compared to food-secure households, children in mildly food-insecure households had higher odds of stunting (AOR = 2.86, 95% CI 1.15–7.12, $p=.024$). Children in moderately food-insecure households showed increased odds of stunting (AOR = 3.42, 95% CI 1.50–7.82, $p=.004$) and underweight (AOR = 2.38, 95% CI 1.13–5.02, $p=.022$). Furthermore, children in severely food-insecure households had significantly higher odds of stunting (AOR = 4.57, 95% CI 2.09–10.00, $p=.000$) and underweight (AOR = 2.63, 95% CI 1.26–5.50, $p=.010$) (Table 5).

Table 5 Multiple logistic regression for factors associated with undernutrition among children (n = 384)

Independent Variables	Stunting AOR (95% CI)	p-value	Wasting AOR (95% CI)	p- value	Underweight AOR (95% CI)	p- value
Low birth weight						
Birth weight <2.5 kg	2.34 (1.07–5.26)	.033*			3.01 (1.41-6.44)	.004*
Birth weight ≥2.5 kg	Ref.				Ref.	
Routine immunization						
Fully vaccinated	Ref.					
Partially/no vaccination	2.26 (1.26–4.07)	.006*				
Recent illness past 2 weeks						
Yes			0.24 (0.13- 0.46)	.000*	0.43 (0.24-0.79)	.007*
No			Ref.		Ref.	
Household food insecurity level						
Food secure	Ref.				Ref.	
Mild food insecure	2.86 (1.15–7.12)	.024*			1.24 (0.51-3.02)	.642
Moderate food insecure	3.42 (1.50–7.82)	.004*			2.38 (1.13-5.02)	.022*
Severe food insecure	4.57 (2.09–10.00)	.000*			2.63 (1.26-5.50)	.010*

Note: $p < .05$ indicated statistically significant (marked with *), AOR = Adjusted Odds Ratio; CI = Confidence Interval. AORs are adjusted for mother's education, mother's age at birth, no of children under 5, low birth weight, place of delivery, birth attendant, immunization status, recent illness, and HFI services.

DISCUSSION

This study assessed the impact of household food insecurity and related factors on undernutrition among under-five children in migrant communities along the Thai–Myanmar border. Based on WHO Anthro Z-scores, 37.0% of children were undernourished by at least one indicator: stunting (18.0%), wasting (19.8%), and underweight (18.5%). The wasting rate exceeded both the WHO South-East Asia regional average (14.7%) and Myanmar's national average (7%), indicating a high burden of acute malnutrition. Although stunting was lower than the national average (29%), underweight prevalence was comparable (19%) (5, 15). Food insecurity was widespread, affecting 62.5% of households: 17.2% were mildly food insecure, 20.8% moderately, and 24.5% severely insecure. These rates are significantly higher than Asia's 2023 regional estimates, where 24.8% experienced moderate or severe food insecurity and 9.8% severe food insecurity (1). These elevated rates underscore the increased vulnerability of migrant populations due to displacement, unstable livelihoods, and limited access to essential

This study identified several factors significantly associated with undernutrition among children under 5. Low birth weight (<2.5 kg) was significantly associated with higher odds of stunting (AOR = 2.39, 95% CI 1.08–5.29) and underweight (AOR = 2.97, 95% CI 1.40-6.33), emphasizing the long-term nutritional risks of poor fetal growth. These findings are consistent with previous studies showing that children born smaller-than-average are over twice as likely to be stunted compared to those with normal birth weight (16). Children with incomplete immunization in our study had higher odds of stunting (AOR = 2.26, 95% CI 1.26–4.07), consistent with findings from Indonesia showing increased stunting risk among incompletely vaccinated children (17). In contrast to studies from Afghanistan, which reported recent illness as a risk factor for wasting (18), our study found that recent illness was associated with lower odds of wasting and underweight. This is likely due to the study area's close proximity to health facilities, where parents promptly sought treatment to avoid prolonged illness. Motivated

by the need to return to work and sustain their income, they frequently consulted health professionals and maintained regular feeding, which helped reduce the nutritional impact of illness. Household food insecurity showed a strong, graded association with stunting and underweight. Children from mildly (AOR = 2.86, 95% CI 1.15–7.12), moderately (AOR = 3.42, 95% CI 1.50–7.82), and severely (AOR = 4.57, 95% CI 2.09–10.00) food-insecure households had significantly higher odds of stunting. Additionally, moderate (AOR = 2.38, 95% CI 1.13–5.02) and severe (AOR = 2.63, 95% CI 1.26–5.50) food insecurity was significantly associated with underweight. These results underscore the critical role of inadequate food access in both chronic and acute undernutrition and are consistent with evidence showing elevated stunting and underweight risk among children in food-insecure households (19).

CONCLUSIONS

This study revealed a high burden of undernutrition among under-five children in migrant populations along the Thai-Myanmar border, with 37.0% affected by at least one form of undernutrition. Wasting prevalence notably exceeded regional and national averages, indicating acute malnutrition. Household food insecurity was widespread, with nearly two-thirds of households affected at varying severity levels. Key factors such as low birth weight, immunization, recent illness and household food insecurity were linked to nutritional outcomes, highlighting the complex and multifactorial nature of undernutrition in this vulnerable group.

RECOMMENDATIONS

To address the high prevalence of undernutrition and food insecurity among children in migrant households, it is essential to strengthen maternal and child health services and improve access to nutritious food. Efforts should prioritize promoting maternal nutrition and quality antenatal care to prevent low birth weight and reduce the risk of stunting and underweight. Ensuring full immunization coverage is also critical to lowering the risk of stunting associated with incomplete vaccination. Targeted food assistance and nutrition-sensitive livelihood

programs tailored to moderately and severely food-insecure households can help reduce the burden of undernutrition. Furthermore, improving access to timely healthcare and encouraging prompt care-seeking behavior may mitigate the nutritional impact of childhood illnesses, as reflected in the lower odds of wasting and underweight among recently ill children.

Lastly, integrating caregiver education and routine growth monitoring into child health services is vital for promoting appropriate feeding practices during illness and facilitating the early identification and management of undernutrition, particularly among high-risk groups.

LIMITATIONS

The cross-sectional design limits causal inferences between identified factors and undernutrition. Data collection relied on mothers' recall, which may introduce bias. The study focused on migrant populations in specific border areas, which may limit the generalizability of findings to other populations or regions.

ETHICAL DECLARATION

This study received ethical approval from the Faculty of Graduate Studies, Mahidol University (COA No. MU-CIRB 2025/157.0805) and the Community Ethics Advisory Board (CEAB-2025-009), which oversees research in migrant communities along the Thailand–Myanmar border. Confidentiality was maintained using identification codes, and data were securely stored with access restricted to the principal investigator.

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UNSEEN AND UNHEARD: DEPRESSION AND STUDENT CHALLENGES AMONG MYANMAR UNIVERSITY STUDENTS IN BANGKOK

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ABSTRACT

Introduction: Globally, one in five university students experiences a mental health disorder annually, with depression being the most prevalent among international students. In Southeast Asia, the prevalence of depression among university students is 29.4%. Myanmar students studying in Thailand face additional challenges such as homesickness and cultural adjustment due to forced relocation and political instability. Despite this, Myanmar students remain underrepresented in mental health research.

Objective: This study aimed to assess the prevalence of depression, anxiety, and stress, and identify the associations between socio-demographic factors, and socio/personal challenges, and depression among Myanmar university students in Bangkok.

Methodology: A cross-sectional online survey was conducted among 383 Myanmar university students studying in Bangkok, using convenience sampling. The DASS-21 was used to measure depression, anxiety, and stress. Independent variables included socio-demographic characteristics, social/personal challenges ((e.g., homesickness, legal issues). Chi-square tests and logistic regression were used to examine associations with depression only.

Results: Depression was reported by 50.4% of participants, anxiety by 41.3%, and stress by 31.9%. Based on percentile distribution, 28.7% reported low level of social/personal challenges, 54.8% moderate, and 16.4% high levels. The bivariate analysis showed that depression was significantly associated with field of study ($p = 0.028$), GPA ($p = 0.002$), length of stay in Thailand ($p = 0.005$), and level of social/personal challenges ($p < 0.001$). In the logistic regression model, students with high GPA (AOR = 1.695, 95% CI: 1.06–2.71, $p = 0.027$), longer stay in Thailand (AOR = 1.74, 95% CI: 1.03–2.95, $p = 0.04$), and high social/personal challenges (AOR = 2.82, 95% CI: 1.743 – 4.574, $p = <0.001$) were more likely to be depressed.

Conclusion: The finding revealed that the prevalence of depression in Myanmar university students was 50.4%, which is higher than regional averages. Depression was significantly associated with academic pressure, longer duration of stay, and social and personal challenges. These findings underscore the need for routine mental health screening, culturally tailored mental health services, and capacity-building for university staff. Strengthening peer support, academic mentoring, and cross-sector collaboration is also essential to address the academic, social, and legal challenges impacting the well-being of Myanmar migrant students.

Keywords: Depression, Myanmar students, Mental health, Student challenges, Thailand

INTRODUCTION

Mental health is a key component of overall well-being and a growing concern among university students worldwide. Some of the most common mental disorders among university students are depression, anxiety, and stress, which affect both their academic work and their well-being (1, 2). Globally, about one

in five university students develops a mental disorder annually (3), and depression is the most common disorder among international students (4). University life is a developmental period of academic pressure, financial stress, and social transition that, if not managed well, can negatively affect mental health.

International students face more challenges than

domestic students. In Southeast Asia, studies show that the median prevalence of depression is 29.4%, anxiety 42.4%, and stress 16.4% among university students (5). These rates reflect significant mental health outcomes across the region. The international students can face additional challenges such as cultural adjustment, homesickness, social isolation, language problems, and legal or resident problems. The burden can especially be immense in students from politically unstable countries like Myanmar. Myanmar's 2021 military coup instigated forced migration, limitations in movement, and uncertainty about education and life plans (6). For most youths, these conditions are behind high rates of mental health challenges in the form of depression for the longer run.

Thailand is among the preferred destinations for Myanmar students to pursue higher education due to geographical proximity, cultural affinity, and ease of access to education. There are over 3,700 Myanmar students pursuing higher education in Thai universities, according to official data (7). While they are increasing in number, limited research has been done examining their mental health or issues related to them as displaced students.

Past research on international students in Thailand has focused mainly on Chinese students (8). Myanmar students, however, may have various problems due to political instability, economic conditions, and separation from families. Visa issues, homesickness, and concern over families left behind are other issues that are not addressed. These kinds of issues may have severe implications for mental health but have not received much attention from researchers.

The main objectives of this study are to establish the prevalence of depression, anxiety, and stress among Myanmar university students in Bangkok, and how depression relates to socio-demographic factors and social/personal challenges. We need to know the mental health requirements of this underrepresented student group to inform effective, culturally appropriate support services within Thai universities.

METHODOLOGYS

The study was a cross-sectional analytical study of Myanmar university students residing in Bangkok, Thailand. The inclusion criteria consisted of Myanmar citizens aged 18 years and older, students who have studied in a Bangkok university for not less than a period of six months and can read and write the Myanmar language. Excluded from the study were students with a diagnosis of mental illness by a mental health expert, and students studying diploma, language, and short courses. The reason of excluding students with a diagnosed mental illness was to focus the study on subclinical and undiagnosed cases of depression, which are more relevant for screening and preventive interventions in university settings. Additionally, this exclusion helped reduce potential confounding from ongoing treatment or psychiatric comorbidities. During data collection, 30 responses were removed by screening questions and among them 12 students self-reported a history of clinical diagnosis, and they were excluded from analysis.

The total sample size was estimated using Cochran's formula, assuming a prevalence of depression of 50% (as a conservative estimate due to the absence of prior data) and then further adjusted for finite population correction with a 95% confidence level and 5% margin of error. As the total population in this case was 3,708 Myanmar students residing in Thailand, the computed sample size was 348. Adding a buffer for non-response of 10%, the total sample size was thus 383 participants.

Convenience sampling was used. Data was collected through an online self-report questionnaire (Google Forms) disseminated through social media and student networks such as "Myanmar students studying in Thailand Facebook group and Telegram group". The questionnaire consisted of four sections: screening, socio-demographic variables, student challenges and mental health. Student challenges, especially for students who study abroad were assessed using a scale adapted from existing literature (9). Responses were assessed using a 5-point Likert scale. The challenges were initially categorized into low

level, moderate level, and high level for descriptive analysis using percentile. Then, they were dichotomized as low and high level for analysis.

Mental health was assessed using the Depression, Anxiety, and Stress Scale (DASS-21), a 21-item scale including 7 items per subscale. Each subscale is scored using 4-point Likert scale ranging from 0 (did not apply me at all) to 3 (much or mostly applied to me) and the severity levels of normal, mild, moderate, severe, and extremely severe were categorized by adding scores of the corresponding items with the multiplication of 2 for the final total of 42 in accordance with predetermined classification criteria (10). The mental health outcomes were dichotomized for bivariate and multivariate analysis: individuals scoring above “normal” were included as having depression, anxiety, or stress.

The questionnaire validity was done by three experts using the Item-Objective Congruence (IOC) method. All items had an IOC average value of 0.984. Pilot testing amongst 38 students showed high internal consistency with Cronbach's alpha for DASS-21 (Depression = 0.900, Anxiety = 0.861, Stress = 0.895), and for social/personal challenges = 0.730.

Descriptive statistics were done in explaining participants' demographics and prevalence of

depression, anxiety, and stress. Chi-square and binary logistic regression were applied in the analysis of associations of independent variables with depression. Statistical significance was determined by p-value < 0.05.

RESULTS

Sociodemographic Characteristics of Participants

A total of 383 Myanmar university students studying in Bangkok participated in this study. Nearly half (47.3%) were under the age of 24, and slightly more than half (52.7%) were 24 years or older. The median and interquartile range of students' age was 24 and 6 years. Gender distribution was balanced, with 193 (50.4%) female and 190 (49.6%) male students. The majority (88.3%) were single. Most students (62.7%) were enrolled in undergraduate programs, while 37.3% were in graduate-level programs. Over half (55.6%) attended private universities. In terms of field of study, 30.3% were in engineering and technology, followed by 23.0% in health and medical sciences. Regarding academic performance, 67.9% had a high GPA (≥ 3.5). Approximately 43.1% of students were on scholarships. Regarding household income, 46.7% reported high household income and 33.9% middle income. Most participants (65.0%) had lived in Thailand for 1 to 3 years. (Table 1)

Table 1 Socio-demographic Characteristics of Participants (N =383)

Variable	Number (n)	Percentage (%)
Age		
Younger students (<24)	181	47.3
Older students (≥ 24)	202	52.7
Gender		
Male	190	49.6
Female	193	50.4
Marital Status		
Single	338	88.3
Partnered (Legally married + Living together)	42	11.0
Divorced/separated	3	0.8
Educational Level		
Undergraduate (Bachelor)	240	62.7
Graduate (Master, Ph.D.)	143	37.3

Variable	Number (n)	Percentage (%)
University		
Private	213	55.6
Public	170	44.4
Field of Study		
Engineering & Technology	116	30.3
Health & Medical Sciences	88	23.0
Business & Economics	78	20.4
Social Sciences & Law	55	14.4
Natural Sciences & Mathematics	15	3.9
Others	31	8.1
Academic Year		
Year 1	135	35.2
Year 2	144	37.6
Year 3	69	18.0
Year 4	35	9.1
GPA		
Low GPA (≤ 2.9)	16	4.2
Medium GPA (3.0 – 3.4)	107	27.9
High GPA (≥ 3.5)	260	67.9
Scholarship		
No	218	56.9
Yes	165	43.1
Household income		
Low income	74	19.3
Middle income	130	33.9
High income	179	46.7
Length of time in Thailand		
Less than 1 year	86	22.5
1-3 years	249	65.0
Above 3 years	48	12.5

Social/Personal Challenges

Regarding social/personal challenges, the most prominent one was stress related to missing family or friends, reported by 64.5% of participants. Visa or legal stress was noted by 55.1%. Additionally, 30% of students indicated uncertainty about where to seek mental or

physical health support. The mean score was 12.16 (± 3.42 SD), with a median of 13 (IQR=10–15). A moderate level of social/personal challenges was reported by 54.8% of participants, with 28.7% reporting low levels and 16.4% reporting high levels. (Table 2)

Table 2 Number and Percent Distribution of Social & Personal Challenges (N=383)

Social & Personal Challenges Items	Strongly Disagree n (%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly Agree n (%)	Total
Stress about visa/legal issues	43(11.2%)	67(17.5%)	62(16.2%)	136(35.5%)	75(19.6%)	383(100%)
Stress due to missing family/friends	33(8.6%)	42(11.0%)	61(15.9%)	185(48.3%)	62(16.2%)	383(100%)
Difficulty making international friends	76(19.8%)	104(27.2%)	120(31.3%)	76(19.8%)	7(1.8%)	383(100%)
Uncertain where to seek mental/physical health support	76(19.8%)	87(22.7%)	105(27.4%)	99(25.8%)	16(4.2%)	383(100%)
Low Level (≤ 10)						110(28.7%)
Moderate (11-15)						210(54.8%)
High (≥ 16)						63(16.4%)

Mental health outcomes

The severity level of depression, anxiety and stress of the students is shown in Table 3.

Table 3 Different Severity level of Depression, Anxiety, and Stress among Students (n = 383)

Severity Level	Stress n (%)	Anxiety n (%)	Depression n (%)
Normal	261(68.1%)	225(58.7%)	190(49.6%)
Mild	51(13.3%)	20(5.2%)	56(14.6%)
Moderate	38(9.9%)	95(24.8%)	91(23.6%)
Severe	25(6.5%)	12(3.1%)	22(5.7%)
Extremely Severe	8(2.1%)	31(8.1%)	24(6.3%)

The prevalence of depression, anxiety, and stress among Myanmar university students is shown in Table 4 by categorizing symptom severity based on DASS-21 scoring. Students scoring within the "normal" range were considered as "absence of depression/anxiety/stress", while those with

scores from mild to very severe were grouped under "presence of depression/anxiety/stress". Among the students, 31.9% reported presence of stress, 41.3% as having anxiety, and 50.4% were found to be presence of depression. Mean scores were 1.61 (± 1.04 SD) for stress, 1.97 (± 1.30 SD) for anxiety, and 2.04 (± 1.24 SD) for depression.

Table 4 Prevalence of Stress, Anxiety and Depression among Students (n = 383)

Mental health outcomes	Number (n)	Percentage (%)
Presence of Stress	122	31.9%
Presence of Anxiety	158	41.3%
Presence of Depression	193	50.4%

Association between socio-demographic characteristics, student challenges and depression among students

Socio-demographic and social/personal challenge variables with a significance level of $p < 0.25$ from the bivariate analysis were included in the binary logistic regression model. In addition, age, gender, and marital status were included in the model regardless of their p-values, due to their theoretical and epidemiological relevance as potential confounders. For the bivariate and multivariate analysis, marital status was grouped into “single” and “partnered” (combining married, separated/divorced). GPA was categorized as “low” and “high” (combining moderate and high). Field of study was grouped into “STEM” (combining Engineering & Technology, Health & Medical Sciences and Natural Sciences & Mathematics) and “non-STEM” disciplines (combining Business & Economics, Social Sciences & Law and Others). Length of stay in Thailand was categorized into “short stay” (≤ 1 year) and “long stay” (> 1 year). Social/personal challenges were recategorized as “low” and “high,” where “high” combined both moderate and high levels of challenge.

The bivariate analysis showed that depression was significantly associated with field of study ($p = 0.028$), GPA ($p = 0.002$), and length of stay in Thailand ($p = 0.005$). Students in STEM

fields, those with higher GPAs, and those who had stayed in Thailand longer were more likely to report depression. Other socio-demographic variables such as age, gender, marital status, academic year, educational level, university type, household income and scholarship status did not show significant associations. Social/personal challenges ($p < 0.001$) was also significantly associated with depression. (Table 5)

In the multivariable model, three factors remained statistically significant predictors of depression. Students with high GPAs were more likely to be depressed than those with low GPAs (AOR = 1.695, 95% CI: 1.06–2.71, $p = 0.027$). Longer stay in Thailand was also associated with higher odds of depression (AOR = 1.74, 95% CI: 1.03–2.95, $p = 0.04$). Students experiencing high social and personal challenges were more likely to be depressed (AOR = 2.82, 95% CI: 1.743 – 4.574, $p = < 0.001$). Field of study (STEM vs. non-STEM) showed borderline significance (AOR = 1.53, 95% CI: 1.00–2.35, $p = 0.052$), suggesting a potential association that warrants further investigation. Age, gender, and marital status were not significantly associated with depression in this model. (Table 6)

Table 5 Bivariate Analysis between Independent variables and Depression (N=383)

Independent Variables	Depression		Chi-square	p-value
	Yes n (%)	No n (%)		
Total	193(50.4%)	190(49.6%)		
Age				
Younger students	86 (44.6%)	95 (50%)	1.137	0.286
Older students	107(55.4%)	95 (50%)		
Gender				
Male	94 (48.7%)	96 (50.5%)	0.127	0.721
Female	99 (51.3%)	94 (49.5%)		
Marital status				
Single	169(87.6%)	169(88.9%)	0.177	0.674
Partnered	24 (12.4%)	21 (11.1%)		
Educational level				
Undergraduate	113(58.5%)	127(66.8%)	2.814	0.093
Graduate	80 (41.5%)	63 (33.2%)		
University type				
Private	99 (51.3%)	114 (60%)	2.939	0.086
Public	94 (48.7%)	76 (40%)		
Field of Study				
STEM	121(62.7%)	98 (51.6%)	4.831	0.028*
Non-STEM	72 (37.3%)	92 (48.4%)		
Academic year				
Lower year (Year 1 and Year 2)	136(70.5%)	143(75.3%)	1.114	0.291
Upper year (Year 3 and Year 4)	57 (29.5%)	47 (24.7%)		
GPA				
Low/Average GPA	48 (24.9%)	75 (39.5%)	9.365	0.002**
High GPA	145(75.1%)	115(60.5%)		
Scholarship				
No	109(56.5%)	109 (59%)	0.031	0.860
Yes	84 (43.5%)	81 (41%)		
Household income				
Low-middle Income	99 (51.3%)	105(55.3%)	0.606	0.436
High Income	94 (48.7%)	85 (44.7%)		
Length of time in Thailand				
Short stay (< 1 year)	20 (16.4%)	66 (25.3%)	7.709	0.005**
Long stay (>=1 year)	102(83.6%)	195(74.7%)		
Social & Personal Challenges				
Low Level	35(18.1%)	75(39.5%)	21.296	<0.001**
High Level	158(81.9%)	115(60.5%)		

*p-value<0.05=Statistically Significant, **p-value<0.01=Highly Statistically Significant

Table 6 Independent Variables Retaining Significance in Multiple Logistic Regression for Depression (N = 383)

Variables	B	S.E.	p-value	AOR	95% CI
Age					
Younger students (<24) (Ref:)					
Older students (≥24)	0.264	0.228	0.247	1.302	0.833 – 2.037
Gender					
Male (Ref:)					
Female	0.111	0.224	0.620	1.118	0.720 – 1.735
Marital status					
Single (Ref:)					
Partnered	0.039	0.350	0.911	1.040	0.524 – 2.063
Field Study					
Non-STEM (Ref:)					
STEM	0.426	0.219	0.052	1.532	0.997 – 2.354
GPA					
Low GPA (Ref:)					
High GPA	0.527	0.239	0.027*	1.695	1.061 – 2.706
Length of Time in Thailand					
Short Stay (Ref:)					
Long Stay	0.554	0.269	0.04*	1.740	1.026 – 2.949
Social & Personal Challenge					
Low Challenge (Ref:)					
High Challenge	1.038	0.246	<0.001**	2.82	1.743 – 4.574

* p -value < 0.05 = Significant, AOR = adjusted odds ratio

DISCUSSION

The result revealed that the prevalence of depression, anxiety, and stress among Myanmar university students was 50.4%, 41.3%, and 31.9%, respectively. Compared to median point prevalence rates among Southeast Asian university students, 29.4% for depression, 42.4% for anxiety, and 16.4% for stress (5), the rates of depression and stress in this sample were notably higher.

One possible reason for the elevated rates of mental health problems among Myanmar students may relate to the ongoing political instability, economic hardship, and displacement in Myanmar, which can increase psychological vulnerability even before arriving in Thailand. Additionally, the academic year's exam period during data collection may have contributed to higher stress levels. Furthermore, students may be facing prolonged family separation, limited social support, and a lack of accessible mental health services in their native language, all of

which are known risk factors for depression and anxiety among international students (11).

Although the prevalence of anxiety (41.3%) in this study closely mirrors the Southeast Asian average, the consistently high levels of all three mental health outcomes highlight the ongoing emotional burden borne by Myanmar students in Thailand. All these prevalence findings suggest the importance of psychosocial support systems tailored to the needs of this unique population.

Remarkably, a majority (54.8%) reported moderate levels of difficulty in social/personal challenge, while 16.4% experienced high levels. Specific concerns included homesickness (64.5%) and worries about legal or visa status (55.1%). Furthermore, nearly one-third (30%) of students indicated that they were unaware of where or how to access physical or mental health services in Bangkok. These challenges point to both psychological stress and critical gaps in university level support systems, especially in

terms of culturally appropriate and accessible health services. The lack of culturally and linguistically accessible health services may exacerbate students' emotional distress. Literature on migrant mental health consistently notes that legal insecurity, isolation, and lack of access to health care are common factors, particularly among young mobile populations (12).

This study found that several individual and academic-related factors were significantly associated with depression among Myanmar university students in Bangkok. One of the most notable findings was the association between field of study and depression. Students from STEM fields had significantly higher odds of experiencing depressive symptoms compared to those in non-STEM fields. This is consistent with global literature that emphasizes the academic intensity, workload, and performance pressure often associated with STEM programs (13). The culture of perfectionism and competitiveness within STEM environments, combined with the challenges of studying in a foreign country, may leave students with limited emotional bandwidth to cope with daily life challenges.

Academic performance, measured by GPA, also showed a surprising trend. Students with higher GPAs (≥ 3.5) were more likely to report depression than those with lower academic performance. While academic pressure was not directly measured, this finding may reflect underlying performance-related stress or perfectionism, commonly observed in high-achieving students. Although this may seem counterintuitive, previous studies suggest that high-achieving students may experience elevated self-imposed expectations and fear of failure, which are known predictors of internalized stress and emotional exhaustion (14). In the case of Myanmar students, many of whom may be studying on scholarships or with strong family expectations, the burden to perform well may be compounded by financial or cultural obligations.

The length of stay in Thailand was another important variable. Students who had been in Thailand for more than one year were significantly more likely to report depressive symptoms compared to those with shorter durations. While longer duration might imply

better cultural adjustment, prolonged separation from family, persistent financial worries, and repeated exposure to structural stressors, such as immigration processes and visa issues, may contribute to cumulative emotional fatigue. This pattern echoes findings from the study of Chinese students in Thailand that students who stay longer in Thailand reported worsening of mental health problems (8) (15). This also aligns with the concept from the study that highlighted "accumulated acculturative stress" among long-term international students can worsen mental health problems (16).

Personal/social challenges was strongly associated with depression. Students facing social or personal challenges such as homesickness or legal insecurity were more likely to develop depression. These findings are aligned with the adapted literature review study done among international students in a Canadian university, where social and personal challenges are consistently cited as major obstacles for international students (9). These also align with the study that emphasizes to promote social support connection and institutional health education support which could enhance physical and mental well-being among international student populations in Australia (17).

Since the study used convenience sampling through online platforms, this may have introduced selection bias, favoring students with academic engagement, or interest in mental health, while underrepresenting those facing severe distress. Also, the findings are specific to Myanmar university students in Bangkok, and it may not be generalizable to students in other regions of Thailand with different living conditions. Data were self-reported and may be affected by recall bias or social desirability, particularly for sensitive topics like mental health. Despite the anonymous format, stigma may have led to underreporting, while situational stress, such as during exam periods, may have inflated symptom reporting. Although students diagnosed with mental disorders were excluded during screening, other unmeasured factors such as recent trauma like earthquake or the political crisis in Myanmar may have influenced participants' mental well-being, potentially confounding the results. Unmeasured confounders that were not captured in the study

such as personality traits, social support networks, or pre-existing coping mechanisms could also influence the relationship between predictors and depression, biasing the results. Furthermore, reverse causality cannot be ruled out in this cross-sectional study. For example, while high GPA is associated with depression, it is unclear whether high GPA leads to depression or if students with depressive symptoms affect their academic performance such as GPA. It is also unclear that whether high social/personal challenge leads to depression or depressed students experience high social and personal challenge. These limitations suggest that findings should be interpreted with caution. Future research should include more diverse samples, integrate qualitative approaches, and explore longitudinal trends to better understand the mental health trends of Myanmar students in Thailand.

CONCLUSION

The study findings revealed a high prevalence of depression, anxiety, and stress among Myanmar university students studying in Bangkok. Depression was the most common mental health concern, followed by anxiety and stress. Factors such as field of study, academic performance, duration of stay, social and personal challenges were found to be significantly associated with depression.

In conclusion, the mental well-being of Myanmar international students warrants immediate attention. These findings highlight the urgent need for culturally sensitive mental health services, routine mental health screening, and orientation programs that address legal, academic, and emotional challenges. Universities should also strengthen peer support systems and ensure accessible, language-appropriate resources to support the well-being of Myanmar students in Thailand.

ETHICAL DECLARATION

Ethical declaration was granted by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (COA No. 165/68).

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PSYCHOSOCIAL DETERMINANTS OF CAREGIVER ENGAGEMENT IN EARLY LEARNING AMONG MYANMAR MIGRANT FAMILIES IN TAK PROVINCE, THAILAND

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ABSTRACT

Introduction: Caregiver engagement in early learning is critical for children's academic success and well-being, especially in migrant settings where educational access is often constrained. Among Myanmar migrant families in Tak Province, Thailand, the psychosocial factors shaping such engagement remain underexplored.

Objectives: The study examines (1) the association between caregiver psychological distress and their engagement in early learning activities and (2) whether family functioning influences this relationship among Myanmar migrant families in Tak Province.

Methodology: Using baseline data from the 2023 Parenting on the Thailand-Myanmar Border (PoB) research project, a retrospective, cross-sectional quantitative analysis was carried out involving 889 caregivers of children aged 4 to 8 years. Descriptive analysis was performed, followed by multivariable negative binomial regression, adjusting for covariates. Results are presented as unadjusted and adjusted incidence rate ratios with 95% confidence intervals.

Results: Higher levels of psychological distress were related to greater caregiver engagement after accounting for covariates and moderation (aIRR = 1.049; 95% CI: 1.022–1.077). Better family functioning, greater social support, and higher caregiver education were significantly associated with increased engagement. In contrast, more children in the household and caring for children aged 6 to 8 years were associated with lower engagement. A significant interaction (aIRR = 0.997; 95% CI: 0.995–0.999) indicates that higher family functioning attenuates the positive association between distress and engagement, suggesting a buffering effect.

Conclusion: Findings challenge the assumption that psychological distress necessarily reduces caregiver engagement. Supportive family dynamics appear to mitigate the influence of psychological distress on early learning engagement. Policymakers and program implementers from non-governmental organizations are encouraged to adopt family-centered interventions that promote caregiver mental well-being and strengthen family cohesion. Furthermore, future research should explore the quality of engagement and examine causal relationships using longitudinal designs.

Keywords: Caregiver Engagement, Early Learning, Myanmar Migrant Children, Psychosocial Determinants, Thailand

INTRODUCTION

Early learning is the foundation for achieving long-term cognitive, emotional, and social development. The early years, especially from infancy through age eight, are vital for establishing the groundwork for a child's overall development. Studies have consistently

demonstrated that early learning engagement, particularly in low-resource contexts, has a significant impact on children's outcomes throughout their educational careers and social inclusion (1).

In Thailand, despite progressive policies that enable access to education for all children

regardless of nationality, Myanmar migrant children continue to face significant barriers. Challenges such as language differences, lack of legal documentation, and economic hardship impede migrant children's access to early learning (2). As of 2019, an estimated 300,000–400,000 migrant children lived in Thailand, with over half lacking access to any education (3). Chronic underfunding of migrant learning centers has further limited their ability to provide quality education, especially to displaced children from Myanmar (4). Consequently, caregiver engagement at home becomes a crucial determinant in shaping children's overall development.

At the same time, the capacity of caregivers to actively engage in early learning is closely linked to their psychosocial well-being. Healthy family functioning and greater social support can enhance caregivers' resilience, enabling them to better manage stress (5). Nevertheless, the prior study highlights that many Myanmar migrant caregivers often face significant psychological distress caused by persistent adversities such as poverty, exploitation, harassment, and limited access to essential services. These stressors compromise family well-being, increase caregiver distress, and weaken caregiver-child relationships (6). According to the 2015–2016 Myanmar Demographic and Health Survey (Myanmar DHS), caregiver engagement in early learning is significantly lower among those living in rural areas, from low-income households, and caregivers who have little or no education (7).

While prior studies have broadly examined factors influencing early learning engagement, little is known about the psychosocial determinants of caregiver engagement among Myanmar migrant families in Tak Province, Thailand. Given the challenges faced by Myanmar migrant families in Thailand and the crucial role of caregivers in fostering early childhood development, this study aims to examine psychosocial factors linked to caregiver engagement to support early learning. This supports the global goal of equitable access to quality early childhood education, as outlined in Sustainable Development Goal (SDG) 4.2 and SDG 10.2, which emphasizes the social and economic inclusion of migrant communities

through equitable education opportunities. To this end, the study examines how psychological distress and family functioning interact to shape early learning practices at home. Grounded in existing literature and informed by the unique vulnerabilities of the migrant population, the study tests the following hypotheses:

H1: Higher levels of caregiver psychological distress are independently associated with lower engagement in early learning activities.

H2: Family functioning influences the relationship between caregiver distress and engagement in early learning activities.

METHODOLOGY

Data Source and Study Design

This study employs a retrospective cross-sectional design using secondary data from the Parenting on the Thailand-Myanmar Border (PoB) project, which is part of the Global Parenting Initiative (GPI). GPI delivers evidence-based, accessible, and engaging parenting support at no cost worldwide. Data were originally collected as part of a cluster-randomized controlled trial conducted across 44 migrant communities in three districts in Tak Province, Mae Ramat, Mae Sot, and Phop Phra, at three time points: pre-intervention (T0), four weeks after intervention (T1), and at a four-month evaluation (T2) (8).

The present study utilizes baseline data (T0) collected between February and June 2023. As the analysis focuses on examining associations between psychosocial factors and caregiver engagement in early learning at a single point in time, a cross-sectional design is appropriate. The survey was administered in Burmese because of resource limitations. Therefore, the eligibility criteria included proficiency in the Burmese language to maintain the consistency and accuracy of the collected data (8).

Study Sample

After applying the inclusion and exclusion criteria, a total of 889 caregivers with complete data were included in the final analysis from the baseline dataset of 2,249 participants. The subsample was selected based on the following inclusion criteria: respondents had to

be the primary caregiver of a child aged 4 to 8 years, a critical developmental stage as identified by UNICEF (9). Primary caregivers included biological parents, grandparents, other relatives, or non-relatives who identified themselves as primarily responsible for the child's care. Caregivers were excluded if the child was outside the specified age range or if data were missing for any variables included in the analysis.

Measurements

The conceptual framework and selection of variables for this study were guided by established theories, particularly Belsky's process model of parenting (10) and Cohen and Wills's stress-buffering hypothesis (11). Belsky's 1984 model identifies three interrelated domains that shape parenting behavior: caregiver characteristics, child attributes, and the broader social context. Within this framework, parental psychological well-being is emphasized as a key determinant of parenting. Cohen and Wills's model outlines two mechanisms through which social support contributes to well-being. The main effect model suggests that social support promotes mental health regardless of stress levels, offering a general benefit. The buffering model proposes that social support is particularly protective during periods of high stress, mitigating the negative impacts of stress on well-being. Additionally, Cohen and Wills emphasized that social support originates from immediate family members, conceptualized in this study as 'family functioning,' as well as from extended relatives, friends, and the broader community. This broader support is measured in this study as 'perceived social support.' This study focuses on family functioning as a moderator, as support from within the family is theorized to exert the most immediate and direct influence on caregiver engagement (11). Meanwhile, perceived social support is included as a covariate to account for its broader contribution to caregiver well-being and engagement. Guided by these theoretical foundations, the study examines the relationship between caregivers' psychological distress and engagement and investigates whether family functioning moderates this relationship while controlling for relevant covariates.

Outcome Variable

The outcome variable is caregivers' engagement in early learning activities, which is one of the essential elements of nurturing care and crucial for children's cognitive, social, and emotional growth (1). It was assessed using six items adapted from the Myanmar DHS (7). These items include six specific caregiving activities (0–6) performed in the past seven days. These are reading books, telling stories, singing, playing, drawing/counting, and taking the child outside. A composite score ranging from 0 to 42 was created and analyzed as count data, with higher scores suggesting more frequent engagement in early learning activities.

Key Predictor

The key predictor of interest is psychological distress, which refers to a maladaptive response to difficult life circumstances, often presenting as a stress reaction. It becomes a concern when it significantly disrupts a person's capacity to function or cope effectively (12).

The 10-item Hopkins Symptom Checklist (HSCL-10) was used to assess this measure. The scale assesses symptoms of anxiety and depression, such as hopelessness, sadness, sleeplessness, and fear (13), demonstrating good internal consistency (Cronbach's $\alpha = 0.85$). Each item was assessed using a five-point Likert scale from 0 (not at all) to 4 (extremely), resulting in a total score ranging from 0 to 40. The overall score was analyzed as a continuous measure, where elevated scores reflected increased levels of psychological distress, reflecting potential mental health concerns that may require further assessment or support. These items capture core indicators of mental health and the individual's ability to manage stress.

Moderating Variable

The moderating variable in this study is family functioning, reflecting a family's ability to manage challenges, express emotions, and demonstrate affection. Strong family functioning has been associated with increased caregiver engagement and mitigates the positive association between distress and engagement. In this study, it was assessed using a subset of six items from the 20-item Burmese Family

Functioning Scale developed by Puffer et al. (2017) (6). The GPI selected these six items for their theoretical and contextual relevance to the migrant caregivers along the Thailand–Myanmar border. Although not utilizing the full scale, the selected items effectively captured key aspects of family dynamics and demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.63$). Responses were rated on a four-point Likert scale (0 = “none of the time” to 3 = “almost all the time”), with total scores ranging from 0 to 18. Higher scores, treated as a continuous variable, indicated stronger family functioning, encompassing both positive and negative dimensions of family interactions.

Controlled Variables

Controlled variables included caregiver and child characteristics, as well as contextual factors, selected based on theoretical relevance and their associations with psychological distress and caregiver engagement. Caregiver age was treated as a continuous variable. Caregivers' educational attainment, based on Myanmar's education system, was categorized into four levels: no formal education, primary, middle school, and secondary school or higher. Marital status was grouped into married and other (including widowed, divorced, or single). Children below 18 years old in the household were grouped into three categories: one, two, or three to seven. Caregiver type was classified as mother, father, or non-parental caregivers. Employment status was divided into full-time, part-time, and not working. The child's age was categorized into 4–5 years and 6–8 years. The child's disability and schooling status were coded as binary variables, yes or no.

Contextual control variables included family functioning and perceived social support, both measured on continuous scales. Social support can influence parenting outcomes, whether perceived or received. Social support, encompassing emotional, informational, and instrumental forms, has been widely linked to more effective parenting (10). This research assessed perceived social support through the Medical Outcome Study Social Support Survey (MOS-SSS), a tool designed to evaluate various types of support such as practical assistance, emotional and informational help, expressions of

affection, and opportunities for positive social engagement (14). The GPI selected the specific five items for their relevance to the migrant context. The scale showed acceptable internal consistency (Cronbach's $\alpha = 0.76$). Responses were rated on a four-point Likert scale (0 = “none of the time” to 3 = “almost all the time”), yielding total scores from 0 to 15. Higher scores, treated as a continuous variable, indicated greater perceived support across multiple dimensions.

Data Analysis

Data analysis was conducted using R version 4.4.2 (2024). Cases with missing data (maximum 1.3%) were excluded via listwise deletion, as missingness was completely at random, resulting in a final complete-case sample of 889 caregivers.

Univariate, bivariate, and multivariable analyses were conducted to address the study objectives. Negative binomial regression was selected due to the count nature of the outcome variable and the presence of overdispersion (i.e., the variance exceeded the mean). Zero inflation was also assessed and determined to be minimal, with only 1.7%. No violation of the independence assumption was detected, as data were collected from individual respondents, and each observation was treated as independent.

Univariate analysis summarized study variables using frequencies and means. Bivariate negative binomial regression examined associations between caregiver engagement and each independent variable. Subsequently, multivariable analysis assessed the relationship between psychological distress and caregiver engagement, adjusting for covariates.

The final multivariable model tested whether family functioning moderated the association between psychological distress and engagement. Results are reported as incidence rate ratios (IRRs), accompanied by 95% confidence intervals (CIs) to indicate statistical significance. All exposure variables were entered simultaneously into the model. Multicollinearity was evaluated using Variance Inflation Factors (VIFs), all below 5, indicating no significant multicollinearity. The likelihood ratio test was used to compare models with and without the moderation term.

Ethical Consideration

A Certificate of Exemption (COE) for this study was granted by the Institutional Review Board of IPSR, Mahidol University. The first author also obtained permission from the PoB research project to access and use the dataset.

RESULTS***Sociodemographic Characteristics of Caregivers and Children***

Table 1 describes the key demographic and psychosocial characteristics of caregivers and children in the study population. Among caregivers, 48% were aged 18–33 years, 38.4% were aged 34–48 years, and 13.6% were 49 years or older. In terms of education, over half had completed primary school (51.7%), 21.5% had never attended school, and only 9% had completed secondary education or higher. Most caregivers were married (88.0%), while 12% had other marital statuses (widowed, divorced, or single). Regarding household composition, 39.8% of caregivers had one child under the age of 18, 35.2% had two, and 25% had between three

and seven children. Most caregivers were mothers (75.5%), followed by non-parental caregivers such as grandparents, other relatives, or non-relatives (19.7%), and fathers (4.8%). In terms of employment status, 24.3% of caregivers worked full-time, 53.4% part-time, and 22.3% were not employed.

Regarding continuous variables, the mean score for early learning engagement was 17.9 (standard deviation [SD] = 10.1). The average psychological distress score was 20.2 (SD = 5.6), while mean scores for family functioning and perceived social support were 12.2 (SD = 3.1) and 6.3 (SD = 3.5), respectively.

Children in the study were predominantly aged 6–8 years (59.5%), with 40.5% aged 4–5 years. Just over half were boys (51.1%), while 48.8% were girls, and 0.1% identified as another gender. Seventeen-point two percent of children were reported to have a disability. Regarding school attendance, 59.7% were enrolled in school at the time of the study, whereas 40.3% were not.

Table 1 Descriptive Statistics of Caregiver and Children Characteristics (N = 889¹)

Characteristic	Mean (SD) or Number (%)
Early Learning Engagement	17.9 (10.1)
Psychological Distress	20.2 (5.6)
Family Functioning	12.2 (3.1)
Perceived Social Support	6.3 (3.5)
Caregiver Age Groups	
18–33	427 (48.0)
34–48	341 (38.4)
49+	121 (13.6)
Education Level	
Never went to school	191 (21.5)
Primary school	460 (51.7)
Middle school	158 (17.8)
Secondary school or higher	80 (9.0)
Marital Status	
Married	782 (88.0)
Others (widowed, divorced or single)	107 (12.0)
Children Under 18 in Household	

Characteristic	Mean (SD) or Number (%)
1	354 (39.8)
2	313 (35.2)
3–7	222 (25.0)
Caregiver Types	
Mother	671 (75.5)
Father	43 (4.8)
Non-parental caregivers	175 (19.7)
Employment Status	
Full time	216 (24.3)
Part time	475 (53.4)
Do not work	198 (22.3)
Child Age Group	
4–5	360 (40.5)
6–8	529 (59.5)
Characteristic	Mean (SD) or Number (%)
Child Gender	
Boy	454 (51.1)
Girl	434 (48.8)
Other	1 (0.1)
Child Disability	
No	736 (82.8)
Yes	153 (17.2)
Child Attending School	
No	358 (40.3)
Yes	531 (59.7)

¹Statistics presented: Mean (SD) for continuous variables; Number (%) for categorical variables, SD=Standard Deviation

Table 2 illustrates the results of negative binomial regression analyses examining factors associated with early learning engagement, comparing unadjusted and two adjusted models (Adjusted Model I and II). In the initial bivariate analysis, psychological distress demonstrated a non-significant association with caregiver engagement. However, in the adjusted and moderation models, the association between psychological distress and caregiver engagement strengthened and reached statistical significance, particularly when accounting for the moderating effect of family functioning.

In the unadjusted model, several factors were significantly associated with higher early learning engagement. These include better family functioning (IRR=1.052, 95% CI: 1.039–1.065), greater perceived social support (IRR=1.044, 95% CI: 1.032–1.056), and higher caregiver education, with the strongest effect observed among those with secondary education or higher (IRR=1.457, 95% CI: 1.243–1.713). Conversely, caregivers with three to seven children under 18 years and those caring for older children (aged 6–8 years) reported significantly lower engagement

levels (IRR = 0.873, 95% CI: 0.786–0.970; and IRR = 0.866, 95% CI: 0.797–0.941, respectively).

In Adjusted Model I, which accounts for sociodemographic and contextual variables, psychological distress emerged as a significant positive correlate of early learning engagement (IRR=1.010, 95% CI: 1.003–1.018). However, this association should be interpreted with caution due to its minimal effect size. While the measure captures the frequency of engagement, it does not reflect the quality of interactions, which may vary considerably based on caregiver well-being. Positive associations with family functioning, perceived social support, and caregiver education remained strong. Meanwhile, the negative associations with having three or

more children in the household and with older children (aged 6–8 years) persisted (Table 2).

In Adjusted Model II, which included the interaction between psychological distress and family functioning, positive associations remained significant with similar or slightly larger effect sizes than Model I. Negative associations for older children (6–8 years) and caregivers with three or more children also persisted. The significant interaction (IRR = 0.997, 95% CI: 0.995–0.999) shows that stronger family functioning weakens the positive link between psychological distress and early learning engagement, highlighting both independent and interactive psychosocial influences on caregiver engagement (Table 2).

Table 2 Negative Binomial Regression for Factors Associated with Early Learning Engagement Among Caregivers: Unadjusted and Adjusted Models (N = 889)

Exposure Variable	IRR (95% CI)	aIRR (95% CI)	aIRR (95% CI)
	Unadjusted model	Adjusted Model I	Adjusted Model II (Moderation Model)
Psychological Distress	1.002 (0.995, 1.009)	1.010**(1.003, 1.018)	1.049**(1.022, 1.077)
Family Functioning	1.052***(1.039, 1.065)	1.043***(1.030, 1.058)	1.114*** (1.065, 1.166)
Perceived Social Support	1.044***(1.032, 1.056)	1.026***(1.014, 1.038)	1.025***(1.013, 1.037)
Psychological Distress: Family Functioning			0.997**(0.995, 0.999)
Age of Caregiver	0.996 (0.993, 1.000)	1.001(0.997, 1.005)	1.001 (0.997, 1.005)
Education Level			
Never went to school		1.0	1.0
Primary school	1.311***(1.179, 1.455)	1.243***(1.125, 1.373)	1.238***(1.120, 1.366)
Middle school	1.184*(1.039, 1.350)	1.116 (0.988, 1.270)	1.110 (0.980, 1.258)
Secondary school or higher	1.457***(1.243, 1.713)	1.405***(1.204, 1.641)	1.389***(1.192, 1.622)
Marital Status			
Married	1.0	1.0	1.0
Others	0.907 (0.800, 1.032)	0.937 (0.825, 1.066)	0.939 (0.827, 1.067)
Children Under 18 in Household			
1	1.0	1.0	1.0
2	0.933 (0.849, 1.026)	0.961 (0.879, 1.050)	0.969 (0.886, 1.059)
3–7	0.873**(0.786, 0.970)	0.898*(0.814, 0.992)	0.904*(0.819, 0.998)
Caregiver's Type			
Father	1.0	1.0	1.0
Mother	1.211* (0.993, 1.465)	1.126 (0.930, 1.355)	1.114 (0.921, 1.339)
Non-parental caregivers	1.056 (0.853, 1.300)	0.991 (0.804, 1.216)	0.976 (0.792, 1.197)

Exposure Variable	IRR (95% CI)	aIRR (95% CI)	aIRR (95% CI)
	Unadjusted model	Adjusted Model I	Adjusted Model II (Moderation Model)
Employment Status			
Full time	1.0	1.0	1.0
Part time	0.958 (0.866, 1.059)	0.988 (0.899, 1.085)	1.003 (0.913, 1.101)
Do not work	1.034 (0.917, 1.167)	1.071 (0.956, 1.200)	1.088 (0.971, 1.219)
Child Age			
4–5	1.0	1.0	1.0
6–8	0.866***(0.797, 0.941)	0.878**(0.804, 0.960)	0.873** (0.800, 0.953)
Child with Disability			
No	1.0	1.0	1.0
Yes	1.028 (0.922, 1.147)	0.990 (0.894, 1.096)	0.993 (0.898, 1.099)
Child Attending School			
No	1.0	1.0	1.0
Yes	0.908* (0.835, 0.987)	0.934 (0.853, 1.021)	0.936 (0.855, 1.024)
Model fitness			
Log-likelihood		-3235.4	-3231.0
LRT (Adjusted Model I vs II)		-	$\chi^2 = 9.194, df = 1,$ $p = 0.002$
Pseudo-R2		0.02	0.02
AIC		6508.75	6501.99
BIC		6599.76	6597.79
N	889	889	889

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$; IRR=Incidence Rate Ratio, aIRR=Adjusted Incidence Rate Ratio, CI=Confidence Interval, LRT=Likelihood Ratio Test, AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion, N=Number of observations; Note: IRRs and CIs are reported to three decimal places to avoid misrepresenting statistically significant values that would otherwise round to 1.00 with two-decimal formatting

DISCUSSION

This study investigated the association between caregivers' psychological distress and their engagement in children's early learning among Myanmar migrant families in Tak Province, Thailand, utilizing data from the 2023 PoB baseline survey. Findings revealed that higher psychological distress was found to be modestly but significantly associated with increased engagement after adjusting for relevant covariates. Furthermore, in the moderation model, this association was stronger, with family functioning emerging as a significant moderator, suggesting that stronger family functioning buffers the impact of psychological distress on caregiver engagement.

Contrary to common assumptions,

higher levels of psychological distress were associated with greater caregiver engagement among Myanmar migrant caregivers, rejecting the first hypothesis. This underscores the unique sociocultural and adaptive dynamics of the Myanmar migrant caregivers along the Thailand-Myanmar border, who face distinct stressors and challenges.

Some literature suggests that psychological distress does not necessarily lead to poor parenting behaviors. For example, previous studies have shown that certain caregivers, particularly mothers, can maintain consistent parenting behaviors despite psychological distress, possibly reflecting resilience or a strong sense of parental commitment (15). Another possible explanation

is that caregiver distress may trigger compensatory behaviors, such as heightened engagement. This could be driven by feelings of guilt, anxiety, or a desire to fulfill cultural expectations regarding parental roles, especially in the context of migration or family challenges (16). Apart from cultural norms or expectations, individual personality traits, such as a high sense of responsibility or conscientiousness, may also contribute to the observed pattern. Previous research has shown that caregivers with a high sense of responsibility often experience higher stress levels but are also more engaged with children (17). Finally, the finding may also reflect unmeasured contextual or protective factors. For example, distressed caregivers may spend more time at home due to barriers such as language limitations and social exclusion, thus increasing their engagement in caregiving activities (18). Nevertheless, it is important to acknowledge that this study only assessed the frequency but not the quality of engagement, which remains an area for further exploration to draw a conclusion.

Family functioning played a significant role in shaping the relationship between caregiver psychological distress and engagement. Specifically, it attenuated the positive association between psychological distress and engagement, suggesting that supportive family dynamics can mitigate the adverse effects of psychological distress on caregiver engagement in early learning. This finding supports the stress-buffering hypothesis (Cohen & Wills, 1985), which posits that emotionally supportive and well-organized family systems can protect individuals from the adverse effects of stress (11) and supports the second hypothesis that family functioning influences the relationship between psychological distress and engagement. This interaction effect underscores the importance of strengthening family relationships as a strategic target for parenting interventions. Programs aiming to enhance early learning outcomes in migrant settings should consider incorporating components that promote family cohesion and emotional support within households.

Furthermore, the study discovered that stronger family functioning and greater perceived social support were consistently

associated with higher engagement. These positive associations align with established research, highlighting the crucial role of supportive environments in promoting caregiver engagement (11). Additionally, higher caregiver education was linked to increased engagement, consistent with existing literature (19). In contrast, engagement was lower in households with three or more children and among older children (ages 6–8), which aligns with prior studies (20, 21). These findings reinforce the existing evidence by confirming these associations within the Myanmar migrant context.

A strength of this study is the use of well-established, culturally adapted measures, such as those from the Myanmar DHS, and an acceptable to high internal consistency across the scales. However, the study has certain limitations. Its cross-sectional design prevents drawing causal conclusions. Additionally, reliance on self-reported data may introduce recall bias and social desirability effects, particularly for measures of psychological distress, social support, and family functioning over the past 30 days. The study may also underestimate caregiving by others, as only the primary caregiver was surveyed. Despite adjusting for covariates, unmeasured factors, such as personality traits, cultural norms, language barriers, and policies, may still influence engagement. Finally, conducting the survey only in Burmese may have excluded non-Burmese-speaking ethnic minority participants.

Overall, the study's findings underscore critical policy implications and practical actions for non-governmental organizations (NGOs) and government institutions dedicated to supporting the well-being of Myanmar migrant caregivers. Interventions that support caregiver mental well-being while strengthening family cohesion and social support can enhance caregiver well-being, thereby promoting more consistent and meaningful engagement in children's early learning among migrant families in Tak Province.

Notably, engagement was lower in households with more children and among older children (ages 6–8), suggesting that caregiver capacity may be constrained by family size and the changing developmental demands of older

children. Programs targeting caregivers, particularly those with lower education, more children, or older children, are critical for improving early learning outcomes among Myanmar migrant children in Tak Province, Thailand.

CONCLUSION

In summary, this study identified a positive association between caregivers' psychological distress and their engagement in children's early learning, potentially reflecting adaptive or compensatory behaviors among Myanmar migrant caregivers. Stronger family functioning and greater perceived social support were consistently linked to higher engagement, with family functioning mitigating the negative impact of distress. Lower engagement among less-educated caregivers, those caring for larger families, and older children (ages 6–8) highlights the need to consider family structure and child development stage in intervention.

These findings shed light on the importance of family-centered interventions that promote caregiver mental well-being, strengthen family cohesion, and improve access to social support services. Future research should explore the quality of caregiver engagement and investigate the causal mechanisms underlying these associations to better inform policies and programs that support early learning in Myanmar migrant communities.

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ANXIETY IN THE AFTERMATH: ASSESSING THE POPULATION'S MENTAL HEALTH FOLLOWING 2021 POLITICAL CRISIS IN MYANMAR

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ABSTRACT

Introduction: Since the 2021 political crisis in Myanmar, compounded by recurrent natural disasters, psychological distress among the population has increased. Generalized Anxiety Disorder (GAD) is a growing concern, already account for over 130,000 DALYs in 2019, yet its associated factors remain understudied.

Objectives: This study aimed to assess the prevalence of probable GAD and examine its associations with socio-demographic characteristics, and risk factors namely prior diagnosed mental disorders, and exposure to military coup and exposure to natural disasters among Myanmar adults following 2021 coup.

Methodology: A cross-sectional online survey of 384 Myanmar adults was conducted using a structured questionnaire. Anxiety was assessed with the Generalized Anxiety Disorder-7 (GAD-7) scale. Descriptive statistics estimated prevalence, Chi-square tests assessed bivariate associations, and multivariable logistic regression analyzed predictors. A p-value < 0.05 was considered statistically significant.

Results: Among the 384 participants, 92 (24%) screened positive for probable GAD. Of these, 26 (19.5%) were males and 66 (26.3%) were females, indicating a higher proportion of probable anxiety among females. Significant associations were found between anxiety and age group, marital status, region of residence, occupation, income level, exposure to military coup, exposure to natural disasters ($p < 0.05$). Multivariable logistic regression identified three significant predictors. Those who were divorced, separated, or widowed, living together as partners had higher odds of anxiety than singles (AOR=6.84, 95% CI: 1.18–39.61). Formal and informal sector workers had lower odds of anxiety than students, dependents, retired group. Exposure to natural disasters increased anxiety risk (AOR=2.64, 95% CI: 1.50–4.64). Other factors were not significant in the adjusted model.

Conclusion: Nearly one in four Myanmar adults reported probable GAD in the aftermath of the 2021 crisis. Marital Status, occupation and natural disasters exposure were key significant predictors. Exposure to the military coup was not significantly associated with probable GAD, possibly due to the widespread nature of exposure, symptoms decline over time due to increasing resilience levels. Targeted psychosocial support is urgently needed for vulnerable populations in disaster-hit areas of Myanmar, with mental health support integrated into the disaster preparedness plan for long-term impact.

Keywords: Generalized Anxiety Disorder, Myanmar, Natural Disasters, Military Coup

INTRODUCTION

On 1st February 2021, Myanmar's Military Coup overthrew the elected government, detaining officials and declaring a nationwide state of emergency. In the four years since, the UN has reported unprecedented violence and human rights abuses, including air strikes, mass arrests, and village burnings (1). As of 30th June 2025, at least 6,840 civilians have been killed and over 29,000 detained for political reasons (2). The

political crisis has severely disrupted social networks and health services.

Previous studies indicate a significant mental health toll. An online survey six months after the coup found that 58% of respondents screened positive for probable anxiety (3). A 2023 telephone survey reported that 34.9% of adults had at least one probable mental disorder

including PTSD, depression, or anxiety, linked to displacement, violence, and job loss (4).

Myanmar's vulnerability to natural disasters has further intensified this crisis. Located on the Bay of Bengal cyclone corridor and active seismic zones, it faces recurrent cyclones, floods, and earthquakes. Since 2023 Myanmar has experienced three major hazards: Cyclone Mocha (May 2023) left 1.6 million people needing aid, monsoon floods (September 2024) affected about 1 million people across 70 townships and the Sagaing earthquake (March 2025) impacted more than 506,000 people, displacing thousands. Exposure on this scale is strongly associated with elevated anxiety disorders, including GAD as a 2023 systematic review of 48 000 disaster survivors found post-disaster anxiety rates ranging from 2 % to 84 % (5). Exposure to disasters thus adds another layer of psychosocial stress in Myanmar's already fragile political context.

GAD is a common mental health condition characterized by excessive, uncontrollable worry and physical symptoms such as restlessness, fatigue, and difficulty concentrating. As stated in the study of Lim et al., who assessed medics in conflict-affected areas of eastern Myanmar using the GHQ-12 (6), and Saw et al., who applied the PHQ-4 in a nationwide survey post-coup (3), most mental health research in Myanmar has focused on general distress scales, showing a gap in GAD assessments using GAD-7 tool.

Moreover, previous research has often grouped anxiety with other mental disorders, making it difficult to isolate the burden of GAD. Additionally, no study has simultaneously examined socio-demographic factors and risk factors in relation to probable GAD. Addressing these gaps is vital for designing targeted mental health and psychosocial support (MHPSS) programs in Myanmar.

Therefore, this study aims to estimate the prevalence of probable GAD among Myanmar adults following the 2021 political crisis, and to examine its associations with socio-demographic factors, prior mental health conditions, and exposure to both the military coup and natural disasters, and aims to generate evidence to help guide government, humanitarian, and community efforts in prioritizing mental health resources and

integrating disaster preparedness with mental health responses.

METHODOLOGY

Study Design, Setting, Period, Duration

A cross-sectional quantitative study was conducted in Myanmar in June 2025 using a structured online questionnaire. Duration of data collection was two weeks.

Sample Size Calculation

Based on a reported 34.9% prevalence of general mental disorders (4), and Myanmar's adult population of 36.86 million (7), the required sample size was calculated using Cochran's Formula ($N_0 = Z^2p(1-p)/e^2$) where $Z = Z$ -score (1.96 for 95% confidence). After adding 10% for potential non-response, the final sample size obtained is 384 participants.

Study Population and Inclusion and Exclusion Criteria

Study population included Myanmar adults aged 18 years or older, residing in Myanmar since 1st February 2021, who had internet access, understood Burmese, and provided informed consent. Participants who did not complete all sections of the survey or any duplicate responses were excluded.

Measurement Tools

Data was collected using a structured, self-administered online questionnaire with three sections. Section 1 covered socio-demographic characteristics namely age, gender, ethnicity, marital status, urban-rural residence, region, education level, occupation, and monthly income. Section 2 covered risk factors namely prior diagnosed mental disorders, exposure to the military coup (self-constructed questionnaire including experiences of violence acts, physical assaults, forced military labour due to conscription law, loss of loved ones: family members, close friends or relatives), and exposure to natural disasters (self-constructed questionnaire including experiences of physical injury, loss of loved ones, loss of home or property, displacement). A response of "Yes" to at least one item in each category was 'exposed' to that risk. Section 3 covered prevalence of

probable GAD using GAD-7 scale (8), which contained 7-item to assess the frequency of anxiety symptoms over the past two weeks. Each item was scored from 0 (Not at all) to 3 (Nearly every day), yielding the total score ranging from 0 to 21. A cut-off score ≥ 10 identifies probable GAD with sensitivity of 89% and specificity of 82% (8).

The questionnaire was reviewed by three experts including a public health professor and two experienced public health professionals, and each item was rated using the following scale: +1, 0 and -1. The average IOC score was 0.92. Cronbach's alpha (α) score for probable GAD was 0.933.

Data Collection Process and Data Analysis

The self-administered online questionnaire, open for two weeks, took 15–30 minutes to complete. To ensure data quality, procedures such as pre-survey testing on 38 participants, standardized clear instructions at the beginning of the survey and skip logic were applied. No personal identifiable information was collected and participation was entirely anonymous and voluntary. Participants first

assessed a Participant Information Sheet. Informed consent was obtained electronically before proceeding. The survey link was disseminated via social media and messaging apps. Screening questions ensured eligibility, and reminders were sent to enhance participation. The survey was optimized for mobile and desktop use. Data were securely exported, cleaned, and analyzed in SPSS software version 22, with duplicate responses excluded.

RESULTS

Table 1 showed socio-demographic characteristics among 384 Myanmar adults. Participants' ages ranged from 18 years upwards, with a median age of 31 years (interquartile range: 25.25 – 40 years). The majority were aged between 18 and 29 age group (42.2%), and were female (65.4%). identified as Bamar (74.5%), singles (61.5%), lived in urban areas (84.9%), and were from the Yangon region (60.7%), achieved college-level education or above (86.7%), and were employed in the formal sector (52.6%), earned above or equal to 500,000 MMK (51.8%).

Table 1 Descriptive Statistics of sociodemographic characteristics (n=384)

Socio-demographic characteristics	Number (n)	%
Age (completed years)		
18 - 29	162	42.2
30 - 44	148	38.5
≥ 45	74	19.3
Median (IQR)= 31 (40-25.25)		
Gender		
Male	133	34.6
Female	251	65.4
Ethnicity		
Bamar	286	74.5
Non-Bamar	98	25.5
Marital Status		
Single	236	61.5
Married	141	36.7
Others	7	1.8
Urban-Rural Status		
Urban	326	84.9
Rural	58	15.1
Region of residence		
Yangon	233	60.7

Socio-demographic characteristics	Number (n)	%
Mandalay	65	16.9
Sagaing	17	4.4
Others	69	18
Education Level		
College and above	333	86.7
Completed High School	47	12.3
Others	4	1
Occupation		
Student/ Dependent/Retired	88	22.9
Formal Sector	202	52.6
Informal Sector	82	21.4
Others	12	3.1
Income per month		
< 500,000 MMK	185	48.2
≥ 500,000 MMK	199	51.8

1 US\$ =4300 MMK, Marital Status (Others = living together as partners, divorced/separated, widowed), Occupation (Formal Sector=Government Employee, Private Employee, Informal Sector=Self-employees, Manual Workers, Others=Monks, Soldiers, Volunteers), Education level (Others = read and write, primary, middle school education)

Table 2 showed risk factors among 384 Myanmar adults. Most participants (96.1%) reported no prior diagnosed mental disorders, and among the small group who had a diagnosis (3.9%), 60% were receiving mental health

treatment. Regarding exposure to military coup, majority reported exposure (61.5%). Regarding disaster exposure, a slight majority (51.3%) had exposure to natural disasters.

Table 2 Descriptive Statistics of Risk Factors (n=384)

Risk factors	Number (n)	%
Prior Diagnosed Mental disorders		
No	369	96.1
Yes	15	3.9
Receiving any mental treatment (n= 15)		
No	6	40
Yes	9	60
Exposure to Military Coup		
No Exposure	148	38.5
Has Exposure	236	61.5
Exposure to Natural Disasters		
No Exposure	187	48.7
Has Exposure	197	51.3

Table 3 showed prevalence of probable GAD among 384 Myanmar adults. 24% of participants (n = 92) were identified as having probable GAD, while the remaining 76% (n = 292) did not meet the criteria.

Table 3 Descriptive Statistics of probable GAD (n=384)

	Number (n)	%
Probable GAD	92	24
No Probable GAD	292	76

Table 4 showed the bivariate association between sociodemographic variables and prevalence of probable GAD among 384 participants. Age group was significantly associated with probable GAD ($p=0.001$), with younger participants (18–29 years) having the highest prevalence of probable GAD (32.7%) compared to older groups. Marital status was also significantly associated with probable GAD ($p<0.001$), with singles reporting a higher prevalence of probable GAD (27.5%) than married group (15.6%). Region of residence showed significant differences ($p=0.01$), with the highest prevalence of probable GAD in the

Sagaing (41.2%). Occupation was significantly associated with probable GAD ($p=0.012$). Students, dependents, and retirees had the highest prevalence of probable GAD (36.4%) compared to those in the formal sector (19.3%). Income level was also significantly associated with probable GAD ($p=0.038$), with participants earning <500,000 MMK reporting higher prevalence of probable GAD (28.6%) than those earning $\geq 500,000$ MMK (19.6%). Gender, ethnicity, urban-rural status, and education level were not significantly associated with probable GAD.

Table 4 Association between sociodemographic variables and prevalence of probable GAD (n=384)

Socio-demographic characteristics	Probable GAD				Chi square	p-value
	No probable GAD		Has probable GAD			
	n	%	n	%		
Age Group						
18-29	109	67.3	53	32.7	13.577	0.001*
30-44	118	79.7	30	20.3		
≥ 45	65	87.8	9	12.2		
Gender						
Male	107	80.5	26	19.5	2.172	0.141
Female	185	73.7	66	26.3		
Ethnicity						
Bamar	218	76.2	68	23.8	0.02	0.886
Non-Bamar	74	75.5	24	24.5		
Marital Status						
Single	171	72.5	65	27.5	15.726	<0.001**
Married	119	84.4	22	15.6		
Others	2	28.6	5	71.4		
Urban-Rural Status						
Urban	251	77	75	23	1.074	0.3
Rural	41	70.7	17	29.3		
Region of residence						
Yangon	184	79	49	21	11.334	0.01*
Mandalay	54	83.1	11	16.9		
Sagaing	10	58.8	7	41.2		
Others	44	63.8	25	36.2		
Education level						
College above	256	76.9	77	23.1	0.96	0.327
Below college	36	70.6	15	29.4		
Occupation						

Socio-demographic characteristics	Probable GAD				Chi square	p-value
	No probable GAD		Has probable GAD			
	n	%	n	%		
Student/Dependent/Retired	56	63.6	32	36.4	10.88	0.012*
Formal Sector	163	80.7	39	19.3		
Informal Sector	65	79.3	17	20.7		
Others	8	66.7	4	33.3		
Income Level						
<500,000 MMK	132	71.4	53	28.6	4.311	0.038*
≥500,000 MMK	160	80.4	39	19.6		

**p-value<0.001=Highly Statistically Significant, *p-value<0.05=Statistically Significant

Table 5 presented the bivariate association between risk factors and prevalence of probable GAD. Exposure to the military coup was significantly associated (p=0.002), with a higher prevalence among exposed participants (29.2%) compared to those without such exposure (15.5%). Similarly, natural disasters

exposure was significantly associated with probable GAD (p<0.001), with exposed individuals having a higher prevalence (32.5%) than those unexposed (15%). Prior mental illness history was not significantly associated (p=0.802).

Table 5 Association between risk factors and prevalence of probable GAD (n=384)

Risk factors	Probable GAD				Chi square	p-value
	No probable GAD		Has probable GAD			
	n	%	n	%		
Prior mental disorders						
No	281	76.2	88	23.8	0.063	0.802
Yes	11	73.3	4	26.7		
Exposure to Military Coup						
No exposure	125	84.5	23	15.5	9.366	0.002*
Has exposure	167	70.8	69	29.2		
ND Exposure						
No exposure	159	85	28	15	16.153	<0.001**
Has exposure	133	67.5	64	32.5		

**p-value<0.001=Highly Statistically Significant, ND Exposure= Natural Disaster Exposure

Table 6 examined predictors of probable GAD through multivariate logistic regression, which was conducted to assess the independent effects of key variables on the outcomes of interest (probable GAD) while controlling for potential confounders. Tables 4 and 5 show bivariate associations with probable GAD, while Table 6 presents multivariate logistic regression results adjusted for other variables. Therefore,

some differences arise because variables that appear significant on their own may lose significance when shared variance with other factors is accounted for, highlighting only those with independent effects.

Three significant predictors namely marital status, occupation, and exposure to natural disasters were identified. Marital status was significantly associated with anxiety.

Participants categorized as “Others” namely living together as partners, divorced/separated, widowed individuals had significantly higher odds of anxiety compared to singles (OR=6.839, 95% CI: 1.181–39.607, p=0.032). Occupation was also significant (p=0.025) with formal sector workers (OR=0.334, 95% CI: 0.161–0.693, p=0.003), and informal sector workers (OR=0.415, 95% CI: 0.176–0.979, p=0.045)

showing lower odds than students/dependents/retired. Natural Disasters exposure was strongly associated with higher odds of anxiety (OR=2.638, 95% CI: 1.500–4.637, p=0.001). Other factors, including age, region, monthly income, and exposure to the military coup, were not significant in the multivariate model.

Table 6 Multivariate Logistic Regression: Predictors of probable GAD (n=384)

Variables	B	S.E.	p-value	AOR Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Age Group						
18-29 (Ref)			0.306			
30-44	-0.196	0.343	0.567	0.822	0.419	1.610
≥45	-0.781	0.511	0.127	0.458	0.168	1.247
Region of residence						
Yangon (Ref)			0.170			
Mandalay	-0.733	0.402	0.068	0.480	0.219	1.056
Sagaing	0.187	0.609	0.759	1.205	0.366	3.973
Others	0.266	0.343	0.438	1.305	0.666	2.556
Marital Status						
Single (Ref)			0.043*			
Married	-0.389	0.363	0.284	0.677	0.332	1.381
Others	1.923	0.896	0.032	6.839	1.181	39.607
Occupation						
Student/ Dependent/ Retired (Ref)			0.025*			
Formal Sector	-1.097	0.372	0.003	0.334	0.161	0.693
Informal Sector	-0.880	0.438	0.045	0.415	0.176	0.979
Others	0.011	0.765	0.988	1.012	0.226	4.531
Income Level						
<500,000 MMK (Ref)						
≥500,000 MMK	0.302	0.324	0.351	1.353	0.717	2.554
Exposure to Military Coup						
No exposure (Ref)						
Has exposure	0.504	0.305	0.099	1.655	0.909	3.010
ND Exposure						
No exposure (Ref)						
Has exposure	0.970	0.288	0.001*	2.638	1.500	4.637

*p-value<0.05=Statistically Significant, AOR=Adjusted Odds Ratio, 95% C.I.=95% Confidence Interval, Ref=Reference group, Marital Status (Others = living together as partners, divorced/separated, widowed), Occupation (Formal Sector=Government Employee, Private Employee, Informal Sector=Self-employees, Manual Workers, Others=Monks, Soldiers, Volunteers)

DISCUSSION

This study aimed to assess the prevalence of probable GAD and examine its associations

with socio-demographic characteristics and risk factors among Myanmar adults following the

2021 military coup. The prevalence of GAD was 24%, consistent with a 2024 study among people living in Israeli conflict areas three months after the escalation where 24% reported anxiety symptoms using the same GAD-7 screening tool (cut-off ≥ 10) (9).

Most participants were young adults (18–29 years, 42.2%), females (65.4%), Bamar ethnicity (74.5%), single (61.5%), urban residents (84.9%), and educated above college level (86.7%). Over half worked in the formal sector (52.6%) and earned more than 5 lakhs monthly (51.8%). These findings align with previous studies, including research in Afghanistan showing a predominantly young sample (10), and national data indicating urban concentration in Yangon and Mandalay (11) and high rates of tertiary education (4). Regarding occupation, this matches findings from the Netherlands highlighting how online surveys often overrepresent individuals with better internet access and higher education (12).

The majority lived in Yangon (60.7%). Notably, the highest prevalence of anxiety was found in Sagaing, while the lowest was in Mandalay, although region of the residence was not significant in the final model. Higher anxiety in Sagaing may relate to the military's brutal violence, which killed nearly 1,000 residents as of July 2023 (13), and the region's severe impact from the 2025 earthquake (14). In contrast, Mandalay may show lower GAD due to greater urban stability and better access to resources and mental health services, buffering anxiety symptoms despite conflict or disaster events.

For risk factors, most participants (96.1%) had no prior diagnosed mental disorders, and among the 3.9% with a diagnosis, 60% were receiving treatment, likely reflecting limited mental health resources, with only 0.3% of Myanmar's health budget allocated to mental health (15). A majority experienced exposure to either the military coup (61.5%) or natural disasters (51.3%). Comparable findings were observed in Rwanda in 2004, where many faced displacement and loss during genocide (16). Myanmar has similarly faced multiple crises, including typhoons, cyclones (2023–2024), and a 7.7 magnitude earthquake in 2025 affecting major regions (17).

The study identified three key predictors of probable GAD. First, marital status was significant, with individuals categorized as "Others" (living with a partner, divorced/separated, or widowed) having higher odds of probable GAD than singles. This may be due to unresolved distress or social isolation, consistent with findings by Liu and Umberson (18).

Second, occupation was significantly associated with probable GAD, with both formal and informal sector workers showing lower odds compared to students, dependents, or retirees. Employment may provide financial stability and reduce anxiety risk, highlighting that unemployment increases vulnerability to poor mental health outcomes (19).

Lastly, natural disaster exposure significantly increased the likelihood of probable GAD. This aligns with findings from Fort McMurray, Canada, where those exposed to both COVID-19 and disaster-related trauma were over 11 times more likely to report GAD (20). Such disasters may cause anxiety through trauma, loss of loved ones or property, displacement, and ongoing uncertainty.

Surprisingly, no significant association was found between exposure to military coup and probable GAD. This may be since many individuals develop resilience and coping strategies in the months and years following major trauma, and psychological distress often decreases as they find ways to manage ongoing challenges (21).

CONCLUSION AND RECOMMENDATIONS

This study found a 24% prevalence of probable GAD among 384 Myanmar adults. Analytic findings revealed that marital status, occupation, and natural disaster exposure were significantly associated with probable GAD. These findings suggest that mental health services in Myanmar should be strengthened and better funded to improve access and care quality. Routine screening for anxiety disorders should be integrated to primary healthcare settings, especially high-risk groups. Community programs are needed to raise awareness, reduce stigma, and teach coping strategies. Support services should be expanded in conflict- and

disaster-affected regions like Sagaing. Future research should also explore factors like childhood adversity, protective supports, resilience levels to guide comprehensive interventions.

LIMITATIONS

This is the first study in Myanmar to assess the prevalence of probable GAD and its associations with socio-demographic and risk factors, including prior mental disorders, exposure to military coup, and exposure to natural disasters. It employed a validated screening tool (GAD-7) culturally adapted for the Myanmar context, and the questionnaire was pilot-tested to enhance clarity and reliability.

However, several limitations must be acknowledged. The cross-sectional design cannot establish causal inference. As an online survey using convenience sampling, the findings may not be generalizable to the entire population of Myanmar, particularly those without internet access. Anonymity may have contributed to overreporting, and self-reported data lack clinical verification. The study did not assess comorbid mental disorders (depression, acute stress), early-life adversity, or protective factors such as social support and coping mechanisms.

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. 159/68). Participants were fully informed about the study and their rights. Participation was voluntary and confidential. Questions were designed to minimize harm, and mental health resource information was provided at the end of the survey.

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UNMET NEEDS FOR MENTAL HEALTH SERVICES AMONG SEXUAL AND GENDER DIVERSE INDIVIDUALS IN INDONESIA, THE PHILIPPINES, AND SINGAPORE: A QUANTITATIVE STUDY

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ABSTRACT

Introduction: Sexual and gender diverse (SGD) individuals face a higher burden of mental health problems compared to non-SGD individuals, both globally and within Southeast Asia. Unmet needs for mental health services among those populations remain substantial. Multiple barriers contribute to this gap, exacerbated by limited legal protections and social acceptance in Southeast Asia.

Objective: This study aimed to analyze how predisposing characteristics, enabling resources, and need factors influence utilization of mental health care among SGD individuals in Indonesia, the Philippines, and Singapore.

Methodology: This cross-sectional, quantitative study analyzed secondary data from a cross-sectional survey conducted as part of the APCOM Foundation's LGBTQI Mental Health Project in four Southeast Asian countries, Indonesia, Singapore, Thailand, and the Philippines in 2023 and 2024. A total of 1,685 respondents who felt the need for mental health services but decided against seeking them, i.e., having an unmet need for mental health services, from Indonesia, the Philippines, and Singapore were included in this study. Binary logistic regression models stratified by country were utilized to analyze associations between sociodemographic, SGD identity-related, and structural factors, and unmet needs for mental health services.

Results: The prevalence of unmet need for mental health services was significant across all countries (79% to 81%), although factors associated with unmet need varied significantly. In Indonesia, never avoiding public displays of affection (AOR = 0.48, 95% CI: 0.27, 0.85) and having moderate knowledge of mental health services (AOR = 0.43, 95% CI: 0.25, 0.73) were associated with lower unmet need. In the Philippines, experiencing assault (AOR = 1.99, 95% CI: 0.99, 4.02), perceived stigma (AOR = 1.95, 95% CI: 0.99, 3.82), and poor knowledge (AOR = 5.90, 95% CI: 2.12, 16.44) were associated with higher unmet need. In Singapore, expectations of rejection (AOR = 6.09, 95% CI: 1.73, 22.08), experiencing assault (AOR = 4.36, 95% CI: 1.36, 22.10), and lack of service knowledge (AOR = 2.08, 95% CI: 0.99, 4.66) increased the odds.

Conclusion: This study highlighted the consistently high prevalence of unmet mental health needs among SGD individuals across Indonesia, the Philippines, and Singapore. While structural barriers were evident in all three countries, stigma-related factors were more prominent in Singapore and the Philippines, which also suggested normalization of stigma in Indonesia. Targeted interventions are required to reduce stigma and improve access to mental health services.

Keyword: Sexual and gender diverse individuals, mental health services, Southeast Asia, unmet needs.

INTRODUCTION

A significantly higher prevalence of mental health issues, ranging from substance abuse, anxiety and depressive symptoms to suicidal ideation and suicidal attempts, has been observed globally among sexual and gender

diverse (SGD) individuals, in other words, individuals of diverse sexual orientation and/or gender identity and expression (SOGIE) compared to heterosexual and cisgender counterparts (1-9). This burden of mental health disparities among SGD populations also

remains a critical issue across Southeast Asia, with the limitations on their rights and recognition in Southeast Asia (10). Studies in Southeast Asia have consistently reported a high prevalence of depression, anxiety, self-harm, as well as suicidal ideation and attempts among SGD populations. Studies from the Philippines reported significant prevalence of depression, anxiety and stress among SGD individuals linked to discrimination (11), higher rates of depression, anxiety and stress in sexual minority women compared to their heterosexual peers (12), and higher odds for suicidal ideation among gay and bisexual young men (13). One study from Malaysia revealed the prevalence of mental disorders among sexual minority individuals to be over 80%, compared to 29.2% in the general population (14).

One contributing factor for the mental health disparities observed in SGD populations in Southeast Asia is the hostility of legal and social environments in the region and the marginalization of SGD populations. Many limitations in SOGIE rights exist in Southeast Asia in terms of recognition of gender identity, legal provision for same-sex marriage, anti-discrimination laws, and decriminalization of homosexuality (10). Unfavorable attitudes towards homosexuality and sexual minorities also create hostile environments, with national surveys conducted in Southeast Asian countries indicating moderate to strong negative attitudes towards homosexuality (13).

The mental health disparities among SGD individuals can be succinctly explained by Meyer's sexual minority stress theory, which is a conceptualization of how social conditions influence the mental well-being of sexual minority individuals. According to this theoretical model of sexual minority individuals, events of discrimination and violence against sexual minorities constitute distal minority stressors, which influence proximal minority stressors, such as internalized homophobia, expectations of rejection and sexual minority identity concealment, which lead to further adverse mental health outcomes (5).

While the prevalence of mental disorders among SGD individuals remains high, there is a gap between their mental health needs

and their utilization of mental health services. Unmet needs for mental health services among SGD individuals remains substantial (9, 15-18). Multiple barriers to accessing mental health services contribute to these unmet needs, including minority stress-related barriers such as fear of rejection, discrimination and lack of disclosure, financial constraints, lack of availability of SGD inclusive mental health services and providers, and unsatisfactory encounters with culturally incompetent mental health providers (15, 19, 20). No previous research was found on unmet need for mental health services among SGD populations in Indonesia, the Philippines, and Singapore.

Despite evidence of high rates of mental health disorders among SGD individuals in Southeast Asia, which are linked to the social and legal challenges they face due to discriminatory attitudes and legislations, and their significant unmet needs for mental health services, few studies have been conducted in the unique socio-cultural context of Southeast Asian countries (21). The research gaps are more pronounced in countries where SGD individuals face significant legal restrictions and social discrimination (10). The objective of this cross-sectional, quantitative study was to analyze how predisposing characteristics, enabling resources, and need factors influence utilization of mental health care among SGD individuals in Indonesia, the Philippines, and Singapore based on a combination of two theoretical frameworks: Meyer's sexual minority stress theory (5) and Andersen's behavioral model of health service utilization (22). Due to the challenging and sensitive nature of primary data collection from vulnerable populations such as sexual and gender diverse individuals, this study utilizes secondary data from an already established dataset with a relatively large sample size and with the addition of time and cost effectiveness (23). The hypotheses of this study were that barriers related to minority stress of SGD individuals and mental health service availability would be significantly associated with their unmet need for mental health services, and that those associations would differ by country (Indonesia, the Philippines, and Singapore).

METHODOLOGY

Data source and study sample

This study utilized a cross-sectional, quantitative design to analyze the secondary data from a cross-sectional survey conducted as part of the LGBTQI Mental Health Project launched by APCOM Foundation in collaboration with local community organizations and the Institute for Population and Social Research at Mahidol University in four Southeast Asian countries, Indonesia, the Philippines, Singapore, and Thailand, previously documented through research briefs (24-27), and a conference paper focused on the findings of the project from Thailand (28). The data was collected from November 2023 to January 2024 from individuals who identified themselves as an individual of diverse SOGIE through the use of a non-probability, targeted online sampling method. The survey platform Qualtrics was utilized to collect data due to ease of use. To test the accuracy and reliability of the survey instrument, a pilot phase was carried out in all participating countries prior to data collection process (29). To ensure active engagement from respondents and to maintain their privacy, the self-administered survey was distributed through social media platforms (Facebook and Instagram) of community organizations in respective countries. The total number of respondents from these four countries was 3,087. A multiple imputation method was used to replace missing values and to reduce bias. After multiple imputation, the dataset of the present study included 629 respondents from Indonesia, 410 from the Philippines, and 646 from Singapore, with a total of 1,685 respondents who felt the need for using mental health services. The data from Thailand was excluded from the analysis as the response rate for unmet need for mental health services from Thailand was very low. The study obtained ethical approval from the Institutional Review Board (IRB) of the Institute for Population and Social Research at Mahidol University and adhered to the ethical standards, with informed consent from all participants prior to the data collection (24).

Description of variables

The main outcome variable of this study was self-reported unmet need for mental health

services and was assessed using two survey question items employing binary categorical scales. The respondents were first asked, "Have you ever felt the need for mental health services?" with two response options, "Yes" and "No." Only those who answered "Yes" to this question were asked about their unmet need for mental health services, with the question, "Have you ever felt the need for mental health services but chose not to seek them?". There were two response options, "Yes" and "No". Since the focus of this study was on unmet need for mental health services, those who answered "No" were excluded from the study.

The predictor variables of this study were chosen on the basis of the study's conceptual framework and the availability of relevant items in the survey. Many variables were re-coded to be usable in the regression analyses. The predictors of interest included sex assigned at birth, the respondent's openness about their diverse sexual orientation and gender identity (SOGI), expectation of rejection, avoidant behavior resulting from fear of discrimination and violence, the number of times they had been physically or sexually attacked in the past five years, the respondent's perception of the trend of SGD-related stigma in their country (increased, decreased, or stayed the same), prior experiences while accessing healthcare services, and the respondent's level of knowledge about the availability of mental health service providers in their vicinity. Respondents' age (in full years) and their source of income were included as covariates, and their current country of living was used for stratification during the analysis. The key variables are described in detail in Table 1.

Statistical analysis

All analyses were conducted using R statistical software (v 4.5.0; R Core Team 2024). Before conducting the binary logistic regression analyses, the data was first checked for missing values. Missing values ranged from 15.6% to 28.8% across all variables and were mostly due to non-response items. Multiple imputation was used to replace the missing values before filtering for desired data to reduce potential bias (30). The distribution of key variables is presented using descriptive statistics (Table 1). Bivariate binary logistic regression analyses were conducted for

each key predictor, with statistical significance defined at $p < 0.05$. All key predictors were included in the multivariate model regardless of their statistical significance, based on the literature. The analyses of unmet need for mental health services were stratified by country: Indonesia, the Philippines, and Singapore. Binary logistic regression models were utilized to generate adjusted odds ratios (aORs) with 95% confidence intervals for the measure of association between key predictors and unmet need. However, Firth's penalized logistic regression was used for Singapore model due to data non-convergence (Table 3) (31). Each model included all key predictors with the covariates age and source of income. To justify for stratification of the models by country, a binary logistic regression model with country as the interaction term was first run (effect modification) to examine whether the interactions between country and minority stress-related variables were statistically significant.

Multicollinearity was tested using the Variance Inflation Factor (VIF). The linearity assumption for one continuous predictor, age, was also tested using the Box-Tidwell test.

RESULTS

Out of the 1,685 respondents, 629 (37.3%) were from Indonesia, 410 (24.3%) from the Philippines, and 646 (38.3%) from Singapore, all individuals having identified themselves as an SGD individual. Unmet need for mental health services was consistently high across all countries, with the majority of respondents having an unmet need for mental health services; 79% in Indonesia, 81% in the Philippines, and 80% in Singapore. The statistical significance of each predictor and covariates were checked using bivariate logistic regression models (Table 2). However, due to their theoretical significance, all predictors and covariates were included in the final stratified models irrespective of their statistical significance (Table 3).

Table 1 Descriptive characteristics of respondents by country
N = 1,685 (Indonesia = 629; The Philippines = 410; Singapore = 646)

Characteristic	Indonesia (N = 629) ¹	The Philippines (N = 410) ¹	Singapore (N = 646) ¹
Sex assigned at birth			
Female	111 (18%)	130 (32%)	412 (64%)
Male	518 (82%)	280 (68%)	234 (36%)
Openness about SOGI			
Definitely	296 (47%)	343 (84%)	308 (48%)
Not really	281 (45%)	57 (14%)	303 (47%)
Not at all	52 (8%)	10 (2%)	35 (5%)
Avoidant behavior^a			
No partner	125 (20%)	149 (36%)	320 (50%)
Never	176 (28%)	112 (27%)	104 (16%)
Sometimes	232 (37%)	125 (30%)	167 (26%)
Always	96 (15%)	24 (7%)	55 (8%)
Expectation of rejection			
No	351 (56%)	342 (83%)	317 (49%)
Yes	278 (44%)	68 (17%)	329 (51%)
Prior experience with healthcare services			

Never accessed before	23 (3.7%)	22 (5.3%)	15 (2.3%)
Poor	395 (62.7%)	261 (63.6%)	390 (60.3%)
Good	211 (33.6%)	127 (31.1%)	241 (37.4%)
Number of times physically or sexually attacked in the last 5 years			
Never	380 (60.4%)	205 (50.2%)	548 (85%)
Once	78 (12.4%)	52 (12.6%)	37 (5.7%)
Two to ten times	117 (18.6%)	110 (26.8%)	48 (7.4%)
More than ten times	54 (8.6%)	43 (10.4%)	13 (2.0%)
Trend of stigma in the country			
Stayed the same	168 (27%)	93 (23%)	167 (26%)
Decreased	50 (8%)	126 (31%)	307 (48%)
Increased	411 (65%)	191 (47%)	172 (27%)
Level of knowledge about mental health service availability			
No need	195 (31%)	124 (30%)	144 (22%)
Very knowledgeable	68 (11%)	51 (12%)	36 (5%)
Somewhat knowledgeable	135 (21.3%)	117 (29%)	192 (30%)
Not very knowledgeable	187 (29.7%)	88 (21%)	166 (26%)
Not at all knowledgeable	44 (7.0%)	30 (8%)	108 (17%)
Age	34 (SD = 11)	30 (SD = 9)	26 (SD = 9)
Source of income			
Independent income	384 (61%)	185 (45%)	283 (44%)
Dependent income	245 (39%)	225 (55%)	363 (56%)
Unmet need for mental health services			
No	135 (21%)	80 (19%)	131 (20%)
Yes	494 (79%)	330 (81%)	515 (80%)

¹Statistics presented:

n (%) for categorical variables;

Mean (SD) for continuous variables

^a Having to avoid showing affection to partner in public due to fear of discrimination or violence.

In both bivariate and multivariate unstratified models, having an expectation of rejection and having lower knowledge of mental health service availability (being “not very knowledgeable” and “not at all knowledgeable”) were significantly associated with higher odds of unmet need for mental health services.

Conversely, never having to avoid showing affection to partner in public, having a good prior experience with health services, and being “somewhat knowledgeable” about mental health service availability were significantly associated with lower odds of unmet need (Table 2).

Table 2 Comparison of Crude Odds Ratios (cORs) and Adjusted Odds Ratios (aORs) with 95% Confidence Intervals of Binary Logistic Regression Models for Predictors of Unmet Needs for Mental Health Services (Unstratified Models) (N = 1,685)

Variable	cOR (95% CI)	aOR (95% CI)
Sex assigned at birth: Female is the reference.		
Male	1.03 (0.81, 1.31)	1.14 (0.85, 1.51)
Openness about SOGI: Definitely open is the reference.		
Not really	1.26 (0.98, 1.61)	0.64 (0.36, 1.12)
Not at all	1.16 (0.69, 1.96)	0.54 (0.25, 1.14)
Avoidant behavior: No partner is the reference.		
Never	0.65 (0.48, 0.87) *	0.72 (0.52, 0.99) *
Sometimes	1.20 (0.88, 1.63)	1.21 (0.88, 1.68)
Always	1.10 (0.71, 1.69)	1.08 (0.68, 1.72)
Expectation of rejection: No is the reference.		
Yes	1.38 (1.07, 1.76) *	2.16 (1.20, 3.89) *
Prior experience with health services: Never accessed before is the reference.		
Poor prior experience	0.51 (0.22, 1.20)	0.72 (0.30, 1.75)
Good prior experience	0.31 (0.13, 0.74) *	0.37 (0.15, 0.89) *
Number of times physically or sexually attacked: Never is the reference.		
Once	1.36 (0.89, 2.08)	1.23 (0.79, 1.93)
Two to ten times	1.26 (0.90, 1.76)	1.10 (0.76, 1.58)
More than ten times	1.96 (1.10, 3.50) *	1.71 (0.93, 3.14)
Trend of stigma in the country: Stayed the same is the reference.		
Decreased	1.18 (0.86, 1.63)	1.21 (0.85, 1.70)
Increased	1.12 (0.84, 1.49)	1.12 (0.83, 1.52)
Level of knowledge about mental health service availability: No need is the reference.		
Very knowledgeable	0.85 (0.55, 1.30)	0.85 (0.55, 1.32)
Somewhat knowledgeable	0.68 (0.50, 0.92) *	0.66 (0.48, 0.90) *
Not very knowledgeable	1.86 (1.30, 2.65) **	1.87 (1.30, 2.69) **
Not at all knowledgeable	1.90 (1.17, 3.11) *	1.84 (1.11, 3.04) *
Age	0.99 (0.98, 1.00)	0.99 (0.98, 1.01)
Source of income: Independent income is the reference.		
Dependent income	1.23 (0.97, 1.56)	1.23 (0.95, 1.58)
Country of living: Indonesia is the reference.		
The Philippines	1.13 (0.83, 1.54)	1.25 (0.87, 1.80)
Singapore	1.07 (0.82, 1.41)	1.04 (0.73, 1.49)

Before stratifying models by country for effect modification by country, a multivariate model with country as an effect modifier was first run and the interactions between country and the number of times respondents were physically or

sexually attacked within 5 years was found to be statistically significant for Singapore ($p = 0.01$) and the Philippines ($p = 0.04$). Therefore, the final models were stratified by country (Table 3).

Table 3 Comparison of Adjusted Odds Ratios (aORs) with 95% Confidence Intervals of Binary Logistic Regression Models for Predictors of Unmet Needs for Mental Health Services Stratified by Country

Variable	Indonesia (N = 629)	The Philippines (N = 410)	Singapore ^a (N = 646)
Sex assigned at birth: Female is the reference.			
Male	1.39 (0.80, 2.43)	1.04 (0.58, 1.88)	1.17 (0.75, 1.85)
Openness about SOGI: Definitely open is the reference.			
Not really	1.02 (0.50, 2.08)	1.06 (0.05, 20.67)	0.30 (0.09, 1.01) *
Not at all	0.86 (0.33, 2.29)	0.40 (0.01, 11.27)	0.26 (0.05, 1.24)
Avoidant behavior: No partner is the reference.			
Never	0.48 (0.27, 0.85) *	1.11 (0.57, 2.16)	0.98 (0.56, 1.77)
Sometimes	1.52 (0.84, 2.77)	1.08 (0.55, 2.12)	1.03 (0.62, 1.73)
Always	1.66 (0.76, 3.58)	0.45 (0.15, 1.38)	0.67 (0.32, 1.49)
Expectation of rejection: No is the reference.			
Yes	1.25 (0.60, 2.62)	1.11 (0.06, 21.65)	6.09 (1.73, 22.08) **
Prior experience with health services: Never assessed before is the reference.			
Poor Prior Experience	0.55 (0.12, 2.54)	1.31 (0.38, 4.44)	0.22 (0.00, 2.09)
Good Prior Experience	0.33 (0.07, 1.56)	0.70 (0.20, 2.47)	0.08 (0.00, 0.76) *
Number of times physically or sexually attacked: Never is the reference.			
Once	0.78 (0.41, 1.48)	1.64 (0.69, 3.92)	4.36 (1.36, 22.10) *
Two to ten times	0.85 (0.49, 1.48)	1.99 (0.99, 4.02)*	0.92 (0.45, 2.00)
More than ten times	1.30 (0.56, 3.01)	1.73 (0.65, 4.55)	8.06 (0.95, 1060.73)
Trend of stigma in the country: Stayed the same is the reference.			
Decreased	1.25 (0.53, 2.93)	1.39 (0.69, 2.83)	1.14 (0.69, 1.88)
Increased	1.15 (0.72, 1.84)	1.95 (0.99, 3.82)*	0.75 (0.43, 1.31)
Level of knowledge about mental health service availability: No need is the reference.			
Very knowledgeable	1.54 (0.70, 3.41)	1.14 (0.51, 2.54)	0.31 (0.13, 0.70) **
Somewhat knowledgeable	0.43 (0.25, 0.73)**	1.14 (0.60, 2.14)	0.58 (0.34, 0.99) *
Not very knowledgeable	1.28 (0.74, 2.21)	5.90 (2.12, 16.44)**	1.66 (0.89, 3.14)
Not at all knowledgeable	1.31 (0.52, 3.25)	1.39 (0.50, 3.88)	2.08 (0.99, 4.66) *

Variable	Indonesia (N = 629)	The Philippines (N = 410)	Singapore ^a (N = 646)
Age	1.01 (0.99, 1.03)	1.01 (0.98, 1.04)	0.98 (0.95, 1.00)
Source of income: Independent income is the reference.			
Dependent Income	1.06 (0.69, 1.63)	1.48 (0.86, 2.55)	1.39 (0.91, 2.13)

^a Firth's penalized logistic regression method applied due to non-convergence

After controlling for other variables, in the final stratified models (Table 3), not being really open about one's SOGI was significantly associated with lower odds of unmet need in Singapore (aOR = 0.30, 95% CI: 0.09, 1.01) but not in Indonesia and the Philippines. Similarly, never having to display avoidant behavior was only significantly associated with unmet need in Indonesia (aOR = 0.48, 95% CI: 0.27, 0.85), but not in the other two countries. Having a good prior experience with healthcare services (aOR = 0.08, 95% CI: 0.00, 0.76) and having higher levels of knowledge about mental health service availability (aOR = 0.31, 95% CI: 0.13, 0.70 for very knowledgeable; aOR = 0.58, 95% CI: 0.34, 0.99 for somewhat knowledgeable) were significantly associated with lower odds of unmet need in Singapore. Being somewhat knowledgeable about mental health service availability was also significantly associated with lower odds of unmet need in Indonesia (aOR: 0.43, 95% CI: 0.25, 0.73).

Factors significantly associated with a higher likelihood of unmet needs in the Philippines were having been attacked physically or sexually at least two to ten times in the last five years (aOR = 1.99, 95% CI: 0.99, 4.02), increasing trend of stigma in the country (aOR = 1.95, 95% CI: 0.99, 3.82), and not being very knowledgeable about mental health service availability (aOR = 5.90, 95% CI: 2.12, 16.44). Additionally, having an expectation of rejection (aOR = 6.09, 95% CI: 1.73, 22.08), being attacked at least once in the last five years (aOR = 4.36, 95% CI: 1.36, 22.10), and having no knowledge about mental health service availability at all (aOR = 2.08, 95% CI: 0.99, 4.66) were significantly associated with higher odds of unmet need. Sex assigned at birth, age, and source of income were not statistically significant predictors in any of the three countries

(Table 3).

DISCUSSION

This study examined the association between factors influencing unmet needs for mental health services among SGD individuals to investigate barriers to mental health service utilization among these populations in three Southeast Asian countries: Indonesia, the Philippines, and Singapore. It has been well-established in other contexts that the prevalence of mental health problems and unmet need for mental health services are higher among SGD individuals compared to their cisgender and heterosexual counterparts, but few studies have been conducted in the Southeast Asian countries that have varying limitations on SOGIE rights. This study also examined whether these factors differ by country. By examining these factors separately for each country, this study indicates a need for specific mental health policies for SGD individuals as well as for improving their legal rights.

Consistent with previous studies (9, 15, 17-19), unmet needs for mental health services among SGD individuals were widespread, with roughly 80% having such unmet need across all three countries; these unmet needs had significant associations with minority stress experienced by the respondents and with the availability of mental health service providers in their vicinity, in keeping with Andersen's model which posits that predisposing characteristics and enabling resources influence health service utilization (22). These findings also support the first hypothesis of this study, which stated that unmet need for mental health services would be associated with barriers related to minority stress and with the availability of mental health service providers.

However, country-stratified analyses revealed that the specific factors associated with unmet needs for mental health services differed by each country, suggesting that the unique socio-political context of each country influences how SGD individuals experience stressors and how many resources each country has available for mental health service provision and supporting the second hypothesis of this study. In Indonesia, the protective factor that reduced unmet need was never having to display avoidant behavior in anticipation of discrimination or violence, which suggested that a sense of social support in the form of safe expression of gender identity might influence the healthcare utilization behavior of SGD individuals (5). Another factor that lowered the odds of unmet need in Indonesia was being somewhat knowledgeable about mental health service availability, highlighting the importance of enabling resources, as in Andersen's model (22). However, other stigma-related factors, such as expectation of rejection, physical or sexual violence, or the respondents' openness about their SOGI, were not significantly associated with unmet need, possibly influenced by under-reporting or low variability of these experiences due to rather limited legal rights and hostile social environment for SGD individuals in Indonesia (10, 13).

In the Philippines, stigma-related and structural barriers, such as having experienced physical or sexual violence, perceiving an increased level of stigma in the country and not being very knowledgeable about mental health service availability were associated with higher odds for unmet need, which suggests a need for policies offering protection for SGD individuals and for mental health awareness campaigns.

Similarly, in Singapore, having an expectation of rejection, experiences of violence and not being knowledgeable about mental health service availability were the barriers to mental health service utilization among SGD individuals. Individuals who reported having good experience while accessing healthcare services in the past had lower odds of unmet need, which implied a need for culturally sensitive healthcare providers (20). Interestingly, not being really open about one's SOGI was significantly associated with lower

odds for unmet need, perhaps due to the protective effect of non-disclosure of SOGI in an unfriendly environment (32).

Furthermore, in all three countries, demographic variables such as age, sex assigned at birth, and source of income were not significant predictors of unmet need, implying that stigma-related and structural barriers were more important in understanding and reducing unmet mental health service need for SGD individuals in the three studied countries in Southeast Asia.

This study has several key strengths. The data collected in three Southeast Asian countries, and the country-stratified data analysis method promotes the transferability of data collection and analysis methods to other Southeast Asian countries. Although a probability sampling method was not employed, this study's focus on SGD individuals revealed a critical unmet need for mental health services among these individuals across Southeast Asia, not limited to any single country.

This study also has several limitations. The non-probability sampling method might limit the generalizability of the findings to broader SGD populations in other Southeast Asian countries, although this sampling method might be a suitable method for hard-to-reach minority populations. Since the survey was self-reported, it is subject to recall and social desirability biases especially on sensitive mental health issues and stigma-related experiences. The cross-sectional study design limits the prospect of making causal inferences about the findings, and the multiple imputation method used for missing values may have introduced bias in the data analysis. Future studies should consider culturally sensitive mental health screening tools and qualitative studies for the deeper understanding of the lived experiences of SGD individuals in Southeast Asia, and to identify strategies to improve their mental health.

CONCLUSION

The findings of this study highlight the consistently high prevalence of unmet need for mental health services among SGD individuals across Indonesia, the Philippines, and Singapore,

with significant differences in underlying factors associated with this unmet need. Stigma-related factors, such as fear of rejection and experiences of violence, and structural factors, such as mental health service availability and poor prior experience with health services, were found to be barriers to mental health service utilization among SGD individuals. Only by addressing those barriers in each country's specific context can the unmet need for mental health services be reduced and health equity be promoted for SGD individuals in Southeast Asia.

ETHICAL CONSIDERATION

Ethical approval for the original study was granted by the Institutional Review Board (IRB) of the Institute for Population and Social Research at Mahidol University (COA No. 2023/09-200). Permission to use the dataset was sought from Dr. Dusita Phuengsamran, Assistant Professor at the Institute for Population and Social Research at Mahidol University. Ethical approval for this reanalysis was obtained from the Institutional Review Board (IRB) of the Institute for Population and Social Research at Mahidol University (COE. No. 2025/05-036).

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WHO USES FREE HEALTHCARE? EXPLORING UTILIZATION PATTERNS OF THAILAND'S THREE MAIN PUBLIC HEALTH INSURANCE SCHEME BENEFICIARIES - ANALYSIS AND POLICY RECOMMENDATIONS BEYOND UTILIZATION RATES.

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ABSTRACT

Introduction: The three main public health insurance schemes in Thailand include the Universal Coverage Scheme (UCS), the Social Security Scheme (SSS), and the Civil Servant Medical Benefit Scheme (CSMBS), which covers approximately 97% of the population. However, a number of individuals reported not having utilized the schemes during their last visit to a medical facility. Non-utilization of free healthcare raises a question regarding the ability to access and utilize public health insurance schemes and whether or not they are able to appropriately provide horizontal equity.

Objectives: This study is to examine the influence of demographic and health-related characteristics on the utilization of public health insurance in Thailand.

Methodology: Secondary data were derived from the 2023 Health and Welfare Survey conducted by the National Statistical Office of Thailand (n = 11,430). The analysis includes individuals who reported using outpatient services in the past month. Binary logistic regression was employed to assess the associations between demographic and health variables and public insurance utilization.

Results: Chronic illness was the most influential factor associated with the utilization of public health insurance, followed by the type of PHI scheme, living arrangement, age, area of residence, education level, and employment status, respectively. Additionally, the most cited reason for not utilizing insurance was the perception of mild illness, long wait time, and the inconvenience of accessing services during regular work hours.

Conclusion: Chronic illness within each scheme is a crucial determinant of utilization, implying that the evaluation of public health insurance schemes' utilization must account for the effect of chronic illness within the scheme. Policy recommendations include the possible adoption of the “30 Baht Treatment Everywhere” program for SSS and CSMBS, and flexible service hours.

Keywords: Binary logistic regression, Demographic characteristics, Health and Welfare Survey, Horizontal equity, Insurance utilization, Public health insurance

INTRODUCTION

Thailand has been making great efforts to ensure the health of its population. As of 2023, its population is insured by one of the many public health insurances (PHI) schemes, however, the majority are covered by one of the three schemes, Universal Coverage Scheme (UCS), Social Security Scheme (SSS), or Civil Servant Medical Benefit Scheme (CSMBS), combined, the three scheme covers 96.56% of the population (1). All

three schemes would, in most cases, cover all of the treatment costs or reduce them to a very affordable amount. The schemes, though, have differences. The UCS covers everyone who is not covered by any other PHI schemes. Its beneficiaries are registered to a hospital, where almost all medical treatments are covered (2). The SSS covers formal sector workers. The benefit is similar to the UCS, but also includes labor

protection (3). The CSMBS covers all civil servants and their family members and their children with certain conditions; however, this scheme can be utilized in all public hospitals (4).

The 2023 Health and Welfare survey showed that 34.7% of people did not utilize their PHI scheme during their last visit to a healthcare facility (5). The decision to decline affordable healthcare raises the question regarding the accessibility to utilize the insurance schemes and healthcare at large. Previous studies have shown that individuals of higher socio-economic status, young, had a high income, were employed, lived in urban areas, or did not have a chronic disease, tended to underutilize UCS (6,7). However, few studies analysed include SSS and CSMBS and are without an analysis of the reason for non-utilization.

METHODOLOGY

A cross-sectional study was conducted to assess This study utilized secondary data from The 2023 Health and Welfare survey (1) by the National Statistical Office. This study applied binary logistic regression to analyze the association of demographic characteristics and the utilization of PHI schemes, and cross-

tabulation analysis to analyze the reasons for non-utilization. Analyses in this study was conducted via IBM SPSS Statistics. The survey was conducted on the first of March 2023, employing a stratified two-stage sampling with a total of 72,659 people responding. The sample of this study was selected to include only those who visited a healthcare facility in the past month, were older than 18, were covered by one of the three schemes, and without ambiguous PHI coverage, leaving the total sample of the study to be 11,430, and another analysis excluded those without any chronic illnesses, leaving the sample to be 7,949. A total of six regression analyses were conducted in this study to analyze first, the association of demographic characteristics and the utilization of PHI schemes, second, and third, the effect of chronic illness on the utilization, fourth to sixth to analyze specific chronic illnesses. Cross-tabulation analysis was conducted to analyse the reason for non-utilization. The list of all variables included in this study is presented in Table 1. This study has been approved by The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University.

Table 1 Variable table

Variable name	Value label
Utilization of Public Health Insurance (Dependent variable)	0 = Public health insurance not utilized 1 = One of three public health insurance utilized.
Chronic illness	0 = No chronic illness 1 = Having chronic illness(es)
Gender	0 = Male 1 = Female
Employment status	0 = Not worked 1 = Worked
Age	1 = 18-59 2 = 60-69 3 = 70+
Area	0 = Urban 1 = Rural

Variable name	Value label
Education level	1 = None to preschool level 2 = Elementary school level 3 = Secondary school to associate degree level 4 = Higher education
Marital status	1 = Single 2 = Married 3 = Separated
Live alone	0 = No 1 = Yes
Religion	0 = Other 1 = Buddhist
Type of public health insurance scheme	1 = UCS 2 = SSS 3 = CSMBS

Note: Note: As for “Type of public health insurance scheme,” Numbers of respondents answered that they are entitled to multiple PHI schemes, which may or may not be possible; i.e., the only possible combination is SSS and CSMBS, therefore some filtering was required. In this study, those who answered that they did not utilize PHI (Y = 0) are excluded from this study if they responded that they are entitled to multiple schemes (n = 59, 0.5%). Those who answered that they utilize PHI (Y = 1), regardless of their answer, whether or not they responded that they are entitled to one or multiple schemes, were assigned to the scheme group based on the scheme that they utilized in their last healthcare facility visit as assumed to be their main or actual entitled scheme.

As for chronic illness, the question after it asks the respondent “Have you ever been diagnosed with one of the following chronic illnesses?”. This means that although the question which determines chronic illness, which is “Do you have chronic illness(es) that require regular medications?” may seem subjective to the perception of health needs, the questionnaire provides a clear list of illnesses that are considered as chronic illnesses, hence regardless of the perception of what “regular medication” is, the respondents may answer that they have chronic illnesses if they see the illnesses that they have been diagnosed with in the list of answers.

As for marital status, the separated group includes both widowed and divorced.

RESULTS

Table 2 presents the characteristics of the samples included in this study. The majority of the samples are female, aged 18-59, married,

have an elementary school education level, have worked, are Buddhist, live in an urban area, do not live alone, have chronic illness(es), and are covered by UCS.

Table 2 Descriptive statistics

	Variable	Total (N = 11,430)	
		n	%
Gender	Female	6,869	60.1
	Male	4,561	39.9
Age	18-59	5,014	43.9
	60-69	3,178	27.8

	Variable	Total (N = 11,430)	
		n	%
Marital status	70+	3,238	28.3
	Single	1,258	11.0
	Married	7,160	62.7
	Separated	3,010	26.3
	None-Preschool	2,242	19.6
Education Level	Elementary School	5,628	49.3
	Secondary-Associate	2,357	20.6
	Higher	1,190	10.4
Employment	Not worked	5,261	46.0
	Worked	6,166	54.0
Religion	Other	680	5.9
	Buddhist	10,750	94.1
Area	Rural	5,362	46.9
	Urban	6,068	53.1
Live alone	No	9,863	86.3
	Yes	1,567	13.7
Chronic illness	No	3,481	30.5
	Yes	7,949	69.5
Type of PHI scheme	UCS	9,131	79.9
	SSS	973	8.5
	CSMBS	1,326	11.6
Individuals with chronic illnesses (7,949)			
Diabetes	No	5146	64.70%
	Yes	2803	35.30%
Hypertension	No	2956	37.20%
	Yes	4993	62.80%
Dyslipidemia	No	5996	75.40%
	Yes	1953	24.60%

The result of Model 1 showed that individuals who are older than 70, have less than a secondary school level education, have been employed, do not live alone, live in a rural area, have a chronic illness, and are not beneficiaries of

UCS, are more likely to utilize PHI. The most important factor was found to be chronic illness, where those with chronic illness are more likely to utilize PHI by 9.7 times.

Model 1 Binary logistic regression of PHI utilization using demographic characteristics

	B	Exp(B)	Wald	Sig.
Age 18-59	(ref)		5.545	0.063
Age 60-69	0.13	1.139	3.754	0.053
Age 70+	0.175	1.192*	4.634	0.031
None to preschool	(ref)		24.563	<.001
Elementary school	0.03	1.031	0.19	0.663
secondary school to associate degree	-0.214	0.807*	6.143	0.013
Higher education	-0.371	0.69***	12.068	<.001
Employment	-0.269	0.764***	20.131	<.001
Rural	0.158	1.171***	10.221	0.001
Live alone	-0.328	0.721***	19.49	<.001
Chronic illness	2.274	9.713***	1892.465	<.001
UCS	(ref)		38.474	<.001
SSS	0.492	1.636***	30.893	<.001
CSMBS	0.328	1.388***	13.085	<.001

Significance levels: *P < 0.05, **P < 0.01, ***P < 0.001

List of insignificant independent variables: gender, marital status, and religion

Inspection of the utilization rate of each PHI scheme, shows contradictory results where UCS showed the highest utilization rate, followed by SSS, then CSMBS, whereas Model 1 shows that the likelihood of utilization of SSS's beneficiary is the highest, followed by CSMBS, then UCS. Furthermore, the Wald value of chronic illness is 1892.465, showing that it is extremely significant in the model. The Utilization rate and prevalent of chronic illness of each PHI scheme are shown in Table 3.

To investigate this phenomenon, Model 2 was conducted to analyse the likelihood of each scheme without chronic illness.

Further analysis was conducted to see the effect of chronic illness on the utilization of PHI.

Model 3 only includes chronic illness to test its significance alone.

Table 3 Utilization rate and prevalent of chronic illness of each PHI scheme

	PHI utilized		Have chronic illnesses	
	n	%	n	%
UCS	6,416	70.3	6,450	70.60%
SSS	575	59.1	420	43.20%
CSMBS	1,046	78.9	1,079	81.40%

Model 2 Binary logistic regression of PHI utilization using demographic characteristics, excluding chronic illness

	B	Exp(B)	Sig.
Gender	-0.013	0.987	0.773
Age 18-59	(ref)		<.001
Age 60-69	0.551	1.734***	<.001
Age 70+	0.646	1.909***	<.001
Single	(ref)		0.064
Married	0.153	1.165*	0.031
Separated	0.173	1.189*	0.031
None to preschool	(ref)		<.001
Elementary school	0.013	1.013	0.838
Secondary school to associate degree**	-0.466	0.628*	<.001
Higher education	-0.581	0.56***	<.001
Employment	-0.535	0.586***	<.001
Buddhist	-0.296	0.744***	<.001
Rural	0.081	1.084	0.065
Live alone	-0.440	6.440***	<.001
UCS	(ref)		<.001
SSS	0.314	1.37***	<.001
CSMBS	0.467	1.596***	<.001
Constant	0.661	1.937	<.001

Model 3 Binary logistic regression of PHI utilization using only chronic illness

	B	Exp(B)	Sig.
Chronic Illness***	2.431	11.368	<.001
Constant	-0.627	0.534	<.001

Significance levels: *P < 0.05, **P < 0.01, ***P < 0.001

The result of Model 1-3 shows that chronic illness has a significant effect on the likelihood of PHI utilization. Model 2 shows that without chronic illness, the Nagelkerke R² value decreased, Hosmer and Lemeshow Test showed a poor fit, and overall classification accuracy decreased. All variables that were not significant in Model 1 became significant, except for two, and one that became insignificant, signifying that chronic illness has a suppressor effect. Model 3 yielded a Nagelkerke R² value similar to Model 1

(-0.012), and overall classification accuracy (+0.1%) shows similar ability to predict the utilization of PHI. Table 4 presents the Model's performance of Models 1-3.

Further analysis was conducted among those who have chronic illnesses. Model 4 shows that the likelihood of utilizing PHI for those who have chronic illnesses differs depending on the type of chronic illness. Individuals with diabetes and hypertension show a significantly higher likelihood of utilizing PHI.

Furthermore, interaction terms between age and a specific chronic illness showed that the utilization pattern within a specific illness also differs. Individuals who are over 70 and have diabetes are less likely to utilize PHI compared to those aged 15-59 ($P > 0.001$), whereas the interaction terms between age and hypertension did not show significance.

Cross-tabulation analysis of the reason for non-utilization of PHI was conducted to analyze the effect of demographic characteristics on the reason for non-utilization of PHI, shown in Table 5. The analysis was conducted and found that gender, marital status, and chronic illnesses show a significant effect on the likelihood of citing mild illness as the reason for not utilizing PHI.

Table 4 Model's performance of Model 1-3

	Nagelkerke R ²	Hosmer and Lemeshow Test	Percentage Correct
Model 1 (All variables)	0.333	0.113	79.5%
Model 2 (No Chronic illness)	0.112	0.001	72%
Model 3 (Only Chronic illness)	0.321	N/A	79.6%

Model 4 Binary logistic regression for analysing the likelihood of the 3 most common chronic illnesses (Diabetes, hypertension, dyslipidemia) along with demographic characteristics

	B	Exp(B)	Sig.
Female	-0.156	0.856*	0.027
Age 18-59	(ref)		0.496
Age 60-69	-0.036	0.964	0.680
Age 70+	-0.117	0.889	0.254
Single			0.754
Married	-0.093	0.911	0.470
Separated	-0.062	0.94	0.651
None to preschool	(ref)		<.001
Elementary school	0.033	1.033	0.698
Secondary school to associate degree	-0.233	0.792*	0.044
Higher education	-0.494	0.610***	<.001
Employment	-0.403	0.668***	<.001
Other religion	-0.076	0.927	0.599
Rural	0.070	1.072	0.296
Live alone	-0.254	1.289*	0.013
UCS	(ref)		0.009
SSS	0.147	1.159	0.31
CSMBS	0.346	1.413**	0.002
Diabetes	0.576	1.778***	<.001
Hypertension	0.162	1.176*	0.021
Dyslipidemia	-0.138	0.871	0.073

Significance levels: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 5 Cross Tabulation of “Mild illness” reason for non-utilization of PHI and demographic characteristics

	Variable	Cited Mild Illness as the main reason to not utilize PHI		Chi-square
		n	%	
Gender	Female	1,175	66.2	7.566**
	Male	888	70.9	
Age group	18-59	1,323	69.7	5.91
	60-69	432	66.5	
	70+	308	64.4	
Marital Status	Single	381	77.0	22.314***
	Married	1,234	65.8	
	Separated	447	68.0	
Education level	None-Preschool	284	69.6	5.608
	Elementary School	855	67.0	
	Secondary-Associate	643	70.5	
Employment	Higher	275	64.9	0.425
	Not worked	620	67.3	
Religion	Worked	1,443	68.5	0.074
	Other	142	62.8	
Area	Buddhist	1,921	68.6	0.784
	Urban	1,144	68.8	
Live alone	Rural	919	67.3	2.329
	No	1,689	67.6	
Type of PHI scheme	Yes	374	71.0	5.418
	UCS	1,650	68.7	
	SSS	257	69.3	
Chronic illness	CSMBS	156	61.7	115.152***
	No	1,558	74.2	
Diabetes	Yes	505	54.5	0.557
	No	1,914	68.3	
Hypertension	Yes	149	65.9	27.445***
	No	1,738	70.3	
Dyslipidemia	Yes	325	58.8	12.585***
	No	1,924	69.0	
	Yes	139	57.9	

Significance levels: *P < 0.05, **P < 0.01, ***P < 0.001

DISCUSSION

Analyses of this study have shown that demographic characteristics play a role in affecting the likelihood of utilization of PHI. The result of Model 1 showed that the trend for the utilization pattern of all three PHI is the same for UCS as the previous study suggests (6,7) The reason differs within each group, where the likelihood of utilization is higher in those with chronic illness and the elderly, where higher actual and perceived health needs lead to frequent hospital visits, which encourage the utilization of PHI (8). Individuals who have worked may face a time barrier, where their working hours may overlap those of a hospital, forcing them to choose between career and health (8). Higher levels of education are associated with better health (9, 10), where they are more likely to practice preventive measures (11). Those living in a rural area are more likely to utilize PHI. This may reflect the fact that 95% of hospitals in rural areas are public hospitals (12), leaving the respondents with fewer choices. Added that people living in rural areas are less healthy, have less access to healthcare and check-ups, and are shown to practice less preventive measures for COVID-19 (13,14). Living alone was found to be associated with feeling less rushed for time (15); hence, individuals not living alone may face time-related barriers due to long waits in public hospitals. Furthermore, living alone, independently, is difficult for low-income individuals in a weak welfare state (16), meaning that financial barriers to utilizing private healthcare facilities are lower among those living alone. The result shows that individuals older than 70 with diabetes utilized less PHI, contradicting the results of Models 1 and 4, where age, chronic illness, and specifically diabetes, increase PHI utilization. This contradiction is beyond the primary scope of this study, which may be explored in future studies.

Analysis on the reason for non-utilization found that individuals who are female, married, and have chronic illnesses, especially hypertension and dyslipidemia, are less likely to cite mild illness as the reason for non-utilization. Studies found that females tend to have a more negative perception of health risk (17,18), hence reflecting less citation of mild illness. Married individuals, although shown to have better health

and health perception (19,20,21), tend to take more preventive measures (22), added that frequent interaction among family members may encourage healthcare utilization (23), regardless of severity. Individuals with chronic illnesses tend to report negatively in self-reported evaluations (24), leading to a more cautious stance and higher frequency of healthcare utilization.

Models 1-3 demonstrated that chronic illness is a stronger predictor of PHI utilization than all other variables combined, where PHI utilization is largely a reflection of the prevalence of chronic illness among its beneficiaries.

RECOMMENDATIONS

SSS and CSMBS must consider expanding their benefit to those of the UCS with their 30 Baht Treatment Everywhere program. The program has the potential to alleviate the top three most important reasons not to utilize PHI, where expanding the coverage to private pharmacies may decrease crowding, and while allowing its beneficiaries to utilize UCS outside of the hospital's working hours. The program started one year after data collection of The 2023 HWS, meaning that the impact of the program on the utilization rate and the reason for not utilizing is yet unknown. However, if the program yields positive results, indicating a change in the reason for non-utilization and utilization rate, the adoption of the program into SSS and CSMBS must be considered with the potential risk of moral hazard that may emerge from the program.

Hospital wait time must be shortened, and service time must be flexible to accommodate those with time constraints, which were cited as the second and third most important reasons not to utilize PHI. Hospitals should allow appointments to reduce waiting time, including for specific hours outside of the normal working hours to encourage utilization for those with time restrictions, such as the employed. Hospitals offer more flexible working hours that allow for the utilization of PHI.

Instead of the raw utilization rate, the effectiveness of the policy must be further calculated to reflect the proportion of beneficiaries with chronic illnesses in each scheme. Chronic illness is an extremely

influential factor that drives the utilization rate. Without adjustment, the utilization rate of PHI may largely be dependent on the proportion of its beneficiaries with chronic illnesses.

CONCLUSION

Analysis suggests that some demographic characteristics have an impact on the likelihood of utilizing PHI. Those without chronic illnesses, have lower than secondary school education, have not worked, live in an urban area, do not live alone, and are less than 60 are significantly more likely to utilize PHI. However, the prevalence of chronic illness has a stronger impact on the utilization rate than all other factors, including the type of PHI scheme itself.

Analysis on reasons for non-utilization is limited due to survey design; however, it is clear that the top three reasons are mild illness, long wait time, and inconvenience to visit during work hours, respectively, where the ranking remains the same through all analysed groups. The most selected main reason to not utilize PHI is mild illness, where females, married individuals and individuals without chronic illnesses are less likely to cite mild illness, showing that negative perception of health increases perceived health needs, which encourages the utilization of PHI, which in turn decreases the likelihood of selecting mild illness as the reason to not utilize PHI.

Future policies should focus on increasing utilization among groups that show less utilization to ensure horizontal equity, i.e., the provision of equal healthcare to equal health needs (25), while ensuring that the populace has an appropriate understanding of health needs to prevent underutilization of healthcare. As Thailand is becoming increasingly aged, it is crucial that PHI schemes are able to provide equitable coverage to prepare for the increased health needs that come with aging, among other groups with specific barriers to utilizing PHI to achieve the goal of providing good health for all.

LIMITATIONS

A limitation of this study is that the data source did not collect income, wealth, and distance from a healthcare facility. The survey only allows its respondents to answer the most

important reason for non-utilization, meaning that the percentage of other reasons other than the most selected one (Mild illness) does not reflect the actual distribution of barriers to utilize PHI; hence, this study only analysed Mild illness. Another problem lies in the term mild illness, where the term does not specify a specific barrier, i.e., it is not possible to speculate whether or not the respondent cited mild illness because they did not see the need to visit a hospital, or whether mild illness, combined with other barriers are stopping PHI utilization.

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KEY DETERMINANTS OF UNDER-FIVE MORTALITY IN MYANMAR FOR POLICY FOCUS

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ABSTRACT

Introduction: Under-five mortality in Myanmar remains at critical values when compared to global standards. Despite having national policies for maternal and infant healthcare, Myanmar continues to rank 44th globally in under-five mortality according to World Bank data 2023.

Objectives: To examine the influence of maternal education, household wealth, and healthcare access on under-five mortality in Myanmar

Methodology: This study used secondary data from the 2015-2016 Myanmar Demographic and Health Survey (DHS). A total of 4,809 children under the age of five, obtained from the interview of 3862 mothers, were included in the analysis. A series of logistic regression models were employed to assess the association between under-five mortality with key independent variables, including maternal education, household wealth index, and place of delivery. Control variables include maternal age at childbirth, literacy, smoking behavior of the mother, birth order, child gender, living with partner, administrative area, media exposure and urban/rural residence. Robust standard error was applied.

Results: A total of 218 child deaths (4.5%) were observed in the sample. Logistic regression analysis revealed that children whose mothers had a primary education had 39% lower odds of dying before age five compared to those with no education (OR = 0.61, p=0.043, CI: 0.38-0.99), while secondary and higher education showed no statistically significant association. Children from rich households had 39% lower odds of death compared to those from poor households (OR = 0.61, p=0.031, CI: 0.39-0.96). Moreover, children delivered at health facilities had 34% reduced odds of death (OR = 0.66, p=0.031, CI: 0.45-0.96). Other control variables were not statistically significant.

Conclusion: The result of the study shows the importance of maternal education, household wealth, and healthcare access in reducing under-five mortality.

Keywords: under-five mortality, maternal education, household wealth, health care access.

INTRODUCTION

According to the World Health Organization, under-five mortality is defined as the probability of a child dying before reaching the age of five. And it is also one of the key indicators under Sustainable Development Goal 3 which aims to ensure healthy lives and promote well-being for all at all ages. Specifically, Target 3.2 aims to reduce preventable deaths of newborns and children under 5 years of age by 2030, with the target of reducing U5MR to at least as low as 25 per 1,000 live births (21). While significant global progress has been made in reducing child mortality over recent decades,

U5MR remains alarmingly high in many low- and middle-income countries (1). In the context of Myanmar, due to the development of the healthcare sector, there is a significant drop in the under-five mortality rate, resulting in a decline from 107 deaths per 1,000 live births in 1993 to 39 in 2023 (20).



Figure 1 Under-five mortality rates in Myanmar from 1993 to 2023

Determinants of Under-Five Mortality

This study adopts the Mosley and Chen framework for child mortality (2) which explained the association between under-five mortality and socioeconomic determinants, such as maternal education and household wealth.

Several studies have also examined under-five mortality in Myanmar using DHS data and other national sources, addressing various determinants such as ethnic disparities (3), socioeconomic status (4), and healthcare access (5).

Guided by previous studies and Mosley and Chen framework, this study focuses on three key determinants, maternal education, household wealth, and place of delivery.

Maternal education is a critical determinant of under-five mortality. Educated mothers are more likely to seek antenatal care, deliver in health facilities, follow vaccination schedules, and adopt better hygiene and nutrition practices (6). A study in Bangladesh also confirmed that even primary-level education significantly lowers child mortality rates. In Myanmar, however, many women especially from rural areas face cultural and economic barriers to education, which limits their access to maternal health services and information (7).

Maternal education and literacy influence under-five mortality through different pathways. Literacy allows mothers to access health information from newspapers, posters, and media, improving awareness of child care practices while mothers with formal education can get structured health knowledge through the school curriculum and enhances decision-making skills.

Household wealth also crucial indicator for under five-mortality. One research done by Barros found that across 64 countries, children in

the poorest households were more likely to die before age five compared to those in the richest households (8). Similar patterns also found in Myanmar, where financial barriers often prevent access to even basic health services, particularly for rural and ethnic minority populations (9).

Place of delivery also play major role in child survival. Delivering at a healthcare facility with trained providers has been shown to reduce the risk of complications during childbirth (10). Systematic reviews from South Asia and Africa confirm that institutional delivery significantly reduce both neonatal and under-five mortality(11).

However, in Myanmar, rural women have many challenges such as inadequate health infrastructure, shortages of trained birth attendants, and financial barriers limit the use of institutional delivery care. These constraints contribute to significant disparities in maternal and child health between urban and rural areas (9).

Other additional factors also shape child survival outcomes. These include maternal age at childbirth, maternal literacy, smoking behavior of mother, birth order, child gender, living with a partner or not, media exposure, mother's current place of administrative area, and rural/urban residence (12).

METHODOLOGY

Data Source

This study used a quantitative, cross-sectional method using secondary data from 2015-2016 Myanmar Demographic and Health Survey (MDHS). The MDHS was implemented by ministry of Health and Sport of Myanmar government and collaborated with ICF international, and technical support from DHS program. The survey employed a two-stage, stratified cluster sampling method, covering all 15 states and regions of Myanmar, and is nationally representative of women aged 15-49 and children under five. A total of 12,885 women were interviewed, and detailed birth histories were collected, enabling the estimation of child mortality indicators.

Study Population and Sample Selection

To ensure the consistency and minimize the missing data bias, the following inclusion criteria were applied; 1) Children born in the five

years prior to the survey. 2) Availability of complete information on child status. And 3) Mothers with valid responses for the key variables and controlled variables. After

following these steps, final sample of 4809 children were analyzed for regression.

Variables and Definitions

Table 1 Description of Variables

Variable name	Background variable	Description
Under-five Mortality	b5	Binary Dead/ alive
Maternal Education	v106	Categorical No education/ primary/ secondary /higher.
Household Wealth Index	v190	Categorical Poor/ middle/ rich
Place of Delivery	m15	Binary Home delivery/ delivery at a healthcare facility
Mother's age at childbirth	(b3 – v011) / 12 b3- child's birth date v011- mother's date of birth	Continuous Year
Literacy	v155	Binary cannot read/ can read
Birth order	bord	Binary First born/ second plus born
Smoke cigarettes	v463a	Binary No/ yes
Child gender	b4	Binary Boy/ girl
Currently with partner	v502	Binary No/ yes
Media exposure	v157, v158, v159	Binary No/ yes
Administrative Area	v024	Categorical Naypyitaw/ Regions/ Ethnic states
Current place	v025	Binary <u>Urban/ rural</u>

Data Analysis

Binary logistic regression is conducted for given the binary nature of the dependent variable. All models were estimated using robust standard errors to adjust for heteroskedasticity.

The model framework consists of four logistic regression models. Model 1 includes maternal education as the key independent variable, along with control variables. Model 2 replaces maternal education with household

wealth, while keeping the same set of controls. Model 3 focuses on place of delivery as the main predictor, again controlling for the same covariates. Finally, Model 4 incorporates all three key variables-maternal education, household wealth, and place of delivery and together with the control variables to assess their combined effects on under-five mortality. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported.

RESULTS***Descriptive Characteristics Analyses***

Table 2 presents the distribution of sample characteristics for all children under five (N = 4,809). Values are shown as counts and column percentages for the total sample, and as row percentages for survival status (Alive and

Deceased). Percentages in the “Alive” and “Deceased” columns represent the proportion of each outcome within the respective subgroup.

A total of 4809 children born within the five years preceding the survey conducted were included in this analysis, with an under-five mortality rate of 4.5% (218 deaths)

Table 2 Distribution of Sample Characteristics (N = 4,809)

Variable	Category	Total n (%)	Alive n (%)	Deceased n (%)
Maternal education	No education	858 (17.8%)	800 (93.2%)	58 (6.8%)
	Primary	2,128 (44.3%)	2,030 (95.4%)	98 (4.6%)
	Secondary	1,494 (31.1%)	1,440 (96.4%)	54 (3.6%)
	Higher	329 (6.8%)	321 (97.6%)	8 (2.4%)
Household wealth	Poor	2,564 (53.3%)	2,426 (94.6%)	138 (5.4%)
	Middle	869 (18.1%)	825 (94.9%)	44 (5.1%)
	Rich	1,376 (28.6%)	1,340 (97.4%)	36 (2.6%)
Place of delivery	At home	3,167 (65.9%)	2,997 (94.6%)	170 (5.4%)
	Health facility	1,642 (34.1%)	1,594 (97.1%)	48 (2.9%)
Literacy	Cannot read	1,069 (22.2%)	1,007 (94.2%)	62 (5.8%)
	Can read	3,740 (77.8%)	3,584 (95.8%)	156 (4.2%)
Birth order	First born	1,547 (32.2%)	1,492 (96.4%)	55 (3.6%)
	Second or higher	3,262 (67.8%)	3,099 (95.0%)	163 (5.0%)
Smoking behavior	No	4,674 (97.2%)	4,468 (95.6%)	206 (4.4%)
	Yes	135 (2.8%)	123 (91.1%)	12 (8.9%)
Child gender	Male	2,524 (52.5%)	2,398 (95.0%)	126 (5.0%)
	Female	2,285 (47.5%)	2,193 (96.0%)	92 (4.0%)
Living with partner	No	222 (4.6%)	207 (93.2%)	15 (6.8%)
	Yes	4,587 (95.4%)	4,384 (95.6%)	203 (4.4%)
Media exposure	No	952 (19.8%)	900 (94.5%)	52 (5.5%)
	Yes	3,857 (80.2%)	3,691 (95.7%)	166 (4.3%)
Current residence	Urban	1,012 (21.0%)	980 (96.8%)	32 (3.2%)
	Rural	3,797 (79.0%)	3,611 (95.1%)	186 (4.9%)
Administrative area	Naypyitaw	241 (5.0%)	232 (96.3%)	9 (3.7%)
	Regions	2,052 (42.7%)	1,965 (95.8%)	87 (4.2%)
	Ethnic states	2,516 (52.3%)	2,394 (95.2%)	122 (4.8%)
Mother's age at childbirth	Mean (SD)	28.91 (6.52)	28.87 (6.49)	29.87 (6.99)

Table 3 shows the under-five mortality percentage within each subgroup, along with p-values testing the association between each variable and under-five mortality. P-values are based on chi-square (χ^2) tests of association for categorical variables, and a t-test for the continuous variable (mother's age at childbirth).

P-values < 0.05 are considered statistically significant.

All three key variables showed a significant association with the under-five mortality. Among other variables, literacy, birth order, smoking behavior, current living area and mother's age at child birth are significant.

Table 3 Under-Five Mortality Rate by Characteristics and Statistical Significance

Variable	Category	Under-Five Mortality (%)	p-value
Maternal education			0.001
	No education	6.8%	
	Primary	4.6%	
	Secondary	3.6%	
	Higher	2.4%	
Household wealth			0.000
	Poor	5.4%	
	Middle	5.1%	
	Rich	2.6%	
Place of delivery			0.000
	At home	5.4%	
	Health facility	2.9%	
Literacy			0.024
	Cannot read	5.8%	
	Can read	4.2%	
Birth order			0.025
	First born	3.6%	
	Second or higher	5.0%	
Smoking behavior			0.014
	No	4.4%	
	Yes	8.9%	
Child gender			0.108
	Male	5.0%	
	Female	4.0%	
Living with partner			0.103
	No	6.8%	
	Yes	4.4%	
Media exposure			0.124
	No	5.5%	
	Yes	4.3%	
Current residence			0.018
	Urban	3.2%	
	Rural	4.9%	
Administrative area			0.511
	Naypyitaw	3.7%	

Variable	Category	Under-Five Mortality (%)	p-value
	Regions	4.2%	
	Ethnic states	4.8%	
Mother's age at childbirth	Continuous	—	0.026

Regression Result

Reference groups: Maternal education = No education; Wealth = Poor; Place of delivery = Home. All models control for mother's age at childbirth, literacy, birth order, smoking behavior, child gender, living with partner, media exposure, and administrative region. Sample size = 4,809.

All models are adjusted for control variables (maternal age at childbirth, maternal literacy, smoking behavior of mother, birth order, child gender, living with a partner or not, media exposure, mother's current place of administrative area, and rural/urban residence).

Table 4 Logistic Regression Models of Key Determinants of Under-Five Mortality in Myanmar (Odds Ratios with 95% CI)

Variable	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)
Maternal education				
Primary	0.60 (0.37–0.98) *	-	-	0.61 (0.38–0.99) *
Secondary	0.51 (0.29–0.90) *	-	-	0.59 (0.33–1.03)
Higher	0.37 (0.15–0.90) *	-	-	0.55 (0.22–1.38)
Household wealth				
Middle	-	0.99 (0.69–1.43)	-	1.04 (0.73–1.50)
Rich	-	0.53 (0.34–0.81) **	-	0.61 (0.39–0.96) *
Delivery place				
At the healthcare center	-	-	0.59 (0.40–0.86) **	0.66 (0.44–0.96) *

Note: Odds ratios (ORs) with 95% confidence intervals (CI) are reported.

*, **, and *** indicate statistical significance at the 0.05, 0.01, and 0.001 levels, respectively

Summary of the Key Findings

Maternal education showed a consistent survival effect for under-five children across models. In Model 1, mothers with all kinds of levels of education had significantly lower odds of under-five mortality compared to mothers with no education. But this effect only remained in the primary education level of mothers in Model 4 after adjusting for wealth and delivery place (OR = 0.61, 95% CI = 0.38–0.99, p = 0.043).

Household wealth was also strongly associated with under-five mortality. In Model 2, children from rich households had significantly lower odds of mortality and this association remained significant in the full Model 4 (OR = 0.61, 95% CI = 0.39–0.96, p = 0.032). Middle

wealth status, however, did not show significant associations in any model.

Place of delivery also had a significant protective effect. In Model 3, childbirth in healthcare center was associated with reduced mortality and this association remained significant in Model 4 (OR = 0.66, 95% CI = 0.44–0.96, p = 0.031), indicating that access to healthcare facilities during childbirth plays an important role in child survival.

Other variables such as maternal age at childbirth, literacy, birth order, smoking, child gender, living with partner, current residence and media exposure were not significantly associated with under-five mortality in the adjusted models.

DISCUSSION

Similar to the global context, this study found that higher maternal education is associated with lower under-five mortality (13). This study aligns with previous studies that stated educated mothers are more likely to adopt health-promoting behaviors, seek timely care, and utilize preventive services (14). However, in this study, secondary and higher education were not significant in the full model. This may reflect contextual factors in Myanmar, where educational quality is uneven and literacy alone may not translate into improved health-seeking behavior. In addition, gender norms and traditional household structures in Myanmar may limit women's decision-making power regarding healthcare, even when they have formal education (15). Furthermore, barriers such as poverty and poor healthcare access may overshadow the effects of education alone, particularly for women in rural or ethnic minority areas. Previous research in Southeast Asia also found that the impact of education can be mediated by household wealth and healthcare access, which may explain the weaker effect observed here (16).

The results of household wealth from this study are also consistent with many low and middle-income country case studies (8). Poor households face multiple disadvantages, for example lower access to quality food, clean water, and healthcare services, that increase mortality risk. In Myanmar, financial barriers remain a major obstacle to healthcare access, particularly in rural areas (17).

Delivery place was strongly associated with lower under-five mortality, showing the same findings from studies across South Asia and Sub-Saharan Africa (11). At the health care center, child births are monitored by Skilled birth attendants who can manage complex birth complications, and delayed childbirth, which leads to a reduction in mortality rate. In Myanmar, many poor mothers still give birth at home due to transport costs, fear of informal fees, or lack of facilities (UNFPA, 2021).

CONCLUSION

This study examined under-five mortality in Myanmar, identifying maternal education, household wealth, and place of

delivery as key determinants. Primary education, higher household wealth, and healthcare facility deliveries significantly reduced child mortality risks. These findings emphasize the importance of integrated interventions targeting social and healthcare inequalities. Addressing these determinants is crucial for Myanmar to develop necessary interventions to reduce preventable under-five deaths across both urban and rural communities.

LIMITATIONS

This study has some limitations that should be acknowledged. First, because the analysis relies on cross-sectional data, it cannot establish causal relationships between the independent variables and under-five mortality. Second, there may be reporting errors in some of the data, such as smoking and literacy status. In addition, not all relevant determinants, such as antenatal care and nutrition, were included in the analysis, which may have limited the comprehensiveness of the results. Finally, certain variables were excluded due to collinearity issues, which may have constrained the scope of the models.

RECOMMENDATIONS

The following three policy options are proposed

Policy Option 1: Lifeline for two

The policy is inspired by the successful Nigeria Abiye Project (18). This approach seeks to provide comprehensive support for poor pregnant. Expectant mothers would receive a free basic mobile phone to ensure continuous communication with trained healthcare providers. In addition, the program would guarantee free teleconsultation services, prenatal care, and safe delivery services. To further reduce maternal and child mortality risks, free ambulance transportation would be made available for labor and emergency situations.

Policy Option 2: Increase General Health Education Campaigns

This policy involves expanding mass media campaigns (radio, TV, posters) to educate

mothers and communities on the importance of maternal healthcare and institutional delivery. During the COVID-19 pandemic, public health messaging campaigns proved effective in spreading simple behaviors such as handwashing, mask-wearing, and social distancing (19).

Policy Option 3: Targeted Financial Support for Institutional Delivery through Existing Health Protection Schemes

This policy consists of providing delivery fee waivers or cash transfers for poor mothers who deliver at public healthcare facilities. It can be integrated with existing social health protection schemes such as township level funds. Partner with local health centers to identify eligible mothers using existing community health volunteers and poverty databases.

This policy directly responds to the study's finding that place of delivery matters, and focuses on financial barriers that prevent mothers from choosing institutional care.

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MENTAL WELL-BEING AND ITS ASSOCIATED FACTORS IN HIGH SCHOOL STUDENTS IN NAKHON RATCHASIMA PROVINCE, THAILAND

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ABSTRACT

Introduction: Mental well-being plays a significant role in adolescent development, influencing life satisfaction, interpersonal relationships, and stress management. Poor mental health in this age group is associated with increased risks of anxiety, depression, and behavioral issues. Understanding factors associated with mental well-being is essential for informing targeted interventions, especially in Thai adolescents, who often face considerable academic and social pressures.

Objectives: This study aimed to examine the level of mental well-being and its associated factors among high school students in Nakhon Ratchasima Province, Thailand.

Methodology: A cross-sectional study was conducted in May 2025 among 458 secondary school students from an extra-large school in Nakhon Ratchasima province. Participants were selected using multistage and convenience sampling. The 10-item Brief Emotional Intelligence Scale (BEIS-10) and WHO-5 Well-Being Index were used to assess emotional intelligence and mental well-being, respectively. Data were collected via an online survey. Descriptive statistics summarized demographic data, and logistic regression identified factors significantly associated with mental well-being.

Results: Among the 458 participants, 360 (78.6%) reported good mental well-being, while 98 (21.4%) reported poor mental well-being. Logistic regression analysis identified significant associations between mental well-being and gender. Female participants had 69.1% lower odds of reporting good mental well-being compared to males (OR = 0.309, 95% CI: 0.186–0.513, $p < .001$). Regarding external support, those with moderate support had significantly lower odds of good mental well-being compared to those with high support (OR = 0.371, 95% CI: 0.231–0.598, $p < .001$). The final multiple logistic regression model indicated that mental well-being in this adolescent population is primarily influenced by gender and family relationships, rather than by peer relationships or other external factors.

Conclusion: This study highlights the importance of gender and family-based support systems in promoting adolescent mental well-being. Targeted interventions should focus on strengthening family dynamics and addressing gender-specific mental health needs to enhance overall adolescent mental health outcomes.

Keywords: Adolescents, Emotional Intelligence, Mental well-being, Students, Thailand.

INTRODUCTION

Mental well-being is a fundamental component of overall health, particularly during adolescence, a period marked by rapid physical development, emotional change, and evolving social roles. (1),(2). Adolescents with positive mental well-being often report greater life satisfaction, better perceived physical health, higher academic self-concept, stronger parental and peer support, and greater resilience in managing stress (3), (4). Conversely, poor mental

well-being during adolescence increases the risk of anxiety, depression, and behavioral problems, which may persist into adulthood if unaddressed (3), (5).

In Thailand, adolescents are increasingly exposed to academic pressures, social media influences, and shifting family dynamics, factors that may negatively impact mental health (6). According to the Thai Ministry of Public Health (2023), Nakhon Ratchasima Province ranks among the top six provinces with the highest

prevalence of intentional self-harm. Alarming, adolescents account for the highest rates of suicide attempts when classified by age group (7). Identifying protective factors that foster adolescent mental well-being is therefore critical for informing prevention strategies and early intervention. Established protective factors include family and peer support, self-esteem, and physical health, all of which help reduce mental health risks and enhance resilience in young people (8), (4).

Although adolescent mental health has received increasing national attention, empirical research on protective factors for mental well-being remains limited, especially within specific provincial contexts. Particularly, Nakhon Ratchasima, Thailand's largest province by area, reports alarmingly high rates of intentional self-harm and suicide attempts (7), yet few studies have examined its adolescent population. This study addresses this gap by determining protective factors associated with mental well-being among high school students in the province, aiming to inform targeted policies and youth mental health programs in the Thai context.

METHODOLOGY

Study design

This study employed a cross-sectional survey design to assess mental well-being and associated factors among high school students. Data were collected using an online questionnaire administered in May 2025.

Study Participants

A total of 458 students from Grades 10 and 11 were recruited from an extra-large public secondary school in Nakhon Ratchasima Province, Thailand. The school was selected for its large and diverse student population, ensuring adequate representation. Participants were chosen using a combination of purposive, random, and convenience sampling methods. (1) purposive sampling was used to select Nakhon Ratchasima Province, which ranks among the top six provinces for intentional self-harm, with adolescents showing the highest suicide attempt rates by age group. (2) random sampling was applied to select an extra-large public secondary school within the province. (3) convenience sampling was then used to recruit 458 students

currently enrolled in Grades 10 and 11. This sample size was proportionally calculated from the total population of 10,889 Grade 10 and 11 students in schools under the Office of the Basic Education Commission in Nakhon Ratchasima. The eligible criteria were (1) currently enrolled as a Grade 10 or Grade 11 student at the selected school, (2) aged between 15 and 18 years, (3) able to read and understand Thai, and (4) access to the internet and a device to complete the online questionnaire. All students completed the online survey voluntarily.

Data collection

Data were collected via online self-administered questionnaire. Four validated tools were used in this study. General characteristics included age, gender, education level, physical health, and living conditions. Mental well-being was assessed using the Thai version of the WHO-5 Well-being Index (9), with scores ranging from 0 to 25; a cut-off score of <13 indicated poor well-being, and ≥ 13 indicated good well-being. Emotional intelligence (EI) was measured using the 10-item Brief Emotional Intelligence Scale (BEIS-10) (10), with responses categorized into three levels: below average, average, and high. External support was evaluated using the Thai version of the Multidimensional Scale of Perceived Social Support (MSPSS) (11), which includes subscales for family, peer, and significant other support, with overall support levels classified as low, moderate, or high.

Data Analysis

Normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Means and standard deviations were reported for normally distributed data; otherwise, medians, interquartile ranges, and range values were used. Categorical variables were presented as frequencies and percentages.

Binary logistic regression was used to examine associations between independent variables including age, gender, education level, physical health, living conditions, emotional intelligence (EI), and external support and dependent variable; “mental well-being” categorized as good or poor. Variables with $p < 0.05$ in binary logistic regression analysis were included in the multiple logistic regression

model. Odds ratios (OR), adjusted odds ratios (AOR), and 95% confidence intervals (CI) were reported. A p-value < 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics Version 28.

RESULTS

Mental well-being scores were used to categorize the 458 participants into two groups as poor (0–12 points) and good (13–25 points). Based on this classification, 360 students (78.6%) had good mental well-being, while 98 (21.4%) were categorized as having poor mental well-being (Table 1).

A higher proportion of males (88.4%) reported good mental well-being compared to females (70.2%). Good mental well-being was reported by 77.7% of Grade 10 students and 82.7% of Grade 11 students. Interestingly, students who had experienced physical health issues reported slightly higher rates of good

mental well-being (80.5%) than those who had not (78.2%). By living arrangement, 78% of students living with parents and 86.7% of those living with others (e.g., peers or relatives) reported good mental well-being.

The median emotional intelligence (EI) score was 38 (IQR = 34–41), with scores ranging from 10 to 50. Participants with high EI (\geq 95th percentile) had the highest proportion of good mental well-being (92.9%), whereas those with below-average EI (6–24th percentile) had the highest proportion of poor mental well-being (28.4%).

Regarding external support, students with high overall support reported good mental well-being at 83.7%. When disaggregated by type, high family support and high significant other support were associated with good mental well-being at 85.4% and 82.6%, respectively (Table 1).

Table 1 Distribution of mental well-being by general characteristics, emotional intelligence, and external support factors (n = 458)

Factors	Mental well-being	
	Poor (n, %)	Good (n, %)
General Characteristics		
Age (15-18 years)	98 (21.4%)	360 (78.6%)
Median = 15, IQR = 16-15, Min =15, Max = 18		
Gender		
Male	24 (11.6%)	183 (88.4%)
Female	73 (29.8%)	172 (70.2%)
Others	1 (16.7%)	5 (83.3%)
Education level		
Grade 10	84 (22.3%)	293 (77.7%)
Grade 11	14 (17.3%)	67 (82.7%)
Physical health		
Never	83 (21.8%)	298 (78.2%)
Ever	15 (19.5%)	62 (80.5%)
Living condition		
Living together with Parents	94 (22.0%)	334 (78.0%)
Others (living with peers or relatives)	4 (13.3%)	26 (86.7%)
Emotional Intelligence		
Low (\leq 5 percentile)	2 (8.3%)	22 (91.7%)
Below Average (6–24 percentile)	27 (28.4%)	68 (71.6%)
Average (25–75 percentile)	54 (23.9%)	172 (76.1%)

Factors	Mental well-being	
	Poor (n, %)	Good (n, %)
Above Average (76–94 percentile)	13 (15.3%)	72 (84.7%)
High (≥ 95 percentile)	2 (7.1%)	26 (92.9%)
Median = 38, IQR = 41-34, Min = 10, Max = 50		
External Supports		
Low support	5 (17.2%)	24 (82.8%)
Moderate support	44 (34.4%)	84 (65.6%)
High support	49 (16.3%)	252 (83.7%)
Median = 5.75, IQR = 6.42-4.67, Min = 1, Max = 7		
Family relationship		
Low support	9 (25.7%)	26 (74.3%)
Moderate support	49 (32.9%)	100 (67.1%)
High support	40 (14.6%)	234 (85.4%)
Median = 5.72, IQR = 6.5-4, Min = 1, Max = 7		
Peer relationship		
Low support	4 (16.0%)	21 (84.0%)
Moderate support	36 (27.9%)	93 (72.1%)
High support	58 (19.1%)	246 (80.9%)
Median = 6, IQR = 6.5-4.5, Min = 1, Max = 7		
Significant other relationship		
Low support	5 (19.2%)	21 (80.8%)
Moderate support	41 (30.8%)	92 (69.2%)
High support	52 (17.4%)	247 (82.6%)
Median = 5.75, IQR = 6.5-4.68, Min = 1, Max = 7		

Table 2 presents the results of binary and multiple logistic regression analyses examining factors associated with mental well-being among adolescents ($n = 458$). The analysis focused on general characteristics, emotional intelligence, and external support to identify predictors of good mental well-being. Crude odds ratios (ORs) from the binary model and adjusted odds ratios (aORs) from the multiple model are reported with 95% confidence intervals (CIs) and p-values.

In the binary logistic regression, female students had significantly lower odds of reporting good mental well-being compared to males (OR = 0.309, 95% CI: 0.186–0.513, $p < .001$), indicating a 69.1% reduction in likelihood. Regarding external support, students with moderate support had significantly lower odds of good mental well-being compared to those with high support (OR = 0.371, 95% CI: 0.231–0.598, $p < .001$).

Additionally, the results of multiple logistic regression analysis (Table 2) reveals that female gender is the strongest predictor of poor mental well-being in this respondent. After controlling for all other variables in the model, female participants demonstrate significantly lower odds of having good mental well-being compared to their male counterparts (aOR = 0.276, 95% CI: 0.163-0.470, $p < 0.001$). Specifically, female students have approximately 72% lower odds of experiencing positive mental well-being than male participants. Family support emerges as the second significant predictor in the final model. Participants who receive moderate levels of family support show significantly poorer mental well-being outcomes compared to those receiving high family support (aOR = 0.424, 95% CI: 0.213-0.842, $p = 0.014$). These participants have approximately 58% lower odds of having good mental well-being than who with high family support. This finding suggests a response

relationship where higher levels of family support are associated with better mental health outcomes.

Table 2 Binary and Multiple Logistic Regression Analysis of factors associated with mental well-being (n=458)

Variables	Binary Logistic Regression		Multiple Logistic Regression	
	OR (95% CI)	p-value	aOR (95% CI)	p-value
General Characteristics				
Gender				
Male	Ref.			
Female	0.309 (0.186 -0.513)	<.001*	0.276 (0.163-0.470)	<.001*
Others	0.656 (0.073-5.852)	0.706	0.739 (0.076-7.172)	0.794
Education level				
Grade 10	Ref.			
Grade 11	1.372 (0.734-2.563)	0.321		
Physical health				
Never	0.869 (0.470-1.605)	0.653		
Ever	Ref.			
Living condition				
Living together with Parents	Ref.			
Others (living with peers or relatives)	0.547 (0.186-1.605)	0.272		
Emotional Intelligence				
Low	Ref.			
Average	1.173 (0.713-1.931)	0.529		
High	4.189 (0.937-18.733)	0.061		
External Supports				
Low support	0.933 (0.340-2.565)	0.0894	1.271 (0.100-16.173)	0.853
Moderate support	0.371 (0.231-0.598)	<.001*	0.541 (0.168-1.739)	0.302
High support	Ref.			
Family relationship				
Low support	0.494 (0.216-1.131)	0.095	0.273 (0.058-1.290)	0.101
Moderate support	0.349 (0.216-0.563)	<.001*	0.424 (0.213-0.842)	0.014*
High support	Ref.			
Peer relationship				
Low support	1.238 (0.409-3.744)	0.706	2.155 (0.424-10.968)	0.355
Moderate support	0.609 (0.377-0.984)	0.043*	1.180 (0.546-2.549)	0.674
High support	Ref.			
Significant other relationship				
Low support	0.884 (0.319-2.452)	0.813	1.263 (.199-8.001)	0.804
Moderate support	0.472 (0.294-0.759)	0.002*	0.985 (0.388-2.504)	0.975
High support	Ref.			

Note: OR = Odds Ratio; aOR = Adjusted Odds Ratio; CI = Confidence Interval; Ref = Reference category.

*Statistically significant difference (p- value < .05)

DISCUSSION

This study explored mental well-being and its associated factors among high school students in Nakhon Ratchasima Province, Thailand. The findings revealed several key associations that contribute to understanding adolescent mental health in this context. First, the majority of participants (78.6%) reported good mental well-being, while 21.4% were categorized as having poor mental well-being a proportion comparable to national and international data on adolescent mental health issues (12). These results highlight the need for designed mental health care plans targeting school-aged populations. Targeted mental health screening, early identification, and timely access to professional support are critical. Without appropriate intervention, adolescent mental health challenges can persist into adulthood and disrupt various domains of development (13) (14).

Second, the study identified a clear gender disparity in mental well-being. Female students were significantly less likely to report good mental well-being, even after adjusting for external supports and other covariates. This aligns with prior research showing that adolescent girls are more likely to experience psychological distress, depressive symptoms, and anxiety compared to boys (15) (16). While female mental health needs are clearly a priority, early mental health interventions for male adolescents should not be overlooked, as they often face stigma and underreport symptoms. Gender differences in mental health may stem from a range of biopsychosocial factors, including hormonal fluctuations, body image concerns, and increased social pressures during adolescence (17). These results point to the need for gender-sensitive approaches in school-based mental health programs including promoting emotional regulation skills, self-esteem, addressing gender-based stigma, and fostering safe, supportive learning environments.

Third, another significant factor influencing mental well-being was external support, particularly family relationships. Previous studies have identified social support especially from family and significant others as a protective factor that improves mental health by

reducing perceived stress and enhancing positive affect (18). Adolescents who perceived high levels of external support reported better mental well-being than those with low backing. This finding is consistent with The Dual-Factor Model of Mental Health in Youth, which emphasizes youth with complete mental health who perceive more social support from significant adults in their lives than disturbed youth (4). Additionally, it was consistent with Lin, Chen (19) who found that social support was not only more strongly associated with well-being but more significantly with self-concept. Therefore, family support also played a significant role in predicting mental well-being. Adolescents who reported strong family relationships were more likely to have good mental health, underscoring the protective value of familial support.

However, this study has several limitations. Data were collected from a single extra-large public school in one province, which restricts the generalizability of the findings to other regions or school types. Adolescents in rural or smaller schools may experience different psychosocial contexts. Future research should include more diverse populations across multiple provinces and school settings. Longitudinal designs could help clarify causal relationships, and further studies should also examine additional protective and risk factors, such as digital media use, academic pressure, and school climate, to gain a more comprehensive understanding of adolescent mental well-being in Thailand.

CONCLUSION

This study identified gender and family support as significant protective factors associated with mental well-being among high school students in Nakhon Ratchasima Province. Female students were significantly less likely to report good mental well-being than males, highlighting the need for gender-sensitive approaches. Additionally, strong family relationships were linked to better mental health outcomes. These findings emphasize the importance of school-based interventions that not only support emotional development but also actively engage families in promoting adolescent mental well-being.

RECOMMENDATION

Based on the findings, it is recommended that school-based mental health programs be designed with gender sensitivity and include components that promote emotional regulation, stress management, and self-esteem. Efforts should be made to reduce stigma and create safe, supportive environments for all students. Additionally, strategies to enhance family involvement such as parent education programs and school home collaboration initiatives should be prioritized to strengthen the support system for adolescents. Future studies should expand to include more diverse and representative adolescent populations across Thailand and investigate additional protective and risk factors influencing mental well-being. A mixed-methods or longitudinal approach could provide deeper insights into the complex dynamics shaping adolescent mental health.

ETHICAL DECLARATION

This study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University, in May 2025, with the certificate of approval number 127/68. Informed consent was obtained from all participants prior to data collection.

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INTENTIONS TO REDUCE SUGAR-SWEETENED BEVERAGE CONSUMPTION UNDER A PROPOSED EXCISE TAX: EVIDENCE FROM SOUTH SULAWESI, INDONESIA

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ABSTRACT

Introduction: Sugar-sweetened beverages (SSBs) significantly contribute to the global rise in obesity, diabetes, and other non-communicable diseases (NCDs). High consumption leads to excessive sugar intake, increasing the risk of long-term health complications, including cardiovascular diseases and certain cancers. These conditions not only affect individual health but also impose heavy economic burdens on healthcare systems due to treatment costs, productivity losses, and long-term disability. Without interventions to reduce consumption, the burden of NCDs will continue to grow. Several countries introduced excise taxes on SSBs to decrease the consumption. In Mexico, a 2014 SSB tax led to a 7.6% decline in purchases over two years, particularly among low-income groups, demonstrating how fiscal policies can drive healthier consumption patterns. In Indonesia, where 21.8% of adults are obese and 10.9 million people have diabetes, such an excise tax has not implemented yet. Understanding behavioural responses to a proposed tax is important to inform policy maker.

Objectives: This study assesses behavioural responses to a proposed SSB tax, focusing on the public's intention to reduce consumption.

Methodology: A cross-sectional survey was conducted among adults aged 18 and older in South Sulawesi. The questionnaire included demographics, health status, consumption behaviours, and taxation attitudes. Consumption reduction was assessed through a direct yes-or-no question asking whether respondents would reduce SSB purchases if an excise tax were applied. Logistic regression analysed data from 274 respondents to identify influencing factors.

Results: The study found that out of 274 respondents in South Sulawesi, 66.4% expressed intentions to reduce their SSB consumption if a 20% tax were implemented. Bivariate analysis identified significant associations between consumption reduction intentions and variables such as gender, age, education, BMI, mental health, and perceived SSB availability. However, in multivariable analysis, only BMI remained significantly associated. Respondents with non-normal BMI (underweight, overweight, or obese) were significantly less likely to report intentions to reduce consumption compared to those with normal BMI (AOR = 0.462; 95% CI: 0.270–0.792; p = 0.005).

Conclusion: The findings suggest that individuals with normal BMI are more responsive to potential SSB taxation policies. While several factors showed significant associations in bivariate analysis, BMI remained the only independent predictor in the multivariable model. These results underscore the importance of targeting nutrition and health education efforts alongside fiscal policies to effectively reduce SSB consumption in Indonesia.

Keywords: Sugar-Sweetened Beverage, excise tax, consumption reduction, Indonesia.

INTRODUCTION

Sugar consumption has become a major global health concern, with even a modest 1% increase in soft drink intake associated with significant rises in overweight, obesity, and diabetes prevalence (1). The World Health Organization (WHO) recommends limiting free sugars to less than 10% of total daily energy intake—about 50 grams or 12 teaspoons per day for adults—to reduce the risks of obesity and related diseases (2,3). Multiple meta-analyses have confirmed that excessive sugar intake is linked to weight gain, while reducing sugar consumption supports weight loss (2). Furthermore, high sugar intake has been associated with increased risks for at least 12 types of cancer, elevated all-cause mortality, and disproportionately severe impacts in low- and middle-income countries (3, 4).

Recent global data indicate a dramatic rise in obesity: in 2022, an estimated 2.5 billion adults were overweight, including over 890 million living with obesity(5). Diabetes has similarly surged in burden, moving from the 20th leading cause of disability-adjusted life years (DALYs) in 1990 to the 8th by 2019, highlighting an urgent need for interventions (6). Excise taxes on sugar-sweetened beverages (SSBs) have been adopted in several countries to reduce sugar consumption. For example, Barcelona’s implementation of a sugar tax in 2017 led to a 7.7% decrease in SSB consumption in its first year, with further reductions in subsequent years (7). Similar policies in Mexico, Chile, and the UK have demonstrated positive impacts on public health and fiscal revenue (8).

Indonesia faces a growing burden of obesity and diabetes, with national data showing obesity affects 21.8% of adults and diabetes impacts over 10.9 million people, many of whom are undiagnosed (9). High body mass index (BMI) ranks among the top five risk factors for non-communicable diseases (NCDs) in Indonesia (10). The economic burden is equally substantial, with estimates suggesting a potential saving of IDR 40.6 trillion from implementing a 20% SSB tax, while the total indirect costs of overweight and obesity

are estimated at IDR 368.25 trillion (11, 12). A 20% ad valorem tax could generate approximately IDR 3.4 trillion (US\$ 223.9 million) in revenue each year, supporting Indonesia’s health financing needs (13).

Despite global evidence supporting the effectiveness of SSB taxation, Indonesia lacks empirical data on behavioural responses and the factors influencing intentions to reduce SSB consumption under such a policy. Under Indonesia’s Law Number 37 of 2007, excise taxes can be applied to goods that pose negative societal impacts, including SSBs. Evidence from other countries shows that such taxes can reduce consumption, promote healthier behaviours, and provide crucial funding for health initiatives. For instance, part of Mexico’s sugar tax revenue was allocated to water infrastructure projects in schools, improving children’s access to healthier drink options(12). Given the high prevalence of SSB consumption in Indonesia—reaching 46.5% in South Sulawesi, close to the national average of 45.7%—understanding behavioural responses to potential SSB taxation is vital. This study investigates the factors influencing individuals’ intentions to reduce SSB consumption if an excise tax were introduced. By examining these intentions under a hypothetical tax scenario, the study captures behavioural responses crucial for informing future policy in contexts where actual taxation is yet to be implemented. Clarifying these behavioural patterns provides evidence-based insights to help policymakers design targeted and effective SSB taxation strategies.

To support this aim, a conceptual framework was developed to illustrate the relationships between demographic characteristics, purchasing behaviours, self-rated health, and individuals’ intentions to reduce SSB consumption under a proposed excise tax. The conceptual framework (figure 1) serves as a theoretical guide to systematically analyse how individual and environmental factors may influence intentions to reduce SSB consumption under a proposed excise tax.

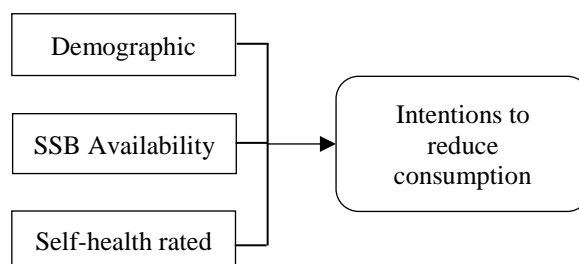


Figure 1 conceptual framework

METHODOLOGY

Study Design

This study used a cross-sectional design with a structured questionnaire administered through face-to-face interviews. The research aimed to evaluate respondents' intentions to reduce consumption of sugar-sweetened beverages (SSBs) under a hypothetical excise tax scenario among adults in South Sulawesi, Indonesia. A cross-sectional approach was selected to capture a snapshot of respondents' demographics, purchasing habits, attitudes toward taxation, and intentions to reduce SSB consumption.

Study setting and population

The study was conducted in South Sulawesi, selected because the province's population age distribution closely mirrors Indonesia's national demographic pyramid, and the rate of sugar-sweetened beverage (SSB) consumption in South Sulawesi is comparable to the national average, making it representative of the broader Indonesian population. After selecting South Sulawesi, Makassar was chosen among other areas in the province due to its high population density, which provides access to a diverse and concentrated pool of potential respondents. Eligible participants were adults aged 18 years and older who had lived in Makassar for at least six months. non-Indonesian citizens were excluded from participation. The final analysis included 274 respondents. Sampling was carried out systematically in public areas with high pedestrian traffic, including traditional markets, urban parks, shopping centres, and universities, where every fifth eligible adult passerby was invited to participate after providing consent. The sample size of 274 respondents was determined based on logistical feasibility and prior studies using similar methodologies. Although a formal power calculation was not conducted, this sample size allowed for exploratory regression analysis while maintaining adequate representation of diverse demographic subgroups.

In accordance with the theoretical framework presented in Figure 1, the study examined how various factors influenced intentions to reduce SSB consumption under a proposed excise tax. Demographic characteristics—including gender, age, monthly household income, and education—were measured using closed-ended questions. Income was reported as an open-ended monthly household income, later categorized based on the median (IDR 4,000,000)

due to non-normal distribution. Education was grouped into “no-secondary education” and “higher education” based on initial four-category responses. Purchasing behaviours were assessed by asking about usual buying locations and perceived availability of SSBs. Self-rated health status was measured using the SF-8 instrument, grouped into physical and mental health domains. The outcome variable—intention to reduce SSB consumption—was measured via a binary yes-or-no response under a hypothetical 20% tax scenario. These variables were analysed using logistic regression to determine their association with the primary outcome.

Data Collection and Measurement

Data collection commenced following ethical approval from the Central Human Research Ethics Committee of Mahidol University and was completed by the second week of June 2025. Three trained data collectors carried out face-to-face interviews using digital questionnaires deployed through the Kobo Toolbox platform, which allowed real-time data entry and reduced manual errors. Before participation, respondents received information about the study's purpose, procedures, confidentiality, and voluntary nature before providing informed consent.

The structured questionnaire collected information on key demographic variables, including gender, age, monthly household income, highest level of formal education completed, and Body mass index (BMI) was calculated from self-reported height and weight using the formula $\text{weight (kg)} / \text{height squared (m}^2\text{)}$ which may be subject to reporting bias and could affect the accuracy of the BMI values. Purchasing behaviour variables included usual SSB purchasing locations (e.g., supermarkets, schools, meal packages, online platforms) and the perceived availability of SSB products around the respondents' environment, assessed through agreement with statements such as “SSBs are easy to find where I live.”

Self-rated health was assessed using the SF-8 instrument, which included eight questions later grouped into two domains for analysis: physical health (four questions) and mental health (four questions), with higher scores indicating better perceived health status. The primary outcome variable was respondents' intention to reduce SSB consumption if an excise tax were introduced. This was assessed through a direct yes-or-no question: “If a tax of 20% or higher is

implemented, would you consider reducing your consumption of SSB products?” Respondents who answered “yes” were classified as having the intention to reduce their consumption. The 20% threshold was selected based on international practices where tax rates at or above this level have demonstrated significant behavioural impacts on consumption, such as in Mexico and the United Kingdom. This threshold also aligns with global health recommendations (WHO) for meaningful fiscal measures. Throughout data collection, the principal investigator monitored progress daily to ensure data completeness and accuracy.

RESULT

Table 1 Participant Characteristic (n=274)

Variable	n	Percentage (%)
Gender		
Female	177	64.6
Male	97	35.4
Age		
<=24	143	52.2
>24	131	47.8
Income		
<=4000000	139	50.7
>4000000	135	49.3
Education		
No to high education	142	51.8
Higher education	132	48.2
BMI		
Normal	151	55.1
Not normal	123	44.9
Physical health		
<=4	140	51.1
>4	134	48.9
Mental health		
<=8	174	63.5
>8	100	36.5
SSB is Easy to find around neighborhood		
Yes	255	93.1
No	19	6.9
SSB Available in Supermarket		
Yes	222	81.0
No	52	19.0
SSB easy to find in School, Office and other		
Yes	262	95.6
No	12	4.4
SSB are often included in Meal package		
Yes	245	89.4
No	29	10.6

Statistical analysis

Data were analysed using SPSS version 21. Descriptive statistics summarized respondents’ demographic characteristics, purchasing behaviours, and self-rated health scores. The association between the dependent variable—intention to reduce SSB consumption under a proposed 20% or higher excise tax—and independent variables was examined using binary logistic regression, with odds ratios (ORs) and 95% confidence intervals reported. A p-value ≤ 0.05 was considered statistically significant.

Variable	n	Percentage (%)
SSB easy to find in Online shopping		
Yes	255	93.1
No	19	6.9

Table 1 present a total of 274 respondents completed the survey. Most participants were female (64.6%), while 35.4% were male. The sample was relatively balanced by age, with 52.2% aged 24 years or younger and 47.8% older than 24. Monthly household income was split evenly, with 50.7% earning IDR 4,000,000 or less, and 49.3% earning above that level. Income data were collected using open-ended questions during the interview and later categorized based on the median value of IDR 4,000,000 from the collected dataset. This approach was chosen because the income distribution was not normally distributed, as confirmed by normality testing, and the median was used as a suitable cutoff to create binary groups for analysis.

Education levels were also similar, with 51.8% having a lower level of education (up to secondary school) and 48.2% having completed higher education. In the questionnaire, respondents were initially presented with four options for educational attainment: no formal education, primary education, secondary education, and

tertiary/higher education. To facilitate binary logistic regression analysis and ensure adequate sample size within each category, these levels were subsequently grouped into two categories based on the distribution of responses. The resulting binary variable classified participants as either having no to secondary education or higher education. In BMI variable, 55.1% of respondents were classified as normal weight, and 44.9% were either underweight or overweight/obese. Regarding self-rated health, 51.1% of respondents reported physical health scores of 4 or below, while 48.9% scored higher than 4. For mental health, 63.5% had scores of 8 or below, with 36.5% scoring above 8.

Most participants reported that SSBs were easy to find around their neighbourhood (93.1%), readily available in supermarkets (81.0%), and easy to access in schools, offices, or similar locations (95.6%). Additionally, 89.4% of respondents said SSBs were often included in meal packages they purchased, and 93.1% noted that SSBs were easy to find through online shopping platforms.

Table 2 Participants' Characteristics and Association with Intention to Reduce Consumption.

Variable	n	Reduction 20% n (%)		X ²	p-value
		No	Yes		
Gender				5.668	0.017*
Female	177	69 (39.0)	108 (61)		
Male	97	24 (24.7)	73 (75.3)		
Age				10.134	0.001*
≤24	143	61 (42.7)	82 (57.3)		
>24	131	32 (24.4)	99 (75.6)		
Income				0.216	0.642
≤4,000,000	139	49 (35.3)	90 (64.7)		
>4,000,000	135	44 (32.6)	91 (67.4)		
Education				5.052	0.025*
Low education	142	57 (40.1)	85 (59.9)		
High education	132	36 (27.3)	96 (72.7)		

Variable	n	Reduction 20% n (%)		X ²	p-value
		No	Yes		
BMI				8.330	0.004*
Normal	151	40 (26.5)	111 (73.5)		
Not normal	123	53 (43.1)	70 (56.9)		
Physical health				2.768	0.096
≤4	140	41 (29.3)	99 (70.7)		
>4	134	52 (38.8)	82 (61.2)		
Mental health				10.212	0.001*
≤8	174	47 (27.0)	127 (73.0)		
>8	100	46 (46.0)	54 (54.0)		
SSB is Easy to find around neighborhood				5.224	0.022*
Yes	255	82 (32.2)	173 (67.8)		
No	19	11 (57.9)	8 (42.1)		
SSB Available in Supermarket				0.288	0.591
Yes	222	77 (34.7)	145 (65.3)		
No	52	16 (30.8)	36 (69.2)		
SSB easy to find in School, Office and other				9.436	0.002*
Yes	262	84 (32.1)	178 (67.9)		
No	12	9 (75.0)	3 (25.0)		
SSB are often included in Meal package				0.004	0.948
Yes	245	83 (33.9)	162 (66.1)		
No	29	10 (34.5)	19 (65.5)		
SSB easy to find in Online shopping				0.607	0.436
Yes	255	85 (33.3)	170 (66.7)		
No	19	8 (42.1)	11 (57.9)		

Table 2 show most participants were female (64.6%), with males comprising 35.4% of the sample. The age distribution was nearly even, with 52.2% aged 24 years or younger and 47.8% older than 24. Income was similarly balanced, with 50.7% reporting monthly household earnings of

IDR 4,000,000 or less, and 49.3% earning above that level. Education levels were comparable across the sample, with 51.8% having lower education (up to secondary school) and 48.2% having completed higher education. Regarding BMI, 55.1% were classified as normal weight,

while 44.9% were either underweight or overweight/obese. Self-rated physical health scores showed 51.1% of respondents scored 4 or below, and 48.9% scored above 4. Mental health scores indicated 63.5% had scores of 8 or below, with 36.5% scoring higher.

Chi-square analysis revealed several significant associations with respondents' intentions to reduce SSB consumption if a 20% or higher tax were applied. Female respondents were more likely to intend to reduce consumption compared to males ($p=0.017$). Older participants (>24 years) were significantly more likely to report intentions to reduce consumption than younger ones ($p=0.001$). Education level was also significant ($p=0.025$), with those having higher education more often planning to reduce consumption.

Respondents with normal BMI were more likely to intend to reduce consumption compared to

those with non-normal BMI ($p=0.004$). Mental health scores were significantly associated as well ($p=0.001$), with participants scoring 8 or below more likely to report intentions to reduce consumption. Among environmental factors, perceptions of SSB availability showed mixed results. Respondents who agreed that SSBs were easy to find around their neighbourhood were significantly more likely to plan on reducing consumption ($p=0.022$). SSB availability in schools, offices, or similar locations was also significant ($p=0.002$), with those perceiving SSBs as easily found in these places more likely to intend to reduce consumption. In contrast, availability of SSBs in supermarkets ($p=0.591$), inclusion of SSBs in meal packages ($p=0.948$), and ease of finding SSBs through online shopping ($p=0.436$) were not significantly associated with intentions to reduce consumption.

Table 3 Full logistic regression for association to Intention to reduce SSB consumption.

Variable	Reduction 20% n (%)		cOR	95% CI		P-value
	No	Yes		Lower	Upper	
Gender						
Female	69 (39.0)	108 (61)	(ref)			
Male	24 (24.7)	73 (75.3)	1.943	1.120	3.373	0.017*
Age						
≤ 24	61 (42.7)	82 (57.3)	(ref)			
> 24	32 (24.4)	99 (75.6)	2.301	1.371	3.865	0.001*
Income						
$\leq 4,000,000$	49 (35.3)	90 (64.7)	(ref)			
$> 4,000,000$	44 (32.6)	91 (67.4)	1.126	0.683	1.858	0.642
Education						
Low education	57 (40.1)	85 (59.9)	(ref)			
High education	36 (27.3)	96 (72.7)	1.788	1.075	2.976	0.025*
BMI						
Normal	40 (26.5)	111 (73.5)	(ref)			
Not normal	53 (43.1)	70 (56.9)	0.476	0.286	0.791	0.004*
Physical health						
≤ 4	41 (29.3)	99 (70.7)	(ref)			
> 4	52 (38.8)	82 (61.2)	0.653	0.395	1.080	0.096
Mental health						
≤ 8	47 (27.0)	127 (73.0)	(ref)			
> 8	46 (46.0)	54 (54.0)	0.434	0.259	0.728	0.001*
SSB is Easy to find around neighborhood						
Yes	82 (32.2)	173 (67.8)	(ref)			
No	11 (57.9)	8 (42.1)	0.345	0.134	0.889	0.022*
SSB Available in Supermarket						
Yes	77 (34.7)	145 (65.3)	(ref)			
No	16 (30.8)	36 (69.2)	1.195	0.623	2.290	0.591

Variable	Reduction 20% n (%)		cOR	95% CI		P-value
	No	Yes		Lower	Upper	
SSB easy to find in School, Office and other						
Yes	84 (32.1)	178 (67.9)	(ref)			
No	9 (75.0)	3 (25.0)	0.157	0.042	0.596	0.002*
SSB are often included in Meal package						
Yes	83 (33.9)	162 (66.1)	(ref)			
No	10 (34.5)	19 (65.5)	0.973	0.433	2.189	0.948
SSB easy to find in Online shopping						
Yes	85 (33.3)	170 (66.7)	(ref)			
No	8 (42.1)	11 (57.9)	0.688	0.267	1.773	0.436

Table 3 presents the results of the binary logistic regression analysis assessing the association between various factors and respondents' intention to reduce SSB consumption under a proposed 20% excise tax. Several variables were found to be significantly associated with this outcome. Males were more likely than females to report an intention to reduce SSB consumption (cOR = 1.943, 95% CI: 1.120–3.373, $p = 0.017$). Age was also a significant factor, with individuals older than 24 years showing higher likelihood of reduction (cOR = 2.301, 95% CI: 1.371–3.865, $p = 0.001$). Respondents with higher educational attainment were significantly more likely to intend to reduce consumption compared to those with lower education levels (cOR = 1.788, 95% CI: 1.075–2.976, $p = 0.025$). Interestingly, those with

non-normal BMI were less likely to intend to reduce SSB intake (cOR = 0.476, 95% CI: 0.286–0.791, $p = 0.004$). Better mental health scores were also inversely associated with intention to reduce consumption (cOR = 0.434, 95% CI: 0.259–0.728, $p = 0.001$). Environmental availability appeared influential: participants who disagreed that SSBs were easy to find in their neighbourhood or in schools, offices, and other public settings were significantly more likely to report an intention to reduce consumption (cOR = 0.345, $p = 0.022$ and cOR = 0.157, $p = 0.002$, respectively). Other variables such as income, physical health, and availability of SSBs in supermarkets, meal packages, or online platforms were not significantly associated with the outcome.

Table 4 Adjusted Analysis of Factors Associated with Intention to Reduce Consumption.

Variable	Reduction 20% n (%)		aOR	95% CI		p-value
	No	Yes		Lower	Upper	
Gender						
Female	69 (39.0)	108 (61)	(ref)			
Male	24 (24.7)	73 (75.3)	1.384	0.740	2.586	0.309
Age						
≤24	61 (42.7)	82 (57.3)	(ref)			
>24	32 (24.4)	99 (75.6)	1.536	0.786	3.001	0.209
Education						
Low education	57 (40.1)	85 (59.9)	(ref)			
High education	36 (27.3)	96 (72.7)	1.364	0.753	2.470	0.306
BMI						
Normal	40 (26.5)	111 (73.5)	(ref)			
Not normal	53 (43.1)	70 (56.9)	0.462	0.270	0.792	0.005*
Physical health						
≤4	41 (29.3)	99 (70.7)	(ref)			
>4	52 (38.8)	82 (61.2)	0.989	0.538	1.815	0.971
Mental health						

Variable	Reduction 20% n (%)		aOR	95% CI		p-value
	No	Yes		Lower	Upper	
<=8	47 (27.0)	127 (73.0)	(ref)			
>8	46 (46.0)	54 (54.0)	0.614	0.319	1.182	0.144
SSB is Easy to find around neighborhood						
Yes	82 (32.2)	173 (67.8)	(ref)			
No	11 (57.9)	8 (42.1)	0.699	0.205	2.385	0.568
SSB easy to find in School, Office and other						
Yes	84 (32.1)	178 (67.9)	(ref)			
No	9 (75.0)	3 (25.0)	0.237	0.047	1.199	0.082

In the multivariable logistic regression model, only BMI remained significantly associated with intentions to reduce SSB consumption if a 20% or higher tax were implemented. Respondents with non-normal BMI had significantly lower odds of intending to reduce their consumption compared to those with normal BMI (AOR=0.462; 95% CI: 0.270–0.792; p=0.005). This finding suggests that individuals with underweight, overweight, or obesity may be less responsive to price-based interventions targeting SSB consumption.

Other variables—including gender, age, education level, physical health, mental health, and perceptions of SSB availability—were not significantly associated with reduction intentions after adjusting for potential confounders (all p>0.05). Although older age and higher education showed elevated odds of intending to reduce consumption (AOR=1.536 and 1.364, respectively), these associations did not reach statistical significance.

These results indicate that, when accounting for multiple factors simultaneously, BMI is the strongest predictor of behavioural intentions in response to a proposed excise tax on SSBs.

DISCUSSION

This study examined intentions to reduce SSB consumption under a hypothetical 20% excise tax. In the logistic regression model, only body mass index (BMI) remained a significant predictor, with individuals having non-normal BMI showing lower odds of reducing consumption. This suggests that those with entrenched dietary habits may be less responsive to price-based interventions, likely due to habit, lower health risk awareness, or decreased self-efficacy.

Discrepancies between chi-square and logistic regression findings reflect the difference in unadjusted versus adjusted associations. While

variables like education and gender showed significance in bivariate tests, these effects did not hold in the multivariate analysis, indicating the influence of confounding factors.

Some findings—such as higher education correlating with lower intentions to reduce consumption—may appear counterintuitive. However, this group may be less price-sensitive or influenced by lifestyle preferences. Similarly, frequent purchases from supermarkets may reflect habitual behaviour that weakens tax sensitivity.

Policy implications include the need for complementary interventions alongside taxation. Educational campaigns at supermarkets or schools, behavioural purchases, and targeted messages for high-income or highly educated groups may enhance effectiveness. For instance, those with better mental health may be more capable of acting on health information, indicating a role for tailored health promotion.

These results align with global evidence showing that taxation alone is insufficient. Studies from Mexico (14) emphasize the importance of combining fiscal policies with education and access to healthy alternatives. Indonesia could benefit from a similar comprehensive approach to reduce SSB consumption across diverse demographic groups. The finding also aligns with some studies suggesting that individuals with higher BMI may exhibit stronger habitual consumption patterns and lower responsiveness to pricing strategies (15). However, it also contrasts with other research indicating people with overweight or obesity may reduce consumption when costs rise (16), suggesting cultural or contextual differences in responsiveness that warrant further investigation.

CONCLUSION

This study revealed several key factors associated with Indonesians' intentions to reduce

sugar-sweetened beverage (SSB) consumption under a proposed 20% excise tax. Notably, individuals with higher education were less likely to report intentions to reduce consumption, suggesting that this group may be less price-sensitive or more influenced by lifestyle and personal preferences. Conversely, respondents who frequently purchased SSBs near schools were more likely to intend reducing consumption, possibly due to heightened awareness of health risks or concern over youth exposure. In addition, individuals with better mental health also demonstrated stronger intentions to reduce consumption, which may reflect greater self-regulation or motivation for healthier behaviour.

The study also found that perceived SSB availability—referring to respondents' perception of how easily SSBs can be accessed in their immediate environment—was negatively associated with intentions to reduce consumption, implying that environmental cues and product saturation may limit the effectiveness of price-based interventions alone.

These findings highlight the importance of designing nuanced policy responses. While taxation is a critical fiscal tool, its impact can be strengthened through complementary measures such as educational campaigns targeting highly educated consumers, in-store promotion restrictions in supermarkets, and school-based awareness programs. Future policies should also address environmental factors like product placement and accessibility to reduce habitual consumption patterns. Further research exploring longitudinal behavioral changes after real tax implementation is recommended to validate these insights and inform broader health strategies.

ETHICAL DECLARATION

The study protocol was reviewed and approved by the Central Human Research Ethics Committee of Mahidol University, under certificate number COA(T) No. MU-CIRB 2025/186.3005. Written informed consent was obtained from all participants prior to data collection, and respondent anonymity and data confidentiality were strictly maintained throughout the study.

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RECOMMENDATIONS

Policymakers should complement SSB tax policies with tailored interventions aimed at individuals with non-normal BMI, such as targeted education or behaviour change programs. Future research should use longitudinal designs to better understand how BMI influences actual consumption changes following tax implementation, and qualitative studies could help explore underlying reasons for lower responsiveness among these groups.

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SESSION 5: Poster Presentation

SLEEP HYGIENE PRACTICES AND SLEEP QUALITY AMONG OLDER ADULTS IN NONTHABURI PROVINCE, THAILAND

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ABSTRACT

Introduction: Poor sleep quality is associated with many adverse health outcomes. With Thailand experiencing rapid urbanization and an aging population, understanding factors that influence sleep quality among older adults is crucial for public health planning. Although both demographic characteristics and sleep hygiene practices have been associated with sleep quality, their combined impact remains underexplored in urban Thai contexts. Therefore, this study aimed to examine the association between sleep hygiene practices and sleep quality among older adults in Nonthaburi Province, Thailand.

Methodology: A cross-sectional study was conducted among 300 older adults aged ≥ 60 years in Nonthaburi Province, Thailand. Participants were selected using proportional stratified and convenience sampling. Data were collected from May to June 2025 with the structured questionnaires including general characteristics, the Geriatric Sleep Questionnaire-6 (GSQ-6), and the Sleep Hygiene Behavior Questionnaire. Logistic regression was used to examine factors associated with poor sleep quality.

Results: The prevalence of poor sleep quality was 20.3% (n = 61). Participants were predominantly female (69.3%) with a median age of 68 years (IQR: 65–73). Poor sleep quality was more common among females (77.0%), married individuals (63.9%), those with primary education (55.7%), the unemployed (83.6%), and those with moderate sleep hygiene scores (62.3%; mean score = 50.9). Sleep hygiene practices were not significantly associated with poor sleep quality in either the unadjusted model (OR = 1.409; 95% CI: 0.980–2.026; p = 0.065) or the adjusted model. However, significant associations were found for female (AOR = 1.712; 95% CI: 1.113–2.632; p = 0.014), unemployment (AOR = 0.490; 95% CI: 0.299–0.803; p = 0.005), and financial hardship (AOR = 5.109; 95% CI: 1.909–13.677; p = 0.001).

Conclusion: Female, unemployment, and financial hardship were significantly associated with poor sleep quality among older adults in this urban Thai setting.

Keyword: Sleep quality, Older adults, Sleep hygiene, Urban, Thailand

INTRODUCTION

Thailand is undergoing a rapid demographic transition toward becoming a super-aged society by 2035, with over 20% of the population expected to be aged 65 and above (1). While this shift reflects advancements in healthcare and increased life expectancy, it also presents significant public health challenges. One major concern is poor sleep quality among the elderly, which is linked to cognitive decline, dementia, depression, cardiovascular disease, diabetes, weakened immunity, falls, and reduced quality of life. Globally, an estimated 40% to 70% of older adults report experiencing poor sleep quality (2), and studies in Thailand have

reported similar rates, ranging from 35% to 70% (3-5).

Thailand is also facing accelerated urbanization, particularly in provinces like Nonthaburi, part of the Bangkok Metropolitan Region, which has one of the highest urbanization rates nationwide. Urban environments introduce unique environmental and social stressors, such as noise pollution, crowding, irregular routines, and reduced social support, that may further compromise sleep health in older populations (6). These urban-specific factors, when combined with age-related physiological changes, may contribute to higher rates of sleep disturbances among city-dwelling older

adults.

Sleep hygiene encompasses behavioral and environmental practices that support healthy sleep. It is a modifiable factor associated with better cardiovascular, cognitive, and mental health outcomes (7). Despite its importance, little is known about sleep hygiene behaviors among older adults in Thailand's urban settings.

Therefore, this study aims to examine the association between sleep hygiene practices, sociodemographic characteristics, and sleep quality among older adults in Nonthaburi Province, Thailand. The findings are intended to contribute to the growing evidence base on aging and urban health, with implications for designing practical, community-level interventions to promote healthy sleep and well-being in Thailand's aging society.

METHODOLOGY

Study design

A cross-sectional study was conducted to examine the association between sleep hygiene practices, sociodemographic characteristics, and sleep quality among older adults living in Nonthaburi Province, Thailand.

Study population

The target population included community-dwelling adults aged 60 years and older in Nonthaburi. Participants were recruited through elderly clubs using proportional stratified and convenience sampling across six districts. Inclusion criteria included the ability to communicate in Thai, living in Nonthaburi for at least one year and willingness to provide informed consent. Individuals with severe cognitive or neurological disorders or those who had regularly used sleep medication within the two weeks prior to data collection were excluded.

Data Collection

Data collection was conducted from May to June 2025 across six districts in Nonthaburi Province. Participants completed structured, interviewer-administered, paper-based questionnaires. The instrument consisted of three main sections: 1. demographic information, including age, sex, marital status, education level, occupation, and financial status; 2. sleep quality, assessed using the Geriatric Sleep Questionnaire-6

(GSQ-6), with scores ≥ 16 indicating poor sleep quality (8); and 3. sleep hygiene practices, evaluated using the Sleep Hygiene Behavior Questionnaire and categorized into poor, moderate, or good levels (9). The questionnaire's content validity was confirmed by three experts using the Item-Objective Congruence (IOC) method, with all items achieving an IOC score of 0.50 or higher. The internal consistency reliability of the Sleep Hygiene Behavior Questionnaire was acceptable, with a Cronbach's alpha of 0.700. Additionally, the 6-item Geriatric Sleep Questionnaire (GSQ-6) demonstrated good internal consistency, with a Cronbach's alpha of 0.847.

Data Analysis

Data were analyzed using IBM SPSS version 29 licensed to Chulalongkorn University. Descriptive statistics such as frequencies and percentage were used for categorical variables. For continuous data, the Kolmogorov-Smirnov test was applied to test the normality. Means and standard deviations were reported for normally distributed variables, while medians and interquartile ranges (IQRs) were reported for non-normal distributions. Binary logistic regression was performed to assess the association between sleep hygiene practices and poor sleep quality. Unadjusted analyses were conducted, and results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). For multiple logistic regression, independent variables were selected based on theoretical relevance from prior studies and statistical significance ($p < 0.05$) in bivariate analysis. To control for potential confounding factors, three adjusted models were developed. Model 1 was adjusted for age group, Model 2 was adjusted for sex, as both are key sociodemographic factors commonly associated with sleep quality. Model 3 was fully adjusted for all demographic characteristics, including age group, sex, marital status, education level, employment status, and financial status to account for all relevant sociodemographic influences. Adjusted odds ratios (AORs) and corresponding 95% CIs were reported for each model. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 300 older adults participated

in the study. Based on the Geriatric Sleep Questionnaire-6 (GSQ-6), the prevalence of poor sleep quality was 20.3% (n = 61), while 79.7% (n = 239) were classified as having good sleep quality. The median GSQ-6 score was 13, with an interquartile range (IQR) of 11–15.

The median age of participants was 68 years (IQR = 8), with the majority aged 60–70 years (63.3%), followed by 71–80 years (29.3%) and over 80 years (7.3%). Most participants were female (69.3%), married (61.0%), and either unemployed or retired (77.3%). Regarding education, 50.0% had completed middle school or higher, 48.0% had completed primary school, and 2.0% had no formal education. Financially, the majority reported a moderate financial status (78.0%), while 17.0% reported good financial status and 5.0% reported poor financial status.

In terms of sleep hygiene practices, the

median score was 51 (IQR = 48–54). Of the participants, 44.3% demonstrated good sleep hygiene behavior and 55.7% demonstrated moderate sleep hygiene. Notably, none of the participants were classified as having poor sleep hygiene.

Table 1 presents the distribution of demographic characteristics and sleep hygiene practices according to sleep quality status. Participants with poor sleep quality were more likely to be older, female, unemployed, and report poor financial status, compared to those with good sleep quality. A higher proportion of individuals with poor sleep quality had completed only primary education. Additionally, moderate sleep hygiene behavior was more prevalent among those with poor sleep quality (62.3%) than those with good sleep quality (54.0%).

Table 1 Demographic Characteristics and Sleep Hygiene of Participants by Sleep Quality Status (n = 300)

Variables	Overall n=300	Good sleep quality n=239 (79.7)	Poor sleep quality n=61 (20.3)
Demographic Characteristics			
Age (Years)			
Median (IQR)	68 (65-73)	68 (65-73)	70 (65-74)
Age group, n (%)			
60-70	190 (63.4)	154 (64.4)	36 (59.0)
71-80	88 (29.3)	66 (27.6)	22 (36.1)
>80	22 (7.3)	19 (8.0)	3 (4.9)
Sex, n (%)			
Male	92 (30.7)	78 (32.6)	14(23.0)
Female	208 (69.3)	161 (67.4)	47 (77.0)
Marital status, n (%)			
Unmarried (single, divorced, widowed)	117 (39.0)	95 (39.7)	22 (36.1)
Married (married, separated)	183 (61.0)	144 (60.3)	39 (63.9)
Educational level, n (%)			
Middle school and higher	150 (50.0)	124 (51.9)	26 (42.6)
Primary school	144 (48.0)	110 (46.0)	34 (55.7)
No formal education	6 (2.0)	5 (2.1)	1 (1.7)
Employment status, n (%)			
Unemployed or retired	232 (77.3)	181 (75.7)	51 (83.6)
Employed	68 (22.7)	58 (24.3)	10 (16.4)
Financial status, n (%)			
Good	51 (17.0)	42 (17.6)	9 (14.7)
Moderate	234 (78.0)	189 (79.1)	45 (73.8)
Poor	15 (5.0)	8 (3.3)	7 (11.5)
Sleep hygiene			
Sleep hygiene score			
Median (IQR)	51 (48-54)	51 (48-54)	50 (47-55)

Variables	Overall n=300	Good sleep quality n=239 (79.7)	Poor sleep quality n=61 (20.3)
Sleep hygiene practice			
Good	133 (44.3)	110 (46.0)	23 (37.7)
Moderate	167 (55.7)	129 (54.0)	38 (62.3)

Table 2 presents the results of binary and multiple logistic regression analyses examining the association between sleep hygiene practices and poor sleep quality. In the bivariate analysis, sleep hygiene practices were not significantly associated with poor sleep quality (OR = 1.409, 95% CI: 0.980–2.026, $p = 0.065$). This non-significant association persisted across all adjusted models. After adjusting for age group in Model 1, the association remained non-significant (AOR = 1.396, 95% CI: 0.969–2.013, $p = 0.073$). Model 2, adjusted for sex, also showed no significant association (AOR = 1.340, 95% CI: 0.928–1.936, $p = 0.118$). In the fully adjusted Model 3, which controlled for age group, sex, marital status, education level, employment status, and financial status, sleep hygiene was still not significantly associated with poor sleep quality (AOR = 1.238, 95% CI: 0.833–1.840, $p = 0.292$).

In contrast, several demographic variables showed significant associations with sleep quality. Female participants had significantly higher odds of experiencing poor sleep quality compared to males (AOR = 1.712, 95% CI: 1.113–2.632, $p = 0.014$). Employment status was inversely associated with poor sleep quality; employed individuals were significantly less likely to report poor sleep compared to those unemployed or retired (AOR = 0.490, 95% CI: 0.299–0.803, $p = 0.005$). Additionally, participants reporting poor financial status had significantly higher odds of poor sleep quality compared to those with good financial status (AOR = 5.109, 95% CI: 1.909–13.677, $p = 0.001$). Other demographic factors—including age group, marital status, and education level—were not significantly associated with sleep quality in the fully adjusted model.

Table 2 Association Between Demographic Characteristics and Poor Sleep Quality of Participants (n = 300)

Variables	Bivariate analysis		Model 1**		Model 2**		Model 3**	
	Unadjusted OR (95% CI)	P-value	Adjusted AOR (95% CI)	P-value	Adjusted AOR (95% CI)	P-value	Adjusted AOR (95% CI)	P-value
Demographic Variables								
Age Group								
61-70	Ref.				Ref.		Ref.	
71-80	1.426 (0.963–2.111)	0.076			1.428 (0.962–2.118)	0.077	1.230 (0.812–1.863)	0.329
>80	0.675 (0.316–1.442)	0.311			0.710 (0.331–1.524)	0.379	0.695 (0.309–1.564)	0.38
Sex								
Male	Ref.		Ref.		Ref.		Ref.	
Female	1.626 (1.086-2.434)	0.018*	1.605 (1.070–2.408)	0.022*			1.712 (1.113–2.632)	0.014*
Marital Status								
Married (married, separated)	Ref.		Ref.		Ref.		Ref.	
Unmarried (single, divorced, widowed)	0.855 (0.592–1.236)	0.405	0.865 (0.591–1.266)	0.455	0.789 (0.542-1.149)	0.217	0.693 (0.456–1.054)	0.087
Educational Status								
Middle school and higher	Ref.		Ref.		Ref.		Ref.	
Primary school	1.474 (1.026–2.118)	0.036*	1.492 (1.034–2.152)	0.032*	1.445 (1.003–2.081)	0.048*	1.332 (0.900–1.970)	0.152
No formal education	0.954 (0.249–3.651)	0.945	0.960 (0.250–3.691)	0.953	0.870 (0.226–3.351)	0.84	0.474 (0.100–2.247)	0.347
Employment Status								
Not employed	Ref.		Ref.		Ref.		Ref.	
Employed	0.612 (0.390–0.960)	0.033*	0.609 (0.385–0.964)	0.034*	0.608 (0.386–0.956)	0.031*	0.490 (0.299–0.803)	0.005*
Financial Status								
Good	Ref.		Ref.		Ref.		Ref.	
Moderate	1.111 (0.680–1.814)	0.674	1.149 (0.701–1.883)	0.581	1.108 (0.676–1.815)	0.684	1.089 (0.650–1.824)	0.747

Poor	4.083 (1.654– 10.081)	0.002*	3.892 (1.572– 9.640)	0.003*	4.210 (1.695– 10.455)	0.002*	5.109 (1.909– 13.677)	0.001*
Sleep Hygiene Practice								
Good sleep hygiene	Ref.		Ref.		Ref.		Ref.	
Moderate sleep hygiene	1.409 (0.980– 2.026)	0.065	1.396 (0.969– 2.013)	0.073	1.340 (0.928– 1.936)	0.118	1.238 (0.833– 1.840)	0.292

Footnote:

*Significant level set at p-value < 0.05

**Model 1: Adjusted for age group, Model 2: Adjusted for sex, Model 3: Adjusted for all demographic characteristics including age group, sex, marital status, education level, employment status, and financial status

DISCUSSION

Although prior research has emphasized the importance of sleep hygiene in promoting sleep quality and managing conditions such as insomnia, the present study did not find a statistically significant association between sleep hygiene practices and poor sleep quality among older adults. This contrasts with existing literature that supports sleep hygiene as an effective behavioral intervention to enhance sleep outcomes (10). The lack of association between sleep hygiene and sleep quality in this study may be explained by age-related physiological changes in older adults, such as circadian rhythm disruption and decreased melatonin production, which can impair sleep independently of behavioral practices (11). These biological factors may overshadow the effects of sleep hygiene behaviors in this population. Interestingly, none of the participants were classified as having poor sleep hygiene, and most exhibited moderate-level practices. It is also possible that older adults, compared to younger populations, tend to adopt more health-conscious behaviors, such as limiting caffeine or alcohol intake and avoiding stimulating activities before bedtime, which may reduce the impact of sleep hygiene on sleep quality in this age group.

Despite the non-significant findings regarding sleep hygiene, the study identified several demographic factors that were significantly associated with poor sleep quality. Female participants had a notably higher likelihood of reporting poor sleep compared to males, consistent with previous studies showing that women are more prone to sleep disturbances, including insomnia symptoms, shorter sleep duration, and daytime fatigue (12, 13). These disparities are often attributed to a combination of hormonal fluctuations, caregiving roles, and psychosocial stressors that disproportionately affect women throughout their lifespan.

Employment status also emerged as a significant factor. Older adults who were employed had lower odds of poor sleep quality compared to those who were unemployed or retired. This finding aligns with prior research suggesting that employment may offer protective benefits through structured routines, social engagement, and greater financial stability (14). However, the relationship between retirement

and sleep is complex. While some retirees may experience improved sleep due to reduced work-related stress, others may face sleep disturbances influenced by declining health or reduced social interaction (15).

Financial status demonstrated the strongest association with sleep quality. Participants who reported poor financial status were significantly more likely to experience poor sleep, underscoring the influence of socioeconomic stressors on sleep health. This aligns with evidence indicating that financial insecurity, economic strain, and lower income are strongly linked to increased sleep problems and poor health outcomes among older adults (14, 16).

Together, these findings suggest that sleep quality in older adults is shaped not only by behavioral factors but also by broader social determinants of health. Gender, employment, and financial stability appear to be particularly influential. As such, public health strategies aimed at improving sleep among aging populations should go beyond promoting healthy sleep behaviors and also address underlying socioeconomic inequalities. Holistic, community-based interventions that incorporate gender-sensitive approaches and support for financial well-being may be essential for improving sleep quality and overall health in older adults.

CONCLUSION

This study found no significant association between sleep hygiene practices and sleep quality among older adults in an urbanizing Thai context. However, demographic factors, particularly female sex, unemployment, and financial hardship, were significantly associated with poor sleep quality. These findings highlight the need for tailored sleep interventions that account for the unique routines and social conditions of older adults. Public health strategies should address not only behavioral aspects but also the underlying socioeconomic determinants of sleep health.

The study's strengths include its focus on a representative sample from an urbanizing area and its comprehensive analysis of demographic influences. However, limitations included the cross-sectional design and reliance on self-

reported data. Additionally, health conditions, social and family support, and lifestyle factors such as physical activity and daylight exposure were not explored but may significantly influence sleep quality. Future research should explore causal relationships and include more diverse populations to inform targeted and equitable interventions.

RECOMMENDATION

Future studies should use longitudinal designs and objective sleep measures to strengthen causal inferences and reduce self-report bias. Including more diverse populations, such as rural older adults or those with varying health conditions, would improve generalizability and deepen understanding of sleep quality in aging populations.

ETHICAL DECLARATION

Consent and Ethical Approval Ethical approval for this study was obtained from the Research Ethics Committee of Chulalongkorn University (Group 1). Written informed consent was obtained from all participants prior to data collection. For illiterate participants, verbal explanations were provided, and consent was confirmed through witness co-signing.

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ABORTION KNOWLEDGE AND ATTITUDES AMONG UNDERGRADUATE STUDENTS IN BANGKOK, THAILAND POST-LEGISLATIVE REFORM

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ABSTRACT

Background: Following Thailand's 2021 legislative reforms to expand legal abortion access, informational barriers persist. As teachers are a potential source of reproductive health information for young people, their understanding of abortion is critical. However, safe abortion is not formally included in the training of future educators.

Objectives: This study aimed to assess abortion knowledge and attitudes among undergraduate pedagogical students in Bangkok. Additionally, it examined predictors of abortion attitudes, including knowledge, academic, and sociodemographic factors.

Methodology: A quantitative, cross-sectional study surveyed undergraduate education students at 19 Bangkok tertiary institutions using snowball sampling. Yamane's formula indicated 397 respondents were needed. Self-administered online questionnaire data were analysed using descriptive statistics, bivariate analysis, and multiple linear regression.

Results: Among 401 respondents, 36.7% had low knowledge, 34.9% good knowledge, and 28.4% moderate knowledge. Knowledge gaps concerned procedures, fertility effects, and later-term abortion legality. Attitudes were conditionally pro-choice. Multiple linear regression identified attitude predictors. The model was significant ($p < .001$, Adjusted $R^2 = .307$). Self-perceived religiosity, knowledge score, gender identity, sexual orientation, and political affiliation significantly predicted attitudes.

Conclusion: This study provides evidence on abortion knowledge and attitudes among an influential, non-medical population in post-reform Thailand. Despite pro-choice attitudes, significant knowledge gaps exist regarding abortion legality and safety. Results highlight the need for comprehensive, evidence-based abortion education in teaching curricula. Equipping future educators with accurate knowledge is critical to empowering them to support young people navigating complex reproductive health decisions. Curriculum reform to embed comprehensive abortion education in teacher training programs is essential to align with Thailand's recent legal reforms and ensure safe, accessible abortion services for all.

Keywords: Abortion Attitude, Abortion Knowledge, Pedagogical Education

INTRODUCTION

Unsafe abortion remains a leading, yet preventable, cause of maternal mortality and morbidity despite being a highly safe procedure when performed following established guidelines. Access barriers often lead women to

resort to unsafe practices, resulting in severe complications and death. In Thailand, unsafe abortion contributes to 10-15% of all maternal deaths and places a substantial burden on the public health system, with the government allocating an estimated 150 million baht annually to manage its complications (1).

The consequences extend beyond mortality, including morbidities like haemorrhage and

sepsis (2), and significant socio-psychological repercussions for women (3).

In light of this, Thailand has undergone legislative reform. In 2021, the Constitutional Court legalised abortion on request up to 12 weeks of pregnancy, extended to 20 weeks with medical consultation in 2022 (4, 5). These amendments created a supportive legal framework for safe abortion care. While some Southeast Asian countries like Malaysia maintain restrictive laws (6), Thailand joins Vietnam, Singapore, and Cambodia as one of the regional countries with a permissive legal stance (7).

Still, legal reform alone cannot guarantee access. Knowledge gaps about abortion legality and services can disconnect law from practice, preventing effective healthcare navigation. Even where abortion laws are relatively liberal, such as in India, Zambia, and Ghana, public knowledge of legal grounds remains limited; likewise, in countries like Nepal, India, and Armenia, awareness often lags after legal reforms (8). An enabling environment requires supportive health systems and, critically, accessible, accurate information (9).

Information gaps particularly affect adolescents and youth, who face high unintended pregnancy risk. Thailand's national curriculum does not mandate abortion education, potentially leaving some students without essential health information (10).

In this context, teachers may play a role in bridging this informational divide. As trusted sources of information, they can influence young

people's reproductive health knowledge and decisions (11). A survey in Thailand identified teachers as influencing agents of abortion decision-making among patients citing economic and social factors (12). Yet, research on this group's preparedness following recent legal changes is lacking. Existing studies in Thailand have focused primarily on medical professionals (13-17) or predate the legislative amendments (18). Unlike medical or nursing students, who are trained within a clinical framework, pedagogical students are future professionals who can shape social and educational norms around sensitive health topics in school settings. Understanding their preparedness is crucial for informing curriculum development in teacher-training institutions.

To address this gap, this study focused on future educators: undergraduate students in education programs. Drawing on the Theory of Planned Behaviour (TPB), which posits that attitudes toward behaviour predict behavioural intentions and subsequent actions (19), this study examines how future educators' knowledge influences their abortion attitudes, which may influence their future reproductive health teaching or counselling.

Thus, this study aimed to: 1) assess abortion knowledge and attitudes among undergraduate education students in Bangkok, and 2) examine how knowledge, academic, and sociodemographic factors predict their abortion attitudes. Findings will inform teacher education curricula and policies to ensure future educators can support safe abortion access for youth.

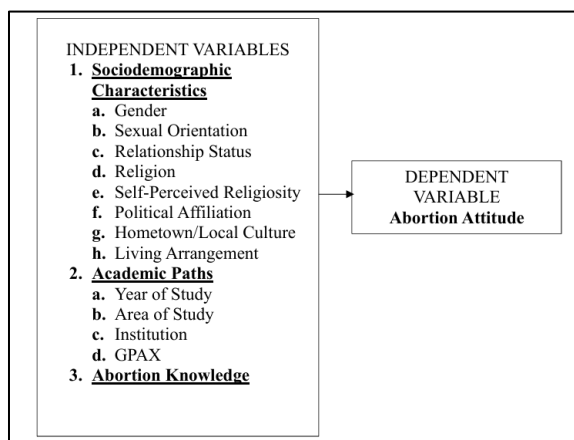


Figure 1 Conceptual Framework of Study

METHODOLOGY

Study design

This study employed a quantitative, cross-sectional design and was conducted in Bangkok, Thailand, from late April to June 2025.

Study population and sample size

The target population comprised undergraduate students enrolled in teaching degree programmes, estimated at approximately 40,000 individuals (20). The inclusion criteria required participants to be enrolled in an institution in Bangkok, understand Thai, and provide informed consent. Screening questionnaires determined participant eligibility.

Despite generalisation limitations, snowball sampling was employed to leverage informal social networks for efficient participant recruitment across institutions while addressing logistical challenges associated with this sensitive research topic. Sample size calculation using Yamane's formula, assuming $N = 40,000$ and $e = 5\%$, obligated at least 397 participants.

Measurement tool

A self-administered online questionnaire, adapted from previous studies (13, 14, 21), was used for data collection. The instrument demonstrated high content validity (Item-Objective Congruence index: .67-1.00) and comprised three sections (See Appendix 1).

Knowledge items were scored dichotomously (1 = correct, 0 = incorrect/uncertain). Attitude items used a 5-point Likert scale from strongly disagree to strongly agree, scored 1-5 for favourable/conditional statements and reverse-scored for unfavourable statements.

A pilot test on 40 undergraduate students (10% of the sample size) assessed reliability. Both scales showed good internal consistency (Cronbach's $\alpha = .831, .868$, respectively).

Knowledge scores were categorised using Bloom's cut-off points into three levels: low (<60%), moderate (60-79.9%), and good ($\geq 80\%$). Higher attitude scores indicated more pro-choice views.

Statistical Analysis

Data were analysed using SPSS version 29 with descriptive statistics, bivariate analyses (t-tests, ANOVAs, simple linear regression), and multiple linear regression.

Ethical Considerations

Ethical approval was obtained from Chulalongkorn University (COA No.104/68). Participants provided electronic informed consent; responses were anonymous and securely stored.

RESULTS

Of 410 initial responses, the final analysis comprised 401 eligible responses from 19 Bangkok institutions after removing incomplete entries.

The sample was predominantly women (71.1%), politically liberal (65.1%), and Buddhist (85.5%). Most participants (66.3%) attended state-autonomous universities. Foundational education (e.g., Early Childhood, Primary) and STEM fields were the most represented majors. Sociodemographic and academic characteristics are presented in Table 1.

Table 1 Summary of Participant Characteristics

Variable	Category	n	%
Gender Identity	<i>Man</i>	107	26.7
	<i>Woman</i>	285	71.1
	<i>Non-binary</i>	6	1.5
	<i>Prefer not to say</i>	3	.7
Sexual Orientation	<i>Straight</i>	286	71.3
	<i>Homosexual</i>	42	10.5
	<i>Bisexual</i>	37	9.2
	<i>Asexual</i>	3	.7

Variable	Category	n	%
Relationship status	<i>Pansexual</i>	33	8.2
	<i>Single</i>	225	56.1
	<i>“Talking stage”/Situationship</i>	48	12.0
	<i>In a relationship</i>	124	30.9
Religion	<i>Married</i>	4	1.0
	<i>Buddhism</i>	343	85.5
	<i>Islam</i>	42	10.5
	<i>Christianity</i>	9	2.2
Self-perceived Religiosity	<i>No religion</i>	7	1.7
	<i>Very religious</i>	35	8.7
	<i>Moderately religious</i>	142	35.4
	<i>Somewhat religious</i>	109	27.2
	<i>Not religious at all</i>	115	28.7
Political Affiliation	<i>Very religious</i>	35	8.7
	<i>Liberal</i>	261	65.1
	<i>Conservative</i>	50	12.5
Hometown Region	<i>Non-political</i>	90	22.4
	<i>Central Region</i>	202	50.4
	<i>Northern Region</i>	45	11.2
	<i>Southern Region</i>	65	16.2
	<i>Northeastern Region</i>	54	13.5
	<i>Eastern Region</i>	30	7.5
Residential Arrangement	<i>Western Region</i>	5	1.2
	<i>Living alone</i>	80	20.0
	<i>Living with parents, guardians, or relatives</i>	222	55.4
	<i>Living with a partner or spouse</i>	30	7.5
Year of Study	<i>Living with friends/roommates</i>	69	17.2
	<i>Year 1</i>	91	22.7
	<i>Year 2</i>	119	29.7
	<i>Year 3</i>	90	22.4
	<i>Year 4</i>	73	18.2
	<i>Year 5</i>	21	5.2
Area of Study (Grouped)	<i>Year 6</i>	7	1.7
	<i>STEM</i>	176	43.9
	<i>Humanities/Social Sciences</i>	70	17.5
	<i>Foundational & Lifelong Education</i>	103	25.7
Educational Institution Type	<i>Applied Arts and Vocational Education</i>	52	13.0
	<i>Public Higher Education Institutions</i>	96	23.9
	<i>State-Autonomous Higher Education Institutions</i>	266	66.3
GPAX	<i>Private Higher Education Institutions</i>	39	9.7
	<i>3.51 - 4.00</i>	132	32.9
	<i>3.01 - 3.50</i>	145	36.2
	<i>2.51 - 3.00</i>	99	24.7
	<i>2.01 - 2.50</i>	24	6.0
	<i>≤ 2.00</i>	1	.2

Abortion Knowledge

Knowledge distribution varied, with 36.7% having low knowledge, 34.9% good knowledge, and 28.4% moderate knowledge. Major

misconceptions concerned the procedure's long-term effects, with only 23.9% correctly identifying that safe abortion does not impact future fertility. Knowledge was also low regarding later-gestation abortion legality (31.4%

correct) and medical abortion safety at home under professional guidance (43.4% correct) (Table 2).

Table 2 Summary of Correct Responses to Abortion Knowledge Items

Item	Frequency Correct (n)	Percentage Correct (%)
It is legal for a pregnant woman to have an abortion at a gestational age of up to 12 weeks	291	72.6
A physician is the only person who can perform an abortion for a pregnant woman legally	331	82.5
It is illegal for a physician to perform an abortion for a pregnant woman with a diagnosis of foetal deformity	233	58.1
It is legal for a physician to perform an abortion for a pregnancy resulting from rape	288	71.8
A physician can perform an abortion legally for a pregnant woman at gestational age 10 weeks whose pregnancy occurred during the period of contraception	251	62.6
A physician can perform an abortion legally for a pregnant woman at a gestational age between 12 and 24 weeks under the conditions set by the Medical Council of Thailand	254	63.3
Abortion performed on pregnant women with her consent at gestational age up to 12 weeks is legal	288	71.8
A physician performing an abortion for the sake of a woman's mental health is legal	256	63.8
A physician performing an abortion for the sake of a woman's physical health is legal	283	70.6
It is legal for a pregnant woman to undergo an abortion at gestational age up to 22 weeks under the conditions set by the Medical Council of Thailand	126	31.4
Abortion services in Thailand are accessible through authorised hospitals and clinics across the country.	236	58.9
People who regularly use contraception can experience unintended pregnancies.	324	80.8
Abortion under 12 weeks can be safely performed at home using medications, provided there is guidance from a medical provider.	174	43.4
Unsafe abortion contributes to 10-15% of maternal deaths in Thailand.	272	67.8
Having an abortion affects your fertility in the future	96	23.9

Abortion Attitudes

Participants were generally supportive of abortion rights, with a mean attitude score of 29.01 (SD = 6.23) where neutral was 24. Most agreed that abortion is a woman's fundamental

right (73.3%) and acceptable for some women in certain situations (81.3%). Most disagreed that "Abortion is considered murder" (58.8% disagreed) and "Abortion is a sin" (56.4% disagreed) (See Table 3).

Table 3 Abortion Attitude Item Summary

Item	Attitude Score n (%)				
	Strongly Agree (5)	Agree (4)	No Opinion (3)	Disagree (2)	Strongly Disagree (1)
Abortion may be a good thing in all cases.	116 (28.9)	57 (14.2)	145 (36.2)	45 (11.2)	38 (9.5)
Abortion is a fundamental right of women.	154 (38.4)	140 (34.9)	66 (16.5)	23 (5.7)	18 (4.5)
Abortion is acceptable after 12 weeks.	85 (21.2)	96 (23.9)	125 (31.2)	56 (14.0)	39 (9.7)
Abortion may be a good thing for some women.	207 (51.6)	119 (29.7)	62 (15.5)	8 (2.0)	5 (1.2)
Abortion can be acceptable after 12 weeks in some situations.	114 (28.4)	136 (33.9)	109 (27.2)	30 (7.5)	12 (3.0)
Abortion is considered murder*	165 (41.1)	65 (16.2)	50 (12.5)	50 (12.5)	71 (17.7)
Abortion is immoral*	145 (36.2)	57 (14.2)	65 (16.2)	96 (23.9)	38 (9.5)
Abortion is a sin*	149 (37.2)	39 (9.7)	64 (16.0)	77 (19.2)	72 (18.0)

*Reversely scored

Factors Associated with Abortion Attitudes

Bivariate analysis showed several variables significantly associated with abortion attitudes. These included gender identity, sexual orientation, religiosity, political affiliation, year of study, and institutional type, with higher scores indicating more pro-choice views (Table 4).

Scores increased progressively from 'very religious' (M = 24.31) to 'not religious at all'

participants (M = 32.18). State-autonomous university students held more supportive views (M = 30.01) than public (M = 27.15) or private (M = 26.77) institution peers. Relationship status, hometown region, residential arrangement, and study area were not significantly associated with attitudes.

Table 4 Comparison of Mean Abortion Attitude Scores Across Sociodemographic and Academic Variables

Characteristic	Category	N	Mean Attitude (SD)	Test Statistics	p-value
TOTAL		401	29.01 (6.230)		
Gender Identity	Man	107	27.34 (6.126) ^a	F(2, 398) = 7.222	<.001
	Woman	285	29.49 (6.163) ^b		
	Non-binary	9	33.44 (5.175) ^b		
Sexual Orientation	Straight	286	28.25 (6.445)	t(399) = -3.868	<.001
	Non-straight	115	30.89 (5.228)		
Relationship Status	Single	225	28.58 (6.336)	F(3, 397) = 0.964	.410
	“Talking stage”	48	29.19 (5.258)		
	In a relationship	124	29.74 (6.346)		
	Married	4	28.25 (7.411)		
Religion	Buddhism	343	29.31 (6.027) ^a	F(3,397) = 8.966	<.001
	Islam	42	25.29 (6.729) ^a		
	Christianity	9	29.00 (5.050) ^{a,b}		

Characteristic	Category	N	Mean Attitude (SD)	Test Statistics	p-value
Self-perceived Religiosity	<i>No religion</i>	7	36.29 (3.039) ^c	F(3, 397) = 25.826	<.001
	<i>Very religious</i>	35	24.31 (5.774) ^a		
	<i>Moderately religious</i>	142	27.04 (6.650) ^a		
	<i>Somewhat religious</i>	109	29.72 (4.720) ^b		
Political Affiliation	<i>Not religious at all</i>	115	32.18 (5.309) ^c	F(2, 398) = 11.729	<.001
	<i>Liberal</i>	261	29.98 (6.000) ^a		
	<i>Conservative</i>	50	25.76 (5.101) ^b		
Hometown Region	<i>Non-political</i>	90	28.00 (6.724) ^b	F(5, 395) = .610	.692
	<i>Central Region</i>	202	29.03 (5.959)		
	<i>Northern Region</i>	45	28.11 (7.398)		
	<i>Southern Region</i>	65	28.49 (6.332)		
	<i>Northeastern Region</i>	54	30.07 (6.231)		
	<i>Eastern Region</i>	30	29.37 (6.003)		
Residential Arrangement	<i>Western Region</i>	5	29.20 (6.870)	F(3, 397) = .776	.508
	<i>Living alone</i>	80	28.61 (6.526)		
	<i>Living with parents, guardians, or relatives</i>	222	29.02 (6.433)		
	<i>Living with a partner or spouse</i>	30	28.03 (4.796)		
	<i>Living with friends/roommates</i>	69	29.86 (5.758)		
Year of Study	<i>1</i>	91	28.47 (6.026) ^{a,b}	F(5, 395) = 3.189	.008
	<i>2</i>	119	29.24 (6.326) ^{a,b}		
	<i>3</i>	90	27.67 (5.681) ^a		
	<i>4</i>	73	30.88 (5.627) ^b		
	<i>5</i>	21	30.52 (5.836) ^{a,b}		
	<i>6</i>	7	25.14 (13.521) ^{a,b}		
Study Area (Grouped)	<i>STEM</i>	176	28.94 (6.187)	F(3, 397) = 2.371	.070
	<i>Humanities/Social Sciences</i>	70	27.49 (6.287)		
	<i>Foundational & Lifelong Education</i>	103	29.52 (6.210)		
	<i>Applied Arts and Vocational Education</i>	52	30.27 (6.088)		
	<i>Public</i>	27.15	27.15 (6.156) ^a		
<i>State Autonomous</i>	30.01	30.01 (6.033) ^b			
<i>Private</i>	26.77	26.77 (6.251) ^a			

Significance level $p < 0.05$

Note: Means in the same column that do not share a superscript letter are significantly different from each other based on post-hoc test at $p < 0.05$.

Knowledge and Attitude

Simple linear regression confirmed total knowledge score significantly predicted pro-choice attitudes, explaining 16.1% of variance on its own ($F(1, 399) = 76.741, p < .001$). Each one-point knowledge increase predicted a 0.75-point attitude increase.

Multivariate Analysis: Finding Predictors of Attitude

Multiple linear regression with all significant bivariate predictors identified unique factors influencing abortion attitudes. Regression assumptions were met. The model was

significant, $F(8, 392) = 21.6941, p < 0.001$, explaining 30.7% of attitude score variance (Adjusted $R^2 = .307$).

Self-perceived religiosity was the strongest predictor ($\beta = .317, p < .001$), followed by knowledge score ($\beta = .286, p < .001$), gender

identity ($\beta = .146, p < .001$), sexual orientation ($\beta = .093, p = .035$), and political affiliation ($\beta = -.087, p = .048$). Study area, institution type, and religion were not significant unique predictors, suggesting their bivariate associations were explained by stronger model variables (Table 5).

Table 5 Summary of Multiple Linear Regression Analysis Predicting Abortion Attitude Score (N = 401)

Variable	B	SE	β	t	p-value
(Constant)	13.548	1.880		7.205	<.001
Gender Identity	1.902	.556	.146	3.422	<.001
<i>Man (1)</i>					
<i>Woman (2)</i>					
<i>Non-binary (3)</i>					
Sexual Orientation (Simplified)	1.278	.604	.093	2.115	.035
<i>Straight (1)</i>					
<i>Non-straight (2)</i>					
Religion	.219	.353	.027	.620	.535
<i>Buddhism (1)</i>					
<i>Islam (2)</i>					
<i>Christianity (3)</i>					
Self-perceived Religiosity	2.043	.290	.317	7.037	<.001
<i>Very religious (1)</i>					
<i>Moderately religious (2)</i>					
<i>Somewhat religious (3)</i>					
<i>Not religious at all (4)</i>					
Political Affiliation	-.652	.329	-.087	-1.981	.048
<i>Liberal (1)</i>					
<i>Conservative (2)</i>					
<i>Non-Political (3)</i>					
<i>Others (4)</i>					
Year of Study	.408	.211	.082	1.935	.054
<i>Year 1 (1)</i>					
<i>Year 2 (2)</i>					
<i>Year 3 (3)</i>					
<i>Year 4 (4)</i>					
<i>Year 5 (5)</i>					
<i>Year 6 (6)</i>					
Educational Institution Category	-.193	.478	-.017	-.404	.687
<i>Public (1)</i>					
<i>State-Autonomous (2)</i>					
<i>Private (3)</i>					
Total Abortion Knowledge Score	.531	.086	.286	6.175	<.001

Note: B = Unstandardised coefficient; SE = Standard Error; β = Standardised coefficient. Significance level $p < .05$.

DISCUSSION

This study found a significant positive association between abortion knowledge and pro-choice attitudes among future Thai educators. While attitudes were generally supportive, knowledge gaps undermined this support, particularly concerning abortion safety and long-term effects. These misconceptions in a university-educated sample indicate systemic shortcomings in current educational curricula regarding evidence-based reproductive health information.

Multivariable analysis revealed self-perceived religiosity as the strongest independent predictor of abortion attitudes, followed by knowledge, gender identity, sexual orientation, and political affiliation. Knowledge remained statistically significant after controlling for personal characteristics, whilst religiosity exerted the greatest influence, underscoring the deeply personal and culturally embedded nature of this issue in Thailand.

Through TPB lens, factual knowledge shapes 'behavioural beliefs' about abortion outcomes (safety and health consequences), influencing attitudes. Concurrently, religiosity, political affiliation, and gender influence 'subjective norms'—perceived social pressure to conform to significant others' views. The strong

CONCLUSION

This study reveals that abortion attitudes among Thailand's future educators reflect tension between evidence-based knowledge and personal values. While knowledge significantly predicts supportive attitudes, self-perceived religiosity emerges as the strongest influence, suggesting that knowledge alone may be insufficient without engaging underlying cultural and value systems.

Though limited to urban, university-educated Bangkok cohorts, findings signal broader systemic challenges. If well-educated future teachers harbour critical misconceptions, knowledge gaps may be more pronounced elsewhere.

The knowledge-attitude association suggests education could shape opinions.

predictive power of both knowledge and religiosity suggests attitudes form at the intersection of evidence-based beliefs and socio-cultural norms.

Critical knowledge gaps exist: only 23.9% correctly understood that safe abortion does not impact future fertility, and less than half knew abortion is legal at later gestational stages under specific circumstances or that medical abortion at home can be safe with professional guidance. Such misconceptions could perpetuate stigma and fear, deterring individuals from seeking safe, legal, timely care.

Given these findings, future educators may perpetuate harmful myths or improve students' reproductive health literacy, highlighting the need for evidence-based reproductive health modules in teacher training programs. Implementation may face challenges, including institutional resistance, cultural opposition, and bureaucratic hurdles, requiring multi-sectoral collaboration and culturally sensitive approaches.

This study has limitations. Non-probability sampling limits generalisability to all future Thai educators. Cross-sectional design prevents causal inference between knowledge and attitudes. Self-report measures may introduce social desirability bias.

Equipping educators with accurate information is essential for fostering supportive environments for safe abortion care and supporting young people navigating reproductive health decisions.

RECOMMENDATION

For Policy and Curriculum Development in Teacher Training

Teacher training should cover the medical, legal (Sections 301 and 305), and safety aspects of abortion, debunk common myths like the abortion-infertility link, and promote destigmatised, evidence-based language. Instead of relying solely on didactic approaches, training should use case-based learning and guided discussions to help students navigate ethical issues and balance science with diverse values.

For Future Research

Qualitative studies (e.g., focus groups, interviews) could explore why misconceptions persist and how personal values influence interpretation of facts. Longitudinal and interventional research should assess how attitudes change and measure the impact of programmes on knowledge and teaching. Systematic evaluations of current sexual and reproductive health and rights (SRHR) curricula in Thai institutions would identify best practices. Future quantitative studies should use representative samples, including rural areas, to capture regional disparities and support equitable, national policy-making.

ETHICAL DECLARATION

This study received ethical approval from the Research Ethics Review Committee for Research Involving Human Research Participants, Group 1, Chulalongkorn University (COA No.104/68).

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FACTORS RELATED TO SPIRITUAL HEALTH AMONG OLDER PEOPLE IN THAILAND: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Spiritual health is one aspect of health recognized by the World Health Organization. Older people are regarded as individuals at risk of having their spiritual health compromised. However, global research is limited, definitions unclear and results inconsistent. Thailand is one of the front-runners in population ageing among low- and middle-income countries. While spiritual health is seen as important for the well-being of older people in national policy, concrete efforts to support and improve it have not been established.

Objectives: This study examined the current state of spiritual health among older people in Thailand and identified the associated socioeconomic characteristics.

Methodology: This cross-sectional study was conducted in June 2025 among 418 independently living individuals aged 60+ from elderly clubs in Ratchaburi Province, selected through multistage sampling. Spiritual health was measured using the Purpose in Life test. Research assistants conducted face-to-face interviews using a structured questionnaire. Data were analyzed using SPSS29 with descriptive statistics, Chi-square tests, and multiple logistic regression.

Results: Mean spiritual health score was 112.4 ± 19.7 , with 79.7% classified as having high spiritual health. Multivariate analysis showed that employment status (AOR=1.993, $p=0.037$), perceived economic status (AOR=3.637, $p<0.001$), pension receipt (AOR=5.555, $p=0.012$), belief or faith status (AOR=11.082, $p<0.001$), and past year volunteering (AOR=4.897, $p<0.001$) were positively associated with spiritual health. In contrast, participation in past year social activities was negatively associated with spiritual health (AOR=0.499, $p=0.046$).

Conclusion: This study found generally high spiritual health among older Thais and identified groups with low spiritual health for targeted interventions. To further enhance spiritual health among older Thais, it is essential to ensure a sense of economic security, strengthen social support, expand opportunities for employment, social activities, and volunteer engagement, and strengthen community support systems that facilitate religious. Additionally, interventions and qualitative research are needed.

Keywords: Older people, Purpose in life, Spiritual health, Thailand

INTRODUCTION

Global population aging is progressing rapidly. By 2050, over 20% of the world's population will be aged 60 or older, with two-thirds residing in low- and middle-income countries (1).

Thailand is among these countries, where the proportion of people aged 60 and over having

increased from 6.8% in 1994 to 20.0% in 2024. With a GDP per capita of around USD 7,000, Thailand faces the challenge of "growing old before becoming rich", and support systems for older people remain underdeveloped. By 2034, older people are expected to make up 28% of the population, attracting global attention to Thailand's response (2).

Spiritual health has been scientifically examined by the World Health Organization (WHO) as the fourth dimension of health (3). Spiritual health can be understood as "the health of recognizing the purpose and meaning of life, accepting oneself as they are, and being able to choose one's own way of living", and is considered an essential component of overall well-being (4, 5).

In later life, individuals often face multiple losses, including physical and cognitive decline, economic changes after retirement, and the loss of social roles, which can diminish their Purpose in Life (PIL), a core element of spiritual health (6). Loss of PIL may lead to a loss of direction and self-acceptance, threatening spiritual health (7). The WHO recognizes the importance of spiritual health and regards it as essential for achieving a healthy and long-lived society (3).

In Thailand, too, spiritual health has been addressed in national initiatives such as "Healthy Thailand" in 2005 and the "Healthy Ageing" policy in 2015 (8, 9).

However, despite its importance globally and in Thailand, there have not been sufficient concrete initiatives to maintain and improve the spiritual health of older people. This is because the limited research, unclear definitions, and inconsistent findings make it hard to identify target groups for policy. Most Thai studies focus on older people with chronic illness and population-based studies are few. Definitions and measures of spiritual health also vary, making comparison difficult (10-12).

Given this background, this study aimed to examine the current state of spiritual health among older people in Thailand and identified the associated socioeconomic characteristics. The findings will help identify priority groups and inform strategies to improve spiritual health among older people.

METHODS

Study Design

This cross-sectional study examined the level of spiritual health and its association with socioeconomic characteristics among Thai older people aged 60 and above.

Study Population

The study population consisted of 500 individuals aged 60 and over residing in Ratchaburi Province. All participants were members of an elderly club, lived independently, were native Thai speakers, and were in stable general health.

Sampling Technique

This study used a multistage purposive sampling technique and examined older people in central Thailand, a region influenced by Bangkok's economic, political, and cultural changes (13). Ratchaburi Province, with a population structure similar to central Thailand, was selected, focusing on Wat Phleng District, which has the highest proportion of older people (34%) (2, 14). Of the three subdistricts, Chom Prathat was excluded due to many unregistered older residents. Thus, 500 older people were selected from Ko San Phra and Wat Phleng subdistricts.

Sample and Sample Size

The sample size was initially calculated by Taro Yamane's formula (15). $n = N / (1 + Ne^2)$ Population size (N)=14,027,411 (older people in Thailand) (2). Margin of error (e)=0.05 for 95% confidence.

This yielded a required sample size of approximately 400. To account for potential refusals, withdrawals, and incomplete or missing data, an additional 25% was added, resulting in a final sample size of 500.

Data Collection

Data were collected via face-to-face interviews using printed structured questionnaires by Thai public health officers and village health volunteers during two weeks in June 2025. The questionnaire had two parts. (1) Socioeconomic characteristics (Q1–Q18), developed by the researchers from literature review.

(2) Spiritual health (Q19–Q38), assessed by Part A of the Purpose in Life (PIL) test by Crumbaugh and Maholick, with scores from 20 (indicating low spiritual health) to 140 (indicating high spiritual health) (16).

Data Entry and Data Analysis

Data were entered in Excel and analyzed using SPSS 29. Descriptive statistics summarized the data. Pearson's Chi-square tests ($p < 0.05$) assessed bivariate associations. Multiple logistic regression identified associations with dichotomous outcomes.

Ethical Consideration

The study was approved by Chulalongkorn University's (COA No.197/68) and Juntendo University's (E23-0364-M03) Ethical Review Committee. Informed consent was obtained and confidentiality maintained.

RESULTS

Of the 500 respondents, 418 were included in the final analysis. Exclusions were due to incomplete responses.

Descriptive Findings**Socioeconomic Characteristics**

Table 1 summarizes the respondents' socioeconomic characteristics. Most participants were female (60.1%) with an average age of 69.1 years (range: 60–97), and 59.6% were aged 60–69. A majority (67.9%) had completed primary or lower secondary education. Over half (55.3%) were married and living with their spouses. 83.0% had children, and 90.7% lived with others. About 69.6% reported at least one illness. More than half (58.1%) were currently working, and 45.7% reported that self-employment was the occupation they had held the longest. While 72.7% had no economic concerns, 61.0% were in household debt, and 51.0% earned 20,000 baht or less per month. Only 15.8% received a pension. 62.4% lived with someone needing care. Most (92.6%) had religious beliefs, mainly Buddhism (84.9%) and Catholicism (12.0%). Regarding social participation, 60.3% joined social activities, and 40.7% did volunteer work in the past year.

Table 1 Descriptive Statistics of Socioeconomic Characteristics (n=418)

Socioeconomic Characteristics	Number	Percent (%)
Gender		
Male	166	39.7
Female	251	60.1
Gender diverse	1	0.2
Age		
60-69 years	249	59.6
70-79 years	120	28.7
80 years and above	49	11.7
Education Level		
Primary or lower secondary	284	67.9
Upper secondary / Vocational	60	14.4
Higher vocational	21	5.0
Bachelor's	48	11.5
Master's or higher	2	0.5
Others	3	0.7
Marital Status		
Single (never married)	64	15.3
Married / Cohabiting	231	55.3
Others	123	29.4
Children		

Socioeconomic Characteristics	Number	Percent (%)
Has	347	83.0
None	71	17.0
Co-residents		
Alone	39	9.3
Living with someone	379	90.7
Current Illness		
None	127	30.4
Has	291	69.6
Employment Status		
Working	243	58.1
Not working	175	41.9
Longest Job		
Self-employed	121	29.0
Not working	72	17.2
Others	225	53.8
Perceived Economic Status		
No difficulty	197	47.1
Somewhat manageable	107	25.6
Slightly worried	87	20.8
Very worried	27	6.5
Household Debt Status		
No debt	163	39.0
Small, manageable debt	173	41.4
Moderate debt (repayment needed)	75	17.9
Heavy debt burden	7	1.7
Monthly Income Level		
<20,000 baht	213	51.0
20,000-39,999 baht	134	32.1
40,000+ baht	71	16.9
Pension Receipt		
Receiving	66	15.8
Not receiving	352	84.2
Care in Household		
Present	261	62.4
Not present	157	37.6
Belief or Faith Status		
Has belief or faith	387	92.6
Does not have or unsure	31	7.4
Religion Type (Multiple answers)		
Buddhism	355	84.9
Christianity (Protestant)	4	1.0
Christianity (Roman Catholic)	50	12.0
Animism / Folk beliefs	1	0.2
None	9	2.2

Socioeconomic Characteristics	Number	Percent (%)
Past Year Social Activities		
Participated	252	60.3
Did not participate	166	39.7
Past Year Volunteering		
Participated	170	40.7
Did not participate	248	59.3

Spiritual Health

Tables 2 present descriptive statistics on spiritual health among older people in Thailand. The mean spiritual health score was 112.4±19.7.

Using a cutoff value of 102 to dichotomize the scores, the majority of respondents (79.7%) were classified as having high spiritual health (16).

Table 2 Descriptive Statistics of Spiritual Health (n=418)

Level of Spiritual Health	Cut off Score	Number	Percent (%)
Low	0-101	85	20.3
High	102-140	333	79.7

Analytic Findings

Bivariate Analysis

Chi-square tests examined associations between socioeconomic characteristics and spiritual health. For bivariate analysis, some socioeconomic characteristics were re-categorized into two groups. Table 3 presents the results of the bivariate analysis. Since only one participant identified as gender diverse, this category was excluded from the analysis to

ensure statistical reliability, with no intention to undermine its importance. Among the socioeconomic characteristics, education level, co-residents, employment status, perceived economic status, monthly income level, pension receipt, belief or faith status, past year social activities, and past year volunteering showed statistically significant associations with spiritual health at the 0.05 level.

Table 3 Bivariate Analysis between Socioeconomic Characteristics and Spiritual Health (n=418)

Independent Variables	Chi-square	p value
Socioeconomic Characteristics		
Gender (n=417)	0.043	0.835
Male		
Female		
Age	3.573	0.059
60-69 years		
70 years and above		
Education Level	12.766	<0.001**
Primary or lower secondary		
Upper secondary or higher		

Independent Variables	Chi-square	p value
Marital Status	2.132	0.144
Married / Cohabiting		
Others		
Children	0.020	0.887
Has		
None		
Co-residents	4.486	0.034*
Alone		
Living with someone		
Current Illness	3.253	0.071
None		
Has		
Employment Status	10.918	<0.001**
Working		
Not working		
Longest Job	2.030	0.154
Self-employed		
Others		
Perceived Economic Status	26.366	<0.001**
Concerned		
Not Concerned		
Household Debt Status	0.286	0.593
No debt at all		
Has debt		
Monthly Income Level	14.541	<0.001**
Less than 20,000 baht		
20,000 baht or more		
Pension Receipt	9.858	0.002*
Receiving		
Not receiving		
Care in Household	0.234	0.629
Present		
Not present		
Belief or Faith Status	24.606	<0.001**
Has belief or faith		
Does not have or unsure		
Religion Type	1.173	0.279
Buddhism		
Others		
Past Year Social Activities	4.192	0.041*
Participated		
Did not participate		
Past Year Volunteering	21.104	<0.001**
Participated		

Independent Variables	Chi-square	p value
Did not participate		

*p-value<0.05, **p-value<0.001

Multivariate Analysis

Table 4 presents the results of the multivariate analysis. Independent variables were chosen based on bivariate significance (p<0.05), borderline significance (p<0.25), and theoretical relevance from the literature review. One gender diverse respondent was excluded, leaving 417 participants. Significant positive associations with high spiritual health were found for

employment status (AOR=1.993, p=0.037), perceived economic status (AOR=3.637, p<0.001), pension receipt (AOR=5.555, p=0.012), belief or faith (AOR=11.082, p<0.001), and past year volunteering (AOR=4.897, p<0.001). Past year social activities showed a negative association (AOR=0.499, p=0.046).

Table 4 Multivariate Analysis: Associations of Socioeconomic Characteristics with Spiritual Health by Multiple Logistic Regression (n=417)

Variables	B	S.E.	Sig.	AOR (95% CI)	95% CI	
					Lower	Upper
Socioeconomic Characteristics						
Gender						
Male (Ref:)						
Female	-0.121	0.312	0.699	0.886	0.481	1.633
Age						
70 years and above (Ref:)						
60-69 years	-0.031	0.305	0.918	1.032	0.567	1.877
Education Level						
Primary or lower secondary (Ref:)						
Upper secondary or higher	0.503	0.416	0.227	1.654	0.732	3.741
Marital Status						
Others (Ref:)						
Married / Cohabiting	0.163	0.338	0.630	1.177	0.606	2.284
Children						
Non (Ref:)						
Has	-0.455	0.447	0.309	0.635	0.264	1.524
Co-residents						
Alone (Ref:)						
Living with someone	0.798	0.464	0.086	2.222	0.894	5.522
Current Illness						
No illness (Ref:)						
Has illness	0.244	0.348	0.483	1.276	0.646	2.522
Employment Status						
Not working (Ref:)						
Working	0.690	0.331	0.037*	1.993	1.042	3.813
Longest Job						

Variables	B	S.E.	Sig.	AOR (95% CI)	95% CI	
					Lower	Upper
Others (Ref:)						
Self-employed	0.306	0.319	0.338	1.358	0.726	2.537
Perceived Economic Status						
Concerned (Ref:)						
Not Concerned	1.291	0.310	<0.001**	3.637	1.981	6.675
Monthly Income Level						
Less than 20,000 baht (Ref:)						
20,000 baht or more	0.030	0.318	0.926	1.030	0.552	1.923
Pension Receipt						
Not receiving (Ref:)						
Receiving	1.715	0.685	0.012*	5.555	1.451	21.261
Belief or Faith Status						
Does not have or unsure (Ref:)						
Has belief or faith	2.405	0.514	<0.001**	11.082	4.044	30.372
Past Year Social Activities						
Did not participate (Ref:)						
Participated	-0.695	0.348	0.046*	0.499	0.252	0.986
Past Year Volunteering						
Did not participate (Ref:)						
Participated	1.589	0.379	<0.001**	4.897	2.332	10.285

Significance level: *p-value<0.05, **p-value<0.001

Model chi-square=97.498 (df=15, p-value<0.001); Nagelkerke R Square=0.328; Hosmer and Lemeshow test chi-square=13.501 (df=8, p-value=0.096)

DISCUSSION

Socioeconomic Characteristics

Compared to existing national census data, the study population's gender and age distribution closely matched national trends. Education levels were slightly higher, while marital status, cohabitation, and single-person household rates showed no major differences. The proportion of individuals currently with any illness exceeded the national average. Labor status differed, with fewer non-working individuals than average. Monthly income levels and pension receipt rates were higher than national figures. Although a larger share had debts compared to the national average, most were small and manageable. The rate of living with family members requiring care was also higher, as was the proportion with beliefs or faith. Participation in social activities and volunteering tended to exceed national data (2).

Spiritual Health

This study assessed the spiritual health of 418 older Thais. The mean score was 112.4 ± 19.7 (range: 26.0–140.0), with an interquartile range of 110.5–114.3, indicating generally high levels. Using a 102-point cutoff, 79.7% were classified as having high spiritual health, consistent with previous Thai studies (12). However, the low minimum score suggests notable individual variation. Overall, spiritual health was high and aligned with earlier findings.

Association between Socioeconomic Characteristics and Spiritual Health

Six socioeconomic characteristics showed significant associations with spiritual health.

Employed individuals had significantly higher spiritual health (AOR=1.993, p=0.037), consistent with Iranian findings (17). Employment may serve as a source of PIL and be linked to spiritual health.

Perceived economic status was

significantly positively associated with spiritual health (AOR=3.637, $p<0.001$), consistent with previous findings from Turkey (18). In contrast, objective measures like income and debt showed no link. Feeling financially secure may provide mental space for self-reflection on PIL and relate to spiritual health.

Pension receipt was also positively associated (AOR=5.555, $p=0.012$), in line with Thai research identifying lack of social support as a factor in spiritual distress (19). Pensions may provide both financial security and a sense of social belonging, and are associated with the level of spiritual health.

Belief or faith showed positive association (AOR=11.082, $p<0.001$), consistent with previous Thai findings (12). It likely plays a key role in discovering PIL and is associated with the level of spiritual health.

Participation in social activities in the past year was negatively associated (AOR=0.499, $p=0.046$), contrary to prior research (20). This may be because people joined social activities to recover from a temporary decline in spiritual health. This suggests the existence of social environments that support older people who are facing a decline in spiritual health.

Finally, volunteering in the past year was positively associated (AOR=4.897, $p<0.001$). While no prior studies have examined this, volunteering may enhance PIL through contributing to others and the community and is associated with the level of spiritual health.

Strengths

This study identified groups of older people in Thailand with low spiritual health to prioritize for future interventions. Using a structured questionnaire to provide quantitative evidence, this study offered valuable insights for policymakers and stakeholders.

LIMITATIONS

This study did not use random sampling. Therefore, caution is warranted when generalizing the findings to the entire older population in Thailand. Furthermore, as a cross-sectional study, it is unable to establish causal relationships between spiritual health and associated factors. Additionally, the data were self-reported, and no observational methods were

employed due to time and budget constraints, thus limiting the objective assessment of living conditions, health status, religious faith, and economic situation. Moreover, recall bias, response bias, and social desirability bias may be present.

RECOMENDATIONS

This study suggests enhancing economic security, strengthening social support, promoting employment and social engagement, and supporting belief or faith practices to improve the spiritual health of older people in Thailand. Receipt of a pension is linked to spiritual health by reducing financial anxiety and fostering reassurance and social belonging. Lower spiritual health among those who engaged in social activities may indicate that those needing support participate more. Providing work and volunteering opportunities, which are thought to foster PIL and positively impact spiritual health, is also important. Belief and faith strongly relate to spiritual health, highlighting the need to work with religious groups. Future research should create culturally suitable interventions and assess them quantitatively, while using interviews and ethnography to better understand spiritual health in the Thai culture.

CONCLUSION

This study explored spiritual health among older people in Thailand and its associated socioeconomic characteristics. Most participants showed high spiritual health, aligning with previous research. Significant associations were found with employment status, perceived economic status, pension receipt, belief or faith status, past year social activities and the past year volunteering.

To further enhance spiritual health among older Thais, it is essential to ensure a sense of economic security, strengthen social support, expand opportunities for employment, social activities, and volunteer engagement, and strengthen community support systems that facilitate religious. Additionally, interventions and qualitative research are needed.

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ASSOCIATION OF SOCIODEMOGRAPHIC AND AL FACTORS WITH KNOWLEDGE RELATED TO SEXUAL AND REPRODUCTIVE HEALTH AMONG OLDER ADOLESCENT GIRLS IN MPIGI DISTRICT, UGANDA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Limited knowledge of sexual and reproductive health (SRH) among adolescent girls remains a global concern, particularly in low-and middle-income countries, affecting their ability to prevent unwanted pregnancies, sexual transmitted infections (STIs), and unsafe abortions.

Objectives: This study aims to 1) determine the association between sociodemographic and family environmental factors and SRH knowledge among older adolescent girls in Mpigi district, Uganda and 2) identify the top incorrect answers in SRH knowledge, related to HIV/STIs, contraception, and pregnancy.

Methodology: A community-based cross-sectional survey was conducted from September to October 2024 among older adolescent girls aged 15 to 19 years in Mpigi district, Uganda. Participants were selected using a multistage sampling method from 12 villages within the district. The data collection method was an interviewer-administered structured questionnaire. Binary logistic regression was performed to determine the association between sociodemographic and family environmental factors and SRH knowledge (p-value < 0.05), while descriptive analysis identified the top incorrect answers within SRH knowledge domain.

Results: A total of 482 participants (mean age 17.0 ± 1.5 years; 98.8% response rate) were included, 302 (62.4%) demonstrated a good level of SRH knowledge. The top incorrect answers were: a) for HIV/STIs domain, 45.6% believed that HIV can be transmitted by sharing a glass of water; b) for contraception domain, 35.1% disagreed with the correct statement of Emergency Contraceptive Pills (ECPs), a woman take EPC as soon as possible (within 72 hours) after intercourse c) for pregnancy domain, 47.3% believed a woman is most likely to get pregnant during her menstruation. Older age (AOR = 1.322, 95% CI: 1.106–1.603, p = .002) and having a mother with a history of teenage birth (AOR = 2.194, 95% CI: 1.439–3.344, p < .001) were positively associated with good SRH knowledge, while having only primary education (AOR = 0.516, 95% CI: 0.328–0.814, p = .004) and living with only one biological parent (AOR = 0.544, 95% CI: 0.315–0.994, p = .046) were associated with lower odds of good knowledge.

Conclusion: Adolescent girls' age, education level, having a mother with a history of teenage birth and

living with a single parent were significant factors on SRH knowledge. These findings suggest that continued enrollment in secondary education and family-based support program implemented by Village Health Teams, particularly for single-parent households, to enhance SRH knowledge among adolescent girls.

Keywords: Adolescent, Sexual and Reproductive Health, Knowledge, Uganda

INTRODUCTION

There is clear evidence that comprehensive sexuality education contributes positively to sexual and reproductive health outcomes and plays a critical role in reducing the incidence of sexual transmitted infections (STIs), including Human Immunodeficiency Virus (HIV), as well as unintended pregnancies (1). However, inadequate knowledge of Sexual and Reproductive Health (SRH) among adolescent girls remains a major concern particularly low- and middle- income countries (LMICs) (2). Globally, approximately 12 million births occur annually among girls aged 15 to 19, accounting for around 11% of all births, with 95% of these births taking place in LMICs (3). Adolescent pregnancy is closely linked to adverse maternal and neonatal outcomes, with complications during pregnancy and childbirth constituting one of the leading causes of mortality for both adolescent mothers and their newborns (4).

Factors influencing knowledge of sexual and reproductive health among adolescents are diverse and include gender, age, wealth index, level of education, parental supervision, and peer influence (5-9).

The family environment serves, as the primary social context, plays a critical role in shaping adolescents' values, beliefs, and behaviors. (10). According to Social Cognitive Theory, adolescents acquire knowledge and behaviors through observational learning,

modeling, and reinforcement within their immediate social environment (11). Research indicated that the family setting, particularly parental supervision, forms a foundational influence on adolescent girls' sexual and reproductive health knowledge and attitudes (12).

Although the global prevalence of adolescent pregnancy has decreased, the rate in Uganda remained stagnant at 25% during the decade from 2006 to 2016. The estimated maternal mortality rate was 189 per 100,000 live births in 2023, with approximately 18% of those deaths occurred among girls aged 15 to 19 (13). Additionally, the unmet needs for family planning among adolescent girls is still high, only 29.9% of sexually active unmarried girls aged 15 to 19 utilize modern contraception (14).

Knowledge of contraceptive methods is almost universal in Uganda, with approximately 99% of both women and men reporting heard of at least one method of contraception (14). However, only 24% of women aged 15 to 19 have accurate knowledge of the fertile period during the ovulatory cycle. Among those who rely on the rhythm method, only 34% correctly identify the fertile period as occurring midway between two menstrual periods (14).

While Uganda Social Health Demographic Survey explored general

adolescent SRH knowledge, there is no study focusing on the socio-demographic and family environmental factors influencing older adolescent girls' SRH knowledge in Mpigi district. Mpigi district, situated in the central region, plays an important role in sustaining Kampala's economy by supplying labor and fulfilling workforce demands (15). This geographical importance contributes to population mobility between Mpigi and Kampala, having one of the highest rates of adolescent pregnancy. Additionally, Mpigi district has a relatively high prevalence of HIV (2-2.9%) among adolescent girls and young women (AGYM), which may be attributed to its distinct geographic features, such as its proximity to Lake Victoria (16).

This study, therefore, aims to 1) determine the association between sociodemographic and family environmental factors and SRH knowledge among older adolescent girls in Mpigi district, Uganda and 2) identify the top incorrect answers in SRH knowledge, related to HIV/STIs, contraception, and pregnancy. The findings of this study are expected to contribute to strategies for improving SRH education and interventions targeting adolescent girls in similar contexts.

METHODOLOGY

Study Design and Settings

A community-based cross-sectional study was conducted in Mpigi District, Uganda, from September to October 2024.

The district is approximately 80% rural and has an 86-kilometer shoreline along Lake Victoria. It comprises six sub-counties and

one town council. These sub-counties include 56 parishes and 229 villages.

Study Population

The study population consisted of all adolescent girls aged 15 to 19 who had lived in the study area for at least six months. Those who were ill, had a mental illness, or were uncertain of their exact age at the time of data collection were excluded from the study.

Sample Size and Sampling method

The sample size was calculated using the single population proportion formula with a 95% confidence level ($Z = 1.96$), a 24% estimated proportion of adolescent pregnancy, and a 4% margin of error. The significance level was set at 5%. After accounting for a 10% nonresponse rate, the final sample size was 482.

Sampling began with purposive selection of sub-counties representing both high and low population density. From these, parishes were randomly selected, followed by two randomly selected villages per parish. Within each selected village, adolescent girls were recruited from conveniently chosen households, which may introduce selection bias. In households with more than one eligible girl, one was randomly selected by the lottery method. If the required sample size was not met in a village, recruitment continued in the nearest village within the same parish. Village Health Teams (VHTs) or a local council secretary assisted the research team to ensure accurate coverage within village boundaries.

Measurement Tool

Data were collected using a self-developed structured questionnaire that incorporated and modified items from validated tools. SRH knowledge was assessed in three domains: knowledge of HIV/STIs, contraception, and pregnancy. These questions were adapted from validated instruments, including HIV knowledge Questionnaire for Adolescent Girls (HIV-KQ AG) (17), and the WHO's Illustrative Questionnaire for Interview Surveys with Young People (18), combined with related literature (19, 20). The SRH knowledge consisted of 21 items, with each correct answer scored as 1 and incorrect answer scored as 0, resulting in a total score range of 0 to 21. A cut-off at the median (15) defined poor (3-14) and good (15-21) knowledge, reflecting the non-normal distribution of scores.

The original English questionnaire was reviewed for content validity by three public health experts using the Item-Objective Congruence (IOC) index. After validation, it was translated into Luganda and back-translated by bilingual translators. A pilot study with 40 participants from a demographically similar area was conducted. The questionnaire was then revised to ensure internal consistency, with KR-20 and Cronbach's Alpha value above 0.7.

Data Collection

The questionnaire was prepared on Kobo Toolbox (<https://eu.kobotoolbox.org>). Data were collected through interviewer-administered surveys by the principal researcher and trained data collectors who completed a three-day training with role-playing to ensure quality.

Statistical Analysis

A total of 487 adolescent girls were eligible for study. Four who resided outside the selected village and one with an incomplete interview were excluded as dropouts, totaling 482 participants (response rate: 98.9%). Data were analyzed by SPSS ver.29. Descriptive statistics identified the top incorrect SRH knowledge response in each domain. Multipliable binary logistic regression assessed association between SRH knowledge and sociodemographic and family environment factors, adjusting for potential confounders based on theoretical relevance. Variables with $p < 0.05$ and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were considered statistically significant.

Ethical Consideration

This study was approved by the Makerere University School of Public Health Research and ethics Committees (SPHREC) on 25th September 2024 (SPH-2024-653). Subsequently, official registration was completed at the Mpigi District Headquarters.

RESULTS***Socio-demographic and Family******Environmental Characteristics***

A total of 482 participants were analyzed, with the mean age of 17.0 years (± 1.5 SD). Catholics represented 44.6% of the participants. More than half (53.1%) had secondary education or higher. Approximately one-third (34.6%) were living with their biological parents. A large portion (87.8%) were single, and among the married

participants, 56% were married before turning 18. At survey time, 56.4% were attending school, and 36.9% were from medium-income households.

Regarding family environmental factors, 50.4% of had married parents. Almost half (43.1%) resided in medium-size households (average 5.7 members). Additionally, 48.1% had mothers with histories with teenage birth, and 23.7% had sisters who had experienced teenage birth (Table 1).

Table 1 Socio-demographic and Family Environmental Characteristics of Participants (N = 482)

Variables	Frequency	Percentage (%)
Age		
(Mean \pm SD: 17.0 \pm 1.5)		
15	112	23.2
16	87	18.0
17	81	16.8
18	92	19.1
19	110	22.8
Religion		
Catholic	215	44.6
Anglican	41	8.5
Muslim	118	24.5
Pentecostal/Born Again/Evangelical	76	15.8
Others	32	6.6
Level of Education		
Secondary level and above	256	53.1
Primary level	213	44.2
Never go to school	13	2.7
Living Arrangement, with		
both biological parents	167	34.6
One biological parent	127	26.3
Non-biological parents	188	39.1
Marital Status		
Single	423	87.8
Married < 18	33	6.8
Married \geq 18	26	5.4
Age at First Marriage		
(Mean \pm SD: 17.2 \pm 1.1) range 13-19		
School Attendance		
Student	272	56.4
Non-student	210	43.6
Economic Status[#]		

Low	145	30.1
Medium	178	36.9
High	159	33.0
Parents' Marital Status		
Married	243	50.4
Divorced/Separated	176	36.5
Widowed	63	13.1
Size of the Household		
Small (1-3)	120	24.9
Medium (4-6)	210	43.6
Large (7 or more)	152	31.5
Family History of Teenage Birth		
Mothers' History of Teenage Birth		
No	250	51.9
Yes	232	48.1
Sisters' History of Teenage Birth		
No	368	76.3
Yes	114	23.7

Economic status (low, medium, high) was based on the ownership of a set of seven household possessions

Knowledge of SRH

Among the participants, 181 (37.6%) demonstrated poor SRH knowledge, while 301 (62.4%) had good knowledge (Table 2).

SRH knowledge questions were categorized into three domains: knowledge of HIV/STIs, contraception, and pregnancy. In the HIV/STIs domain, the top incorrect answer was to Question 5: "A person can get HIV by sharing a glass of water with someone who has HIV.", with nearly half participants (45.6%, n=220) answered incorrectly. In the

contraception domain, the top incorrect answer was to Question 14 regarding Emergency Contraceptive Pills (EPC): "Can a woman take pills as soon as possible (within 72 hours) after intercourse." The statement is true; however, 169 (35.1%) disagreed with it. In the pregnancy domain, the top incorrect answer was to Question 20, with 228 (47.3%) incorrectly agreed that "A woman is most likely to get pregnant during her menstruation." (Table 3)

Table 2 Total knowledge level of SRH (N = 482)

Total Knowledge level	Frequencies (%)
Poor level (Score 3-14)	181 (37.6)
Good level (Score 15-21)	301 (62.4)
Median (Interquartile range)	15 (4)
Minimum, Maximum	3, 21

Table 3 Frequencies and distribution of participants' SRH knowledge (incorrect and correct answer) (N = 482)

Statement	Frequencies (%)	
	Incorrect Answer	Correct Answer
Domain1. Knowledge of HIV/STIs		
1. HIV is known as the Human Immunodeficiency Virus.	63 (13.1)	419 (86.9)
2. HIV develops into AIDS.	49 (10.2)	433 (89.8)
3. Rapid weight loss is one of the symptoms related with AIDS.	159 (33.0)	323 (67.0)
4. White sores in the mouth and throat are one of the symptoms related with AIDS.	213 (44.2)	269 (55.8)
5. A person can get HIV by sharing a glass of water with someone who has HIV. *	220 (45.6)	262 (54.4)
6. A pregnant woman who is infected with HIV/STIs can transmit these diseases to her fetus.	168 (34.9)	314 (65.1)
7. Genital herpes is known as Sexual Transmitted Infections (STIs).	219 (45.4)	263 (54.6)
8. Hemorrhoid is known as STIs. *	140 (29.0)	342 (71.0)
9. Genital sores are symptoms commonly associated with STIs.	177 (36.7)	305 (63.3)
10. A burning sensation during urination is a symptom commonly associated with STIs.	134 (27.8)	348 (72.2)
Domain2. Knowledge of Contraception		
11. Pill: Can women take a pill every day.	146 (30.3)	336 (69.7)
12. Injection: Can women have an injection every 2 or every 3 months.	131 (27.2)	351 (72.8)
13. Concom: Can a man put a rubber device on his penis before sexual intercourse.	71 (14.7)	411 (85.3)
14. Emergency Contraceptive Pills (ECP): Can a woman take pills as soon as possible (within 72 hours) after intercourse.	169 (35.1)	313 (64.9)
15. Condoms can be used more than once. *	84 (17.4%)	398 (82.6)
16. Condoms are an effective way of protecting against HIV/AIDS.	53 (11.0)	429 (89.0)
17. Condoms are an effective way of protecting against Sexually Transmitted Diseases.	78 (16.2)	404 (83.8)
Domain3. Knowledge of Pregnancy		
18. First sex can lead to pregnancy.	115 (23.9)	367 (76.1)
19. Childbirth before the age of 18 increases the probability of death of infants and children under five years old compared to childbirth among adult mothers aged 20-24 years.	123 (25.5)	359 (74.5)
20. A woman is most likely to get pregnant during her menstruation. *	228 (47.3)	254 (52.7)
21. Persistent cramps and abdominal pain are signs of preterm labor.	227 (47.1)	255 (52.9)

Association between knowledge level of SRH and sociodemographic and family environmental factors

Each additional year of age increased the odds of having good knowledge by 33.2% (AOR = 1.322, 95% CI: 1.106–1.603, p = .002). Adolescents with only primary education were less likely to have good SRH knowledge than those with secondary or higher education (AOR = 0.516, 95% CI:

0.328-0.814, p = .004). Living with one biological parent also associated with lower odds compared to those living with both parents (AOR = 0.544, 95% CI: 0.315-0.994, p = .046). Those whose mothers had a history of teenage birth were over twice as likely to have good knowledge (AOR = 2.194, 95% CI: 0.315-0.994, p < .001). This association may reflect intergenerational learning or increased attention to SRH due to past mothers' experiences.

Table 4 Factors associated with knowledge of SRH (N = 482)

Variables	B	S.E.	AOR	95% CI		P-value
				Lower	Upper	
Age	0.286	0.095	1.332	1.106	1.603	0.002*
Religion (Catholic ^{Ref})						
Anglican	0.130	0.399	1.139	0.521	2.489	0.744
Muslim	-0.214	0.256	0.808	0.489	1.334	0.404
Pentecostal/Born Again/Evangelical	-0.221	0.298	0.802	0.447	1.437	0.458
Others	0.006	0.434	1.006	0.430	2.355	0.988
Education Level (Secondary level and above ^{Ref})						
Primary level	-0.661	0.232	0.516	0.328	0.814	0.004*
Never go to school	-0.428	0.672	0.652	0.175	2.432	0.524
Living Arrangement (With both biological parents ^{Ref})						
One biological parent	-0.610	0.329	0.544	0.315	0.994	0.046*
Non-biological parent	-0.089	0.318	0.915	0.491	1.707	0.780
Marital Status (Single ^{Ref})						
Married < 18	0.067	0.469	1.069	0.427	2.680	0.886
Married ≥ 18	0.796	0.582	2.217	0.708	6.938	0.172
School Attendance (Student ^{Ref})	-0.561	0.308	0.570	0.312	1.043	0.068
Economic Status (Low ^{Ref})						
Medium	0.375	0.330	1.456	0.762	2.779	0.255
High	0.161	0.328	1.174	0.617	2.234	0.624
Parent's marital status (Married ^{Ref})						
Divorced/Separated	0.269	0.275	1.309	0.763	2.244	0.328
Widowed	0.438	0.368	1.549	0.753	3.189	0.235
Family Size (Small ^{Ref})						

Variables	B	S.E.	AOR	95% CI		P-value
				Lower	Upper	
Medium	0.509	0.291	1.664	0.940	2.945	0.081
Large	-0.084	0.309	0.920	0.502	1.684	0.786
Mothers' History of Teenage Birth (No^{Ref})	0.786	0.215	2.194	1.439	3.344	<0.001*
Sisters' History of Teenage Birth (No^{Ref})	0.195	0.260	1.215	0.730	2.022	0.454

Model chi-square = 68.502 (df = 20, p<0.001); Negalkerke R Square = 0.219; Hosmer and Lemeshow

Test chi-square = 10.924 (df = 8, p=0.206)

* Significance level p<0.05

DISCUSSION

This study revealed that the significant factors associated with the level of SRH knowledge were age, education level, living arrangement (living with one biological parent), and mothers' history of teenage birth.

The finding that 37.6% had poor knowledge suggests a substantial proportion of girls may be at risk due to limited awareness, reflection gaps in access, quality of education, or communication within families.

Sociodemographic Factors

As age increased, participants were more likely to demonstrate a good level of knowledge. This finding aligns with previous studies (6, 21). Older adolescents are more likely to have encountered sexual and reproductive experiences, leading them to actively seek related information. They are also more likely to benefit from SRH instruction provided in higher school grades.

Adolescent girls who had only primary education were significantly less likely to have good SRH knowledge compared to those who had attained secondary or higher education. This is consistent with findings

from a study conducted in Bangladesh (22) and with the results reported by Tadedde et al., which found that women with formal education were approximately 27 times more likely to have good knowledge of SRH compared to those who did not attend formal education (23). In Uganda, adolescent girls receive SRH information from school/teachers (38.5%) and parents/Guardians (34%) (24), while mass media dominates among young adolescents (25), highlighting the importance of sustained SRH education throughout the school system.

Family Environmental Factors

Participants living with only one biological parent were significantly less likely to have good knowledge compared to those living with both parents. A study in Ethiopia revealed that living with both biological parents significantly increased the likelihood of SRH discussions (26). Adolescents living in a family environment that allows dialogue on SRH topics with both parents may contribute to good knowledge level.

Mother's history of teenage birth is positively related to good SRH knowledge.

Previous studies found that daughters whose mothers had experienced teenage birth were more likely to initiate sexual activity early (27). The experience of teenage births in mothers may facilitate open family discussions about SRH, which could influence adolescents' knowledge levels. Daughters may have observed the challenges their mothers faced and been more attentive to SRH messages.

The influence of family environment supports policy goals to involve parents in adolescent SRH education, which can help close knowledge gaps and improve programs.

Knowledge Gaps and Misconceptions

In the HIV/ STIs domain, almost half of participants believed the false statement "A person can get HIV by sharing a glass of water with someone who has HIV." Although nearly ninety percent of participants were aware of HIV, a large portion had misconceptions about how to transmit HIV, consistent with previous findings (28). This highlighted that improved education is needed to correct misconceptions and reduce stigma. In the contraception domain, the statement regarding ECP had the highest incorrect response rate. In Uganda, only 0.5% of women aged 15 to 19 reported current use of ECP (14). Improving comprehensive knowledge among adolescent girls plays a crucial role in supporting ability to make autonomous decisions about contraceptive use. In the pregnancy domain, nearly half of participants misunderstood the ovulation cycle and the likelihood of pregnancy during menstruation. The

misconception about the fertile window may contribute to unintended pregnancies.

Religion, economic status, and sister's history of teenage birth were not significantly associated, which may reflect the cross-cutting influence of shared cultural norms or limited variability in the sample.

This study had several limitations. First, the cross-sectional design limits the ability to infer causal relationships between variables. Second, convenience sampling at the final stage may have introduced selection bias, affecting representativeness. Third, interviewer-administered questionnaires on sensitive topics may have resulted in bias in social desirability. Fourth, the lack of a "I do not know" option may have led to measurement error, as participants may have selected random responses when unsure. Lastly, findings may not be generalizable beyond Mpigi district due to the localized study setting.

CONCLUSION

This study revealed that older age and having mothers with histories of teenage birth were significantly associated with good SRH knowledge, while attaining only primary education and living with a single parent were related to less likely to have good SRH knowledge. In addition, adolescent girls showed knowledge, particularly regarding HIV transmission, ECP use, and the ovulation cycle.

To address these issues, reinforcing Uganda's National Adolescent Health Policy and Comprehensive Sexuality Education

(CSE) program is essential—particularly through efforts that support girls' continuation in secondary school and improve access to accurate SRH information. Community-level strategies, such as empowering Village Health Teams (VHTs) to support single-parent households, may also enhance outcomes. While this study focused on Mpigi, recommendations may apply to similar rural Ugandan settings. Future research should explore additional factors such as sources of SRH information and parent–adolescent communication, which likely influence knowledge levels.

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KNOWLEDGE AND ATTITUDE TOWARDS SEXUALLY TRANSMITTED INFECTIONS AMONG MALE MYANMAR MIGRANT WORKERS IN SAMUT PRAKAN, THAILAND

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ABSTRACT

Introduction: Thailand hosts over 3.1 million registered migrant workers, with 2.3 million from Myanmar. While migration supports economic growth, it also brings public health challenges, notably the resurgence of communicable diseases like HIV, TB, and sexually transmitted infections (STIs). STIs have risen significantly with the reported cases from the Ministry of Public Health Thailand (MOPH) in 2022. Migrant workers are particularly vulnerable to STIs due to factors such as limited access to healthcare, lack of knowledge, social stigma, low condom usage, and risky sexual behavior, including visiting commercial sex workers. The World Health Organization (WHO) aims to end AIDS, viral hepatitis, and STIs by 2030 through coordinated strategies. In Samut Prakan, a province with migrant workers, syphilis cases have nearly doubled from 2019 to 2022. This situation underscores the urgent need for targeted health education and improved access to reproductive health services. The findings aim to guide community health promotion and strengthen migrant health policies in Thailand.

Objective: The objective of this study is to assess the knowledge level and attitude towards sexually transmitted infections among male Myanmar migrant workers in Samut Prakan, Thailand.

Methodology: A descriptive cross-sectional study was conducted in Samut Prakan, Thailand. A total of 243 sample size is calculated by proportional population method. Male Myanmar migrant workers who are 18 years and above, sexually active, residing in the study area at least 6 months and above, were recruited using the Snowball sampling method to answer self-reported questionnaires. Those who are used condoms solely for contraceptive purpose and unwilling to participate were excluded from the study.

Results: The results showed that majority of the participants (72%) had moderate knowledge of STIs and only 28% had Positive attitude towards STIs. There is a significant association between knowledge and education level (OR = 2.19, 95% CI: 1.14–4.21, $p = 0.019$), income (OR = 3.41, 95% CI: 1.57–7.39, $p = 0.002$), living with family (OR = 3.76, 95% CI: 1.12–12.67, $p = 0.033$). There is also association between attitude towards STIs and living condition such as accommodation (OR: (OR = 1.06; 95% CI: 0.01–0.63, $p = 0.016$, high knowledge level of STIs (OR = 9.50, 95% CI: 1.17–77.46, $p = 0.035$).

Conclusions: The findings highlight that socio-demographic background and living conditions significantly influence STI knowledge and attitudes among Myanmar migrants. Addressing these factors through culturally adapted, workplace-integrated interventions could mitigate STI risks and align with WHO and Thailand's public health goals for better reproductive health outcomes.

Keywords: Sexually Transmitted Infections (STIs), Myanmar Migrant Workers, Samut Prakan, Thailand.

INTRODUCTION

Thailand is a major destination for migrant workers, hosting over 3.1 million registered migrants, with approximately 2.3 million from Myanmar (1). While labor migration contributes significantly to economic growth, it also presents public health challenges, including

the resurgence of communicable diseases such as HIV, tuberculosis (TB), and sexually transmitted infections (STIs) (2). STIs are a global public health concern due to their impact on mortality and morbidity. They can cause stigmatization, infertility, cancers, and pregnancy complications, as well as increase the risk of HIV infection. The

World Health Organization (WHO) aims to eliminate AIDS, viral hepatitis, and STIs by 2030 through coordinated strategies (3). According to the WHO, over one million treatable STI cases occur daily, with an estimated 374 million new infections in 2020 among individuals aged 15 to 49 involving trichomoniasis, gonorrhea, syphilis, and chlamydia (4). Although condom use has been the most effective prevention method for STIs over the past three decades (5), there has been a notable increase in reported STI cases in recent years, according to the report from Ministry of Public Health (MOPH) Thailand 2022 (6), with Migrant workers are disproportionately affected due to limited healthcare access, inadequate knowledge, social stigma, low condom use, and engagement in risky sexual behaviors, such as visiting commercial sex workers (5, 7). Samut Prakan, an industrial province with a large migrant workforce, has seen syphilis cases nearly double between 2019 and 2022 (6, 8). There were previous studies conducted STIs knowledge among Myanmar migrant workers in other provinces such as Samut Sakhon, Ranong, Maesot. Most of the labor work force are male Myanmar migrant, working at factories and construction sites. And little is known about knowledge and attitude regarding STIs among male Myanmar migrant workers in Samut Prakan.

This study aims to assess STI knowledge and attitudes among male Myanmar migrant workers in Samut Prakan. The findings will provide valuable insights into their understanding and perceptions of STIs, supporting the development of migrant-inclusive health policies to reduce STI transmission and improve the well-being of this high-risk group.

METHODOLOGY

Study design

A quantitative, cross-sectional study

Study Area

Samut Prakan Province was purposively selected due to its large migrant population and economic significance.

Study Population

Male Myanmar migrant workers aged 18 or older, sexually active, residing in Samut Prakan for at least six months, and literate in the Myanmar language were recruited in this study. Participants those who were unwilling to participate and using condoms solely for contraceptive purposes with regular partners were excluded.

Sample Size and Sampling Method

Sample size was calculated with proportional population method by using single proportion formula. A total of 243 participants were recruited by Snowball Sampling method. Six to eight initial participants from diverse workplaces (e.g., factories, construction, restaurants) were recruited and then asked to refer eligible peers from their social networks until the target sample was reached.

Measurement Tools and Materials

A structured questionnaire, developed from literature and the study's conceptual framework, was used to collect data across three domains: sociodemographic characteristics, STI knowledge (11 items categorized into low, moderate, and high using Bloom's cutoff), and attitudes (measured with a Likert scale and categorized using the mean \pm standard deviation). The questionnaire was originally in English and translated into Myanmar. Pilot testing on 10% of the sample was conducted to assess reliability and validity. Cronbach's alpha was used for internal consistency (≥ 0.70), and content validity was reviewed by three public health experts using an Item-Objective Congruence (IOC) score of ≥ 0.5 . For the attitude statements Cronbach's Alpha coefficient value is 0.82 and knowledge of STIs, the reliability test was done by using KR-20 and the acceptable value is 0.78.

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University approved (COA No.191/68).

Data collection was carried out by trained, same-gender research assistants through screening interviews and self-administered surveys, in collaboration with a civil society organization working with migrants. Participants provided

written informed consent and signature, and confidentiality was maintained by collecting no identifiable information. Responses were anonymized and coded according to university data retention policies. The duration of data collection is from June to July 2025. Descriptive statistics were used to summarize participant characteristics. Pearson's chi-square test assessed associations between variables, and simple logistic regression identified significant predictors of STI knowledge and attitudes.

RESULTS

As described in Table 1, the participants had an average age of 29 years, with ages ranging from 18 to 56 years. Most were either single or

married, with single individuals being slightly more common (42.8%). The vast majority identified as Buddhist (96.3%). Ethnically, most participants were Bamar (69.14%). In terms of education, high school was the most common level completed (43.62%). The majority of participants worked in factories (61.32%) and mainly during the daytime (84.36%). Most earned a monthly income of 8,000 baht or more (62.96%) and sent financial support back to their families (82.72%). Almost all participants were registered migrants (91.77%). The most common type of accommodation was apartments (63.79%), and most participants did not live alone (76.54%), with the majority living with family members (63.98%).

Table 1 Socio-Demographic characteristics of participants (n=243)

Socio-Demographic	Number	Percent
Age group (years)		
18–23	65	26.75
24–34	112	46.09
35–56	66	27.16
Marital status		
Single	104	42.80
Married	102	41.98
In a relationship	26	10.70
Widowed	8	3.29
Divorced	3	1.23
Religion		
Buddhist	234	96.30
Christian	9	3.70
Ethnicity		
Bamar	168	69.14
Mon	31	12.76
Kayin	31	12.76
Shan	7	2.88
Rakhine	3	1.23
Kachin	3	1.23
Education		
No School	5	2.06
Primary School	22	9.05
Middle School	85	34.98
High school	106	43.62
University and above	25	10.29
Work Place		
Factory	149	61.32
Construction	49	20.16
Resturant	17	7.00
Freelance	24	9.88

Socio-Demographic	Number	Percent
shop	4	1.65
Working hour		
Day	205	84.36
Night/Alternate	38	15.64
Salary		
<8000	90	37.04
≥8000	153	62.96
Support back to Family		
Yes	201	82.72
No	42	17.28
Living Status in Thailand		
Registered	223	91.77
Unregistered/ Pending	12	4.94
	8	3.29
Living accomodation		
Apartment	155	63.79
Hostel	61	25.10
Townhouse	13	5.35
Condo	14	5.76
Living alone		
Yes	57	23.46
No	186	76.54
Living with		
Family	119	63.98
Friend	29	79.57
Co-worker	12	6.45
Partner	26	13.98

As in Table 2, participants had an average STI knowledge score of 8.2 with a standard deviation of 1.7, and scores ranged from 2 to 11. The median score was 9, with most scores falling between 7 and 9. The majority of participants had a moderate level of knowledge (72%), followed by high (21%) and low (7%) knowledge levels.

For attitude towards STIs, participants had an average attitude score toward STIs of 47.2 ± 4.2 , with scores ranging from 33 to 58. The median score was 47, with most scores between 45 and 50. The most common attitude was neutral (36.6%), followed by negative (34.6%) and positive (28.8%) attitudes.

Table 2 Knowledge and Attitude Towards STIs among Myanmar migrant workers (n=243)

	Number	percentage
Knowledge of STIs		
Low	17	7
Moderate	175	72
High	51	21
Mean \pm SD = 8.2 ± 1.7 , Median (Q1 – Q3) = 9 (7–9), Minimum – maximum = 2 – 11		
Attitude Towards STIs		
Negative	84	34.6
Neutral	89	36.6

Positive 70 28.8
 Mean ± SD = 47.2 ± 4.2, Median (Q1 – Q3) = 47 (45 – 50), Minimum – maximum = 33 - 58

As described in table 3, In Age group: Participants aged 24–34 had the highest proportion of good knowledge (24.1%), followed by those aged 18–23 (21.5%) and 35–56 (15.2%). Single participants had higher proportion of high knowledge (25%) compared to those who were married, in a relationship, widowed, or separated (18%). For ethnicity, Bamar participants showed high knowledge (23.8%) compared to other

ethnic groups (16%). Participants with high school or university education had high knowledge (23.7%) than those with lower education levels (18.8%), showing association ($\chi^2 = 5.63, p = 0.018$). Participants who earned more than 8000 THB had high knowledge (22.20%) than those earned less than 8000 THB(21.10%), showed a significant association ($\chi^2 = 10.40, p = 0.001$).

Table 3 Cross-tabulation analysis of Knowledge of STIs and Sociodemographic characteristic(n=243)

Variables	% with High Knowledge	χ^2	p-value
Age group			
18–23	21.50%	2.02	0.363
24-34	24.10%		
35-56	15.20%		
Marital status			
Single	25.00%	1.77	0.184
Married/relationship/widowed/separated	18.00%		
Ethnicity			
Bamar	22.02%	0.35	0.553
Mon/Kayin/Shan/Kachin/Rakhine	18.67%		
Education			
No school/Primary/Middle	14.29%	5.63	0.018
High School/University	26.72%		
Work type			
Factory	21.50%	0.78	0.377
Construction/Shop/Resturants/Freelance	20.20%		
Work hours			
Day	22.90%	0.73	0.392
Night/Alternate	13.20%		
Income			
< 8000 THB	21.10%	10.40	0.001
≥ 8000 THB	22.20%		
Document status			
Registered	21.50%		

Variables	% with High Knowledge	χ^2	p-value
Pending/Unregistered	30.00%	0.47	0.492
Accommodation			
Apartment	21.30%		
Hostel	19.70%		
Townhouse/Condo	33.30%	1.34	0.511
Support back to the family			
No	14.30%		
Yes	23.90%	0.24	0.621
Live alone			
Yes	21.10%		
No	21.50%	2.17	0.141
Live with			
Spouse/Partner	25.20%		
Friends	20.70%		
Family	0.00%		
Others	19.20%	5.41	0.144

As described in Table 4, among the age groups, participants aged 24–34 had the highest proportion of positive attitudes (33.9%), followed by those aged 18–23 (27.7%) and 35–56 (21.2%). In terms of marital status, single participants showed a slightly higher proportion of positive attitudes (29.8%) compared to those who were married, in a relationship, widowed, or separated (28.1). For ethnicity, Bamar participants reported a higher rate of positive attitudes (31.0%) compared to other ethnic groups (24.0%), though

the difference was not statistically significant ($\chi^2 = 1.14$, $p = 0.285$). Participants with pending or unregistered status had more positive attitudes (35.0%) than those who were registered (28.7%), although the difference was not statistically significant ($\chi^2 = 0.38$, $p = 0.536$). Participants living in townhouses or condos showed the highest rate of positive attitudes (37.0%) compared to those in apartments (28.4%) or hostels (27.9%), showing there was a significant association ($\chi^2 = 9.36$, $p = 0.009$).

Table 4 Cross-tabulation analysis of Attitude Towards STIs and Sociodemographic characteristics (n=243)

Variables	% with Positive Attitude	χ^2 (df)	p-value
Age group			
18–23	27.70%		
24–34	33.90%		
35–56	21.20%	3.33	0.189
Marital status			
Single	29.80%		
Married/relationship/widowed/separated	28.10%	0.09	0.766

Variables	% with Positive Attitude	χ^2 (df)	<i>p</i>-value
Ethnicity			
Bamar	31.00%		
Mon/Kayin/Shan/Kachin/Rakhine	24.00%	0.24	0.623
Education			
Noschool/Primary/Middle	25.90%		
High School/University	31.30%	2.24	0.135
Work Place			
Factory	29.50%		
Construction/Shop/Resturants/Freelance	27.70%	0.31	0.576
Work hours			
Day	30.20%		
Night/Alternate	21.10%	0.17	0.681
Income			
< 8000 THB	27.80%		
≥ 8000 THB	30.10%	0.01	0.753
Document status			
Registered	28.70%		
Pending/Unregistered	35.00%	2.03	0.155
Accommodation			
Apartment	28.40%		
Hostel	27.90%		
Townhouse/Condo	37.00%	9.36	0.009
Support back to the family			
No	28.60%		
Yes	29.00%	0.62	0.432
Live alone			
Yes	28.10%		
No	29.00%	0.65	0.419
Live with			
Spouse/Partner	31.90%		
Friends	17.20%		
Family	25.00%		
Others	26.90%	3.31 (3)	0.347

In Table 5, compared to participants with no schooling, primary, or middle school education, those with high school or university education were 2.19 times more likely to have good

knowledge of STIs (OR : 2.19, 95% CI: 1.14–4.21, *p* = 0.019). Similarly, participants earning 8,000 THB or more were 3.41 times more likely to have good knowledge compared to those

earning less than 8,000 THB (OR : 3.41, 95% CI: 1.57–7.39, p = 0.002). Additionally, compared to those living with a spouse or partner, participants

living with family were 3.76 times more likely to have good knowledge (OR : 3.76, 95% CI: 1.12–12.67, p = 0.033).

Table 5 Multivariate Analysis of Socio-demographic characteristics and knowledge of STIs (n=243)

Variables	Odds Ratio (95% CI)	p-value
Age group		
18 - 23	ref.	
24–34	1.16 (0.56–2.41)	0.696
35–56	0.65 (0.27–1.59)	0.347
Marital status		
Single	ref.	
Married/realtionship	0.66 (0.35–1.22)	0.186
Ethnicity		
Bamar	ref.	
Others	0.81 (0.41–1.61)	0.553
Education		
No school/Primary/Middle	ref.	
High school/Uni	2.19 (1.14–4.21)	0.019
Occupation		
Factory	ref.	
Construction/Restrurant/shop/freelance	0.75 (0.39–1.43)	0.378
Work hours		
Day Shift	ref.	
Night/Alternate	0.67 (0.26–1.69)	0.394
Income		
<8000	ref.	
≥8000 THB	3.41 (1.57–7.39)	0.002
Document status		
Registered	ref.	
Unregisterd	0.64 (0.18–2.29)	0.496
Accommodation		
Apartment	ref.	
Hostel	0.65 (0.30–1.40)	0.272
Townhouse	1.47 (0.43–5.05)	0.542
Condo	0.25 (0.03–2.01)	0.194
Support back to family		
No	ref.	

Variables	Odds Ratio (95% CI)	p-value
Yes	0.82 (0.37–1.80)	0.622
Live alone		
No	ref.	
Yes	1.84 (0.81–4.19)	0.145
Live with		
Partner	ref.	
Friends	1.20 (0.46–3.12)	0.714
Family	3.76 (1.12–12.67)	0.033
Coworkers	0.90 (0.31–2.61)	0.839

As in Table 6, participants living in townhouses or condos were 1 time more likely to have a positive attitude toward STIs compared to those living in apartments (OR = 1.06; 95% CI: 0.01–0.63, $p = 0.016$). In addition, compared to

participants with low STI knowledge, those with high knowledge were 9.5 times more likely to have a positive attitude toward STIs (OR =9.50, 95% CI: 1.17–77.46, $p = 0.035$).

Table 6 Multivariate Analysis of Socio-demographic characteristics and attitude towards STIs (n=243)

Variables	Odds Ratio (95% CI)	p-value
Age group		
18 - 23	ref.	
24–34	1.34 (0.69–2.62)	0.391
35–56	0.70 (0.32–1.57)	0.389
Marital status		
Single	ref.	
Married/realtionship	0.92 (0.52–1.61)	0.766
Ethnicity		
Bamar	ref.	
Others	0.86 (0.47–1.58)	0.623
Education		
Noschool/Primary/Middle	ref.	
High school/Uni	1.54 (0.87–2.71)	0.136
Occupation		
Factory	ref.	
Construction/Restrurant/shop/freelance	1.18 (0.67–2.07)	0.576
Work hours		
Day Shift	ref.	
Night/Alternate	1.17 (0.55–2.47)	0.681
Income		

Variables	Odds Ratio (95% CI)	p-value
<8000	ref.	
≥8000 THB	0.91 (0.51–1.62)	0.753
Document status		
Registered	ref.	
Unregisterd	0.41 (0.12–1.45)	0.167
Accommodation		
Apartment	ref.	
Hostel	0.08 (0.56–1.99)	0.868
Townhouse/Condo	1.06 (0.01–0.63)	0.016
Support back to family		
No	ref.	
Yes	1.36 (0.63–2.95)	0.433
Live alone		
No	ref.	
Yes	1.32 (0.67–2.61)	0.419
Live with		
Partner	ref.	
Friends	0.91(0.37 – 2.26)	0.846
Family	1.2(0.34 – 4.25)	0.777
Coworkers	1.27(0.52 – 3.12)	0.602
Knowledge of STIs		
Low	ref.	
Moderate	6.40 (0.83–49.55)	0.075
High	9.50 (1.17–77.46)	0.035

DISCUSSION

This study found that majority of participants (72%) had moderate level of knowledge about STIs. The higher education, income, and living with family were significantly associated with better knowledge of sexually transmitted infections (STIs) among male Myanmar migrant workers in Samut Prakan, Thailand. These findings align with previous research, such as a study in Samut Sakhon showing lower STI knowledge among less-educated migrants (2) and another in Chiang Mai linking education and income with better STI awareness (3). Financial stability may also facilitate access to preventive resources and health care services, contributing to improved knowledge. Interestingly, the current study also

found that participants living with family members were more likely to have high knowledge of STIs which is also consistent with a previous study (5). Living with family may foster communication about health risks and encourage preventive practices. All together, these findings emphasize the need for targeted educational and outreach programs, particularly migrant population at risk.

This study also investigated that only 28.8% of participants had positive attitude towards STIs. This finding demonstrated a positive attitude toward STIs is particularly concerning, as attitudes play a pivotal role in translating knowledge into preventive behaviors. While knowledge provides the informational

foundation for STI prevention, attitudes determine whether individuals are motivated and willing to act on that knowledge. A low proportion of positive attitudes suggests that informational interventions alone may not be sufficient for behavioral change among male Myanmar migrant workers. It stated that better living accommodations and high levels of STI knowledge were significantly associated with positive attitudes toward STIs among male Myanmar migrant workers in Samut Prakan, Thailand. Participants residing in townhouses or condominiums—typically offering greater stability and privacy—were more likely to hold positive attitudes. Previous research has shown that improved housing environments can enhance mental well-being and health-seeking behavior, contributing to better sexual health attitudes (9). Additionally, high STI knowledge was strongly linked to positive attitudes, consistent with the Health Belief Model, such environments may enhance perceived self-efficacy by enabling individuals to seek and access health information without stigma, as well as increasing perceived benefits of engaging in preventive behaviors (10). Similar results were observed among migrant workers in Vietnam, emphasizing the need for both educational and environmental interventions to foster healthier STI-related attitudes in migrant communities (11). These results highlight the importance of improving both living conditions and educational outreach to promote healthier attitudes toward STIs among migrant populations.

This study has several limitations that affect the validity and generalizability of its findings. The use of snowball sampling, while essential for reaching a hidden population, may have introduced selection bias, as participants recruited through social networks could share similar socio-demographic backgrounds and levels of health awareness. This may have inflated knowledge levels if well-informed individuals were overrepresented or underestimated them if the initial participants came from lower-awareness groups. Self-reported data on sensitive issues such as condom use and STI-related attitudes are also vulnerable to social desirability bias, potentially overstating knowledge or positive attitudes; however, the low

proportion of positive attitudes (28.8%) suggests any inflation was modest. The cross-sectional design further limits causal interpretation, as associations between living conditions, knowledge, and attitudes cannot confirm directionality. Additionally, because the study was conducted only in Samut Prakan, an industrial province with unique migrant work and living environments, the findings may not be fully applicable to migrants in fishing, agricultural, or border settings. Overall, while the results provide important insights into STI knowledge and attitudes among male Myanmar migrants in Samut Prakan, they should be interpreted with caution, recognizing that measured levels may be slightly higher or lower than in the wider population. Future research using mixed recruitment strategies, anonymous data collection, and multi-site sampling would help strengthen validity and generalizability.

Another important limitation is that the study focused exclusively on male Myanmar migrant workers, which restricts the ability to understand STI knowledge and attitudes among female migrants or other gender groups. Men's migration experiences, work environments, and social networks often differ substantially from those of women, which can shape exposure to health information, perceived risk, and sexual health behaviors. For example, male migrants may face greater social pressure to engage in high-risk sexual activities but may also have different access points to STI education compared to female workers, who may be more frequently targeted by reproductive health programs. As such, the findings cannot be generalized to all Myanmar migrants in Samut Prakan, and the low proportion of positive attitudes observed in this study may not reflect the perspectives of women or mixed-gender migrant communities. Future research should include both male and female participants to enable gender-based comparisons and to design interventions that are sensitive to the differing needs, risks, and social contexts of each group.

RECOMMENDATIONS AND CONCLUSION

Based on the findings, several recommendations can be made to improve STI-related knowledge and attitudes among male Myanmar migrant workers in Samut Prakan, Thailand. First, targeted health education programs should focus on migrants with lower education and income levels, as these groups were found to have poorer knowledge. Education initiatives can be implemented through community centers, workplaces, and outreach by trained peer educators. Since living with family was associated with better knowledge, family-based or peer-led interventions may also enhance learning and communication about STIs prevention. Additionally, only a small proportion of participants had a positive attitude toward STIs, with better living conditions and higher knowledge contributing to more favorable attitudes. Therefore, improving the quality of housing by promoting stable, clean, and private living environments could support positive behavioral changes. These findings underscore the importance of integrating educational efforts with structural improvements. Moreover, inclusive health policies that address the unique needs of migrant populations, including language-appropriate materials and culturally sensitive services, are crucial. By combining educational outreach with better living conditions and policy support, STI-related knowledge and attitudes in this high-risk group can be meaningfully improved. These could include mobile health clinics stationed near workplaces or migrant housing to provide convenient STI testing and counseling; peer educator programs that train trusted community members to deliver culturally sensitive sexual health education; and digital interventions using WhatsApp or similar messaging platforms to share information and reminders in migrants' native languages. Collaboration with local employers and community leaders can further enhance the reach and acceptability of these initiatives. Additionally, improving living conditions through partnerships with NGOs may foster environments that support healthier attitudes and behaviors. Targeted interventions for migrants with lower education, income, or unstable

housing, along with improvements in education, living conditions, and workplace support, are essential to enhance STI awareness and reduce risk in this vulnerable population to meet the goals of national health and WHO. The findings pointed out the importance of socio-economic and environmental conditions in shaping better sexual health outcomes.

For future research, longitudinal designs would be valuable to understand changes in knowledge, attitudes, and behaviors over time, while expanding studies to include female migrants is essential to capture gender-specific needs. Comparative studies across different provinces and migrant communities could also help identify contextual factors influencing sexual health, enabling more targeted interventions.

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PREVALENCE AND DETERMINANTS OF INSOMNIA AMONG EMPLOYEES IN INTERNET-BASED COMPANIES IN HANGZHOU: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Insomnia is a prevalent public health issue in the Chinese population, with approximately 75% experiencing sleep problems. This is particularly pronounced among employees of Internet companies due to high work pressure, prolonged screen exposure, and inadequate management of work and rest time.

Objectives: This study aims to investigate the prevalence and associated factors of insomnia among Internet company employees aged 18 to 40 years residing in Yuhang District, Hangzhou, People's Republic of China.

Methodology: This cross-sectional survey was conducted from April to June 2025. Insomnia severity was assessed using the Insomnia Severity Index (ISI), while work stress was evaluated using the Work Stress Scale. Participants were randomly selected and completed an online questionnaire covering sociodemographic, lifestyle, occupational characteristics, and physical activity. Chi-square tests and multiple logistic regression analyses were employed for statistical evaluation.

Results: The study found a clinically significant prevalence of insomnia at 89.1% among the 395 participating employees, with 66.8% being female and 33.2% male. The median age was 33 years, and the median ISI score was 13. Chi-square analysis revealed significant associations (P -value < 0.05) between insomnia and factors such as age, marital status, income, alcohol and tea consumption, commuting time and distance, weekly working hours, work stress, exercise frequency, weekly caloric burn, and perceived barriers to digital fitness activities. Multiple logistic regression analysis (P -value < 0.2) indicated that higher weekly caloric burn ($\geq 15,900$ kcal) was independently associated with a reduced risk of insomnia.

Conclusion: Insomnia remains a significant issue among Internet company employees in Hangzhou, with a high prevalence linked to sociodemographic, lifestyle, occupational, and physical activity factors. The findings provide empirical evidence for promoting sleep health awareness, increasing physical activity, and reducing work-related stress among employees in the Internet industry. These results can guide future workplace health management initiatives.

Key Words: Insomnia; Internet company employees; Workplace; Occupational Health

INTRODUCTION

With China's rapid economic growth and urbanization, especially in cities like Hangzhou, high-pressure work environments have become increasingly common, especially in industries such as technology, healthcare (1, 2). This has led to a surge in mental health issues such as insomnia, anxiety, and stresses that not only affect personal well-being but also have broader implications for public health and productivity. According to the 2022 China National Healthy Sleep White Paper (3), about 75% of the

population suffers from sleep disorders, of which insomnia accounts for 23.5%. The survey subjects of this study are adults working in Internet companies in Hangzhou, aged between 18 and 40, with a median age of 33.

Insomnia, as defined by DSM-5(4), involves difficulties falling or staying asleep that persist for at least three months and cause significant daytime impairment. It is closely associated with work stress, which disrupts sleep by activating stress response systems such as the

hypothalamic-pituitary-adrenal (HPA) axis (5), thereby increasing cortisol secretion and causing sleep disruption. In Hangzhou, the rise in sleep disorder outpatient visits by over 454.2% in the past decade highlights the impact of urban lifestyles and occupational stress (6). Exercise is a recognized non-pharmacological intervention for improving sleep and reducing stress (7). However, the potential of digital fitness—interactive games that incorporate physical activity—to improve sleep and mental well-being remains underexplored. These games offer a flexible and engaging exercise format, appealing to busy working professionals with sedentary jobs.

This study investigates insomnia among employees of Internet companies in Yuhang District, Hangzhou. It examines how occupational (e.g., working hours), behavioral (e.g., physical activity, digital fitness use), and psychosocial factors (e.g., perceived work stress) relate to insomnia, aiming to inform tailored workplace health strategies.

METHODOLOGY

This cross-sectional study was conducted among employees of Internet companies in Yuhang District, Hangzhou, to assess the prevalence of insomnia and its associated factors. Data were collected via an anonymous online questionnaire distributed through WeChat, a widely used platform in China. Although effective, this method may introduce selection bias by excluding non-users.

Participants were full-time employees aged 18–40 who had worked in their company for at least three months. Those undergoing psychiatric treatment or using sleeping pills were excluded. A convenience sampling method was used. Among 415 distributed questionnaires, 395 valid responses were collected after excluding incomplete ones, resulting in a 95.2% response rate.

Measures

The questionnaire covered five areas. Sociodemographic: age, gender, marital status, income; Lifestyle: alcohol and tea consumption, smoking; Occupational: weekly working hours, work pressure, commute time; Fitness: exercise

frequency, Calories Burned, digital fitness use; Insomnia: assessed using the Insomnia Severity Index (ISI), a validated instrument by Bastien et al. (2001) to measure insomnia severity (8).

Statistical Analysis

Data were analyzed using SPSS version 28. Descriptive statistics summarized all variables. Chi-square tests were used for univariate analysis. Variables with $P < 0.2$ were included in multivariate logistic regression to identify independent predictors. $P < 0.05$ was considered statistically significant.

RESULTS

General characteristics

The study included 395 participants (66.8% female), aged 18–40 years (The Median age is 33, IQR is 28-35). The median monthly income was 10,000 Yuan \approx 1,392.73 USD, the majority (76.7%) had a healthy BMI (median = 21.78), while 23.3% were overweight or obese.

Among the 395 participants, 74.4% were non-smokers, and 60.8% did not consume alcohol. Although caffeinated beverages (Including coffee, tea, functional drinks, etc.) were commonly available, 74.7% reported consuming no more than one cup per day.

Regarding the time spent using electronic devices before bed, participants used them for a median of 63 minutes, with entertainment being the most common content (83.5%). The median working hours per week of the respondents were 46 hours and commuted to a median distance of 5 km. Nearly half (46.6%) had commutes under 30 minutes. The median job stress score was 27, indicating moderate-to-high work-related stress.

A total of 78.0% exercised at least once per week, most commonly for 30–60 minutes per session. Digital fitness tools were used by 56.5% of participants, primarily 1–2 times per week. The median number of calories burned per week was 15,900 calories, and 54.3% rated the difficulty of digital fitness sessions as moderate.

Insomnia prevalence and severity (ISI)

A total of 395 valid participants were included in this study. Based on the Insomnia Severity Index (ISI), participants with scores ranging from 8 to 28 were classified as having insomnia. Among them, 43 participants (10.9%)

scored between 0 and 7, indicating no clinically significant insomnia, while 352 participants (89.1%) scored 8 or higher, suggesting at least subthreshold insomnia. The overall prevalence of insomnia was 89.11% (95% CI: 12.12–13.05). The median score of 13 (IQR: 9–16), suggesting a general trend toward mild to moderate insomnia symptoms within the sample.

Associations Between Insomnia and Sociodemographic, Lifestyle, Occupational, and Fitness Factors: Chi-Square Analyses

Table 3 reports Chi-square tests were conducted to explore the associations between insomnia and various sociodemographic, lifestyle, occupational, and digital fitness-related factors. Among the 395 participants, the age group (P = 0.002), marital status (P = 0.007), and monthly income (P = 0.021) were significantly associated with insomnia. Participants aged 31–40 years, those who were married, and those with higher monthly income (>12,000 Yuan) reported higher insomnia prevalence.

Regarding lifestyle factors, alcohol consumption (P = 0.009) and tea intake (P = 0.037) were significantly related to insomnia. People who regularly drank tea or did not drink alcohol were more likely to experience insomnia symptoms.

For occupational variables, longer one-way commute times (P = 0.021), extended weekly work hours (P=0.027), and higher work stress levels (P=0.003) were significantly associated with increased insomnia. Specifically, employees who worked more than 40 hours per week had longer commutes, and reported higher work-related stress were more likely to have ISI scores ≥8.

Weekly exercise frequency was significantly associated with ISI scores (P = 0.007). Employees who exercised ≥ 3 times per week had higher insomnia severity than those who exercised 1-2 times per week. This phenomenon may indicate that some patients with insomnia try to improve sleep by increasing exercise frequency, but the effect is limited, or there is a reverse causal relationship. There was also a significant difference in weekly calorie consumption between different groups (P < 0.002), suggesting that higher physical activity levels may be associated with a lower risk of insomnia. The perceived difficulty of completing the digital fitness course was significantly associated with insomnia (P = 0.008), and participants who rated the activity as "easy" were less likely to have insomnia.

Table 1 Association between insomnia index and factors among employees of Internet companies in Hangzhou (n=395)

Variable	ISI ^a score 0-7, no insomnia (n=43, %)	ISI ^b score 8-28, insomnia (n=352, %)	χ ²	P-value
Gender				
Female	27(10.2)	237(89.9)	0.356	0.551
Male	16(12.2)	115(87.8)		
Age (Years)				
18-30 years	26(17.1)	126(82.9)	9.851	0.002*
31-40 years	17(7.0)	226(93.0)		
Marital status				
Single	31(14.9)	177(85.1)	7.311	0.007*
Married (Including divorced/widowed)	12(6.4)	175(93.6)		
Monthly Income (Yuan)				
≤12000 Yuan (\$1,667)	32(14.0)	197(86.0)	5.355	0.021*
> 12000 Yuan	11(6.6)	155(93.4)		

Variable	ISI ^a score 0-7, no insomnia (n=43, %)	ISI ^b score 8-28, insomnia (n=352, %)	χ^2	P-value
Alcohol consumption				
Yes	9(5.8)	146(94.2)	6.785	0.009*
No	34(14.2)	206(85.8)		
Tea consumption				
Yes	26(60.5)	265(75.3)	4.338	0.037*
No	17(39.5)	87(24.7)		
Daily Commute Duration (One-way)				
Less than 30 minutes	29(15.8)	155(84.2)	Fisher's exact test	0.006*
30-60 minutes	12(8.6)	128(91.4)		
More than 60 minutes	2(2.8)	69(97.2)		
Weekly Work Hours(hours)				
≤ 40 Hours (Normal working hours)	15(17.4)	71(82.6)	4.870	0.027*
> 40 Hours (Long working hours)	28(9.1)	281(90.9)		
Work Stress Assessment				
Score < 27 (Moderate work pressure)	29(15.5)	158(84.5)	7.820	0.005*
Score ≥ 27 (High work pressure)	14(6.7)	194(93.9)		
Exercise Frequency Per Week (n=308)				
1-2 times per week	28(14.4)	167(85.6)	7.380	0.007*
3 times or more per week	5(4.4)	108(95.6)		
Calories Burned Per Week[#] (n=395)				
≤ 15900 Calories	12(6.1)	186(93.9)	9.529	0.002*
> 15900 Calories	31(15.7)	166(84.3)		
Completing digital fitness difficulty				
Easy	14(14.9)	80(85.1)	6.987	0.008*
Medium or Difficult	6(4.7)	123(95.3)		

Categorical variables were compared using the Chi-square test or Fisher's exacta test when cell counts were below 5. Sample sizes are indicated in the column headers. The symbol * indicates that a p-value of <0.05 is considered significant. The symbol [#] Weekly calorie consumption includes the basal metabolism of adults, which is about 1,600 calories per day for adult men and about 1,400 calories per day for adult women. ISI^a scored 0-7 between 0 and 7, indicating no clinically significant insomnia, ISI^b scored 8 or higher, indicating subthreshold insomnia

Associations between insomnia and sociodemographic, lifestyle, occupational, and fitness factors: logistic regression analyses

In order to further explore the independent factors affecting insomnia, before conducting multivariate binary logistic regression analysis, referring to the practice of previously

related literature(9), this study included variables with a P value less than 0.2 in the chi-square test into the regression model.

The included variables were age, marital status, monthly income, self-rated health status, alcohol consumption, tea consumption, commuting time, weekly working hours, work stress, weekly exercise frequency, total weekly

calories burned, perceived difficulty of digital fitness activities.

Table 4 reports multivariate logistic regression analysis found that the severity of insomnia among employees of Hangzhou Internet companies was associated with one independently associated significant factors. Consuming more than 15,900 calories per week was significantly associated with reduced insomnia severity (AOR = 0.113, 95% CI 0.019–0.653, P = 0.015). This indicates that participants

who consumed more than 15,900 calories per week were 88.7% less likely to report insomnia severity.

In the adjusted model, other variables such as age, marital status, monthly income, self-rated health status, alcohol and tea drinking, commuting time, weekly working hours, work stress level, and perceived digital fitness difficulty were not significantly associated with insomnia severity (P > 0.05).

Table 2 Binary logistic regression results for factors associated with insomnia (based on variables with P < 0.2 in univariate Chi-square analysis)

Variable	B	AOR	Insomnia Severity Index		P-value ^a
			95%CI		
			Lower	Upper	
Age					
18-30 years (Ref.)					
31-40 years	0.221	1.248	0.263	5.019	0.780
Marital status					
Single (Ref.)					
Married (Including divorced/widowed)	0.071	1.073	0.272	4.244	0.920
Monthly Income (Yuan)					
≤12000 Yuan (\$1,667) (Ref.)					
> 12000 Yuan	1.269	3.558	0.649	19.517	0.144
Alcohol consumption					
Yes (Ref.)					
No	-1.166	0.311	0.068	1.423	0.132
Tea consumption					
Yes (Ref.)					
No	1.147	0.318	0.076	1.330	0.116
Daily Commute Duration (One-way)					
Less than 30 minutes (Ref.)					
30-60 minutes	-20.014	0.000	-	-	0.998
More than 60 minutes	-17.642	0.000	-	-	0.998
Weekly Work Hours(hours)					
≤ 40 Hours (Normal working hours) (Ref.)					
> 40 Hours (Long working hours)	-0.662	0.516	0.114	2.342	0.391
Commute Distance (KM)					
≤ 5km (Median commuting distance) (Ref.)					

Variable	Insomnia Severity Index				
	B	AOR	95%CI		P-value ^a
			Lower	Upper	
> 5km	-0.825	0.438	0.068	2.842	0.387
Work Stress Assessment					
Score <27 (Moderate work pressure) (Ref.)					
Score ≥27 (High work pressure)	1.054	2.868	0.753	10.929	0.123
Exercise Frequency Per Week (n=308)					
1-2 times per week (Ref.)					
3 times or more per week	0.937	2.552	0.827	7.880	0.103
Calories Burned Per Week/ Per 100 calories					
≤15900 Calories (Ref.)					
> 15900 Calories	-2.183	0.113	0.019	0.653	0.015*
Completing digital fitness difficulty					
Easy (Ref.)					
Medium or Difficult	0.819	2.268	0.530	9.697	0.269

Note: ^a P-value from Multivariate binary logistic regression

*P-value < 0.05 indicates statistical significance.

DISCUSSION

This study explored the prevalence of insomnia and its influencing factors among employees of Internet companies in Hangzhou. The results showed that the prevalence of insomnia in this group was as high as 89.1%, significantly higher than the 23.5% of the general population in China (3) and 71.3% of employees of Internet companies in Shanghai (10), indicating that employees in the Internet industry may be a high-risk group for insomnia. This high prevalence may be closely related to the high-intensity work rhythm, performance pressure and overtime culture.

Through the evaluation of the Insomnia Severity Index (ISI) and the Work Stress Scale, combined with binary and multivariate logistic regression analysis, this study identified multiple factors related to insomnia, covering sociodemographic characteristics, lifestyle, occupational factors and fitness factors.

In terms of sociodemographic, age and marital status were significantly correlated in univariate analysis. The ISI scores of employees aged 31-40 were significantly higher than those aged 18-30. This result is similar to the results of a large-scale cross-sectional study in Guangdong

Province (11), however, these associations were not retained in the multivariate model. One possible explanation is that the effects of age and marital status may be mediated by factors such as health status or cumulative work-related stress, which were adjusted for in the model.

In terms of lifestyle, drinking is positively correlated with insomnia (P=0.009). Studies have shown that long-term or excessive drinking can disrupt sleep structure, reduce rapid eye movement sleep time and increase the number of night awakenings, ultimately reducing sleep quality (12). Tea drinking causes insomnia, which may be due to caffeine in tea (13), Caffeine has a significant excitatory effect on the central nervous system and also stimulates the release of adrenaline, causing the human heart rate to increase and blood pressure to rise, seriously interfering with normal sleep patterns (14). These associations became non-significant in the adjusted model, possibly due to confounding by stress levels or exercise behaviors, which may influence both drinking habits and sleep outcomes.

Occupationally, long commuting time, extended work hours, and high stress were

significantly related to insomnia in univariate tests. Notably, work stress was among the strongest predictors in the single-factor analysis and aligns with the Karasek job demand-control model (15). Yet it did not remain significant after adjustment, possibly due to overlapping effects with other variables like self-rated health or physical activity, which may buffer the impact of stress on sleep.

In terms of exercise factors, participants whose total energy consumption per week exceeded 15,900 calories were 88.7% less likely to report insomnia severity. This finding suggests that higher levels of physical activity may have a positive effect on sleep health, and there may be a dose-response relationship. This supports the findings of (16) Yi Xie that exercise promotes sleep quality.

Our study also found that those who rated their digital fitness activities as “easy” had a lower risk of insomnia. While this may reflect better physical condition or less stress from exercising, this remains speculative. Some literature supports that moderate evening activity is beneficial (17), and more research is needed to explore the interactions between exercise duration, intensity, and sleep in digital fitness contexts.

In conclusion, insomnia prevalence among employees of Internet companies remains high and appears to be influenced by multiple factors, including sociodemographic, occupational stress, lifestyle behaviors, and fitness patterns. High work pressure and insufficiently planned exercise routines may contribute. Future interventions should emphasize stress management, appropriate exercise scheduling, and tailored workplace wellness strategies.

CONCLUSION

This study systematically explored the prevalence and related factors of insomnia among Internet practitioners and found that the prevalence of insomnia in this group is high, which is affected by multiple factors such as socio-demographic characteristics, lifestyle, occupational factors and exercise habits. Work pressure, exercise frequency and energy consumption are closely related to the degree of insomnia. The study provides a basis for

corporate health management and public health intervention. It is recommended that companies integrate intervention measures into employee health plans by incorporating digital fitness tools, setting up exercise incentives, and promoting flexible working hours to relieve stress, promote moderate exercise, and thus improve employees' sleep quality and overall well-being.

However, the cross-sectional design limits the ability to infer causality. The use of self-reported data may introduce recall and social desirability biases, and the sample, restricted to Internet company employees in Yuhang District, Hangzhou, may not be representative of other populations. Future research using longitudinal or experimental designs is recommended to validate these findings and explore causal pathways.

ETHICAL DECLARATION

The study was approved by the Research Ethics Review Committee of Chulalongkorn University (RECCU No. 155/68). Informed consent was obtained electronically from all participants.

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DIGITAL TECHNOLOGY USE FOR SOCIAL COHESION AMONG OLDER ADULTS IN RURAL MYANMAR AMIDST THE CRISIS: BARRIERS AND COPING STRATEGIES (A CASE STUDY IN HPA-AN, KAYIN STATE)

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ABSTRACT

Introduction: Older adults in conflict-affected rural Myanmar, particularly in Hpa-An Township, Kayin State, face increasing challenges related to social cohesion, amid political instability, economic hardship, and fragmented family structure. Reduced social cohesion can negatively impact well-being of older adults and weakened support networks. Digital technology offers older adults' opportunities to maintain connections, access information, and enhance their well-being. However, older adults encounter multi-level barriers in using digital technology for social cohesion.

Objectives: This study aims to assess the barriers to use digital technology at multiple levels and examine how older adults adopt unique coping strategies. It is grounded in the Socioecological Model and Stress and the Coping Theory to examine what individual, interpersonal, community, and societal barriers exist among older adults.

Methodologys: Using a qualitative research approach, semi-structured interviews were conducted with 30 older adults aged 60 and above from diverse socio-demographic backgrounds and living situations to understand the barriers they face in digital engagement and the coping strategies they employ. The online in-depth interviews were conducted using Zoom platform, and the transcribed interview scripts were thematically analyzed using Microsoft Excel.

Results: Older adults reported personal to societal-level barriers including limited digital literacy, language barriers, financial hardship, cognitive and attitudinal barriers, unstable signals, insufficient electricity, and limited availability of digital devices. The absence of community-based digital training and support services further compounded these challenges. Additionally, many expressed fears of government surveillance, censorship, and digital scams. In response, participants employed various coping strategies to overcome those multilevel barriers.

Conclusion: Older adults in rural, conflict-affected areas of Myanmar experience multilevel barriers which may impact well-being of older adults due to disconnection from family members and society. Despite these challenges, they demonstrate adaptive resilience by employing context-appropriate coping mechanisms. These findings highlight the need for age-friendly digital inclusion programs, infrastructure development, and policy initiatives that prioritize older populations in underserved regions.

Keyword: Active aging, Digital Technology, Myanmar, Older Adults, Conflict-affected areas, Social Cohesion.

INTRODUCTION

Kayin State, located in southeastern Myanmar, has experienced decades of armed conflict, displacement, and socio-economic instability, significantly affecting its older population (1). As of the 2014 Myanmar Population and Housing Census, Hpa-An Township in Kayin State had approximately 19.5% of the township's population aged 50 and above at that time (2). Like other rural areas in Myanmar, the challenges faced by older adults in Kayin State are multifaceted, stemming from socio-economic shifts and ongoing conflicts. Kayin has the second highest migration rate and the migration as decades of armed conflict, displacement, and socio-economic instability have weakened family structures, particularly as younger generations migrate to urban centers or abroad—often to Thailand—leaving older adults with reduced familial support (3). This absence increases their vulnerability to economic hardships, social isolation, and inadequate care.

Digital technologies have the potential to improve social cohesion among older adults by enabling connections with family, friends, and virtual communities (4). Studies show that digital technology adoption can improve social cohesion and reduce loneliness and depression by facilitating meaningful social interactions, and access to critical information and services (5). Moreover, digital technology can serve as a catalyst for social cohesion by enabling connectivity and engagement within communities, and allows older adults to stay connected with family and friends, access vital information, and participate in social activities (4).

Yet, in rural Myanmar, multi-level barriers limit older adults' engagement with digital technology. Personal constraints (6), financial barriers (4), interpersonal factors—especially the absence of younger family members who might provide assistance (7), and community-level barriers, and the societal level barriers limits older adults to engage digital technology (8). Despite these obstacles, older adults adopt diverse coping strategies to maintain social connections. These include problem-focused approaches, such as seeking help from family or neighbors, self-learning, and using simplified devices, as well as emotion-focused

strategies like accepting limitations, avoiding risky digital spaces, and relying on offline forms of socialization (9).

This study is also situated within the United Nations Sustainable Development Goals (SDGs), contributing to SDG 3.4 (promote mental health and well-being), SDG 9.c (expand access to ICT in least developed areas), SDG 10.2 (promote inclusion for all), and SDG 11.7 (accessible, inclusive spaces). It also aligns with SDG 16.7 (inclusive decision-making) and SDG 17.17 (partnerships for sustainable development).

While digital technology's benefits for older adults are well documented in stable, high-income contexts, there is limited research in conflict-affected environments like Myanmar. This study addresses this gap by examining older adults' use of digital technology for social cohesion in rural Myanmar, the barriers they face, and the coping strategies they employ. Understanding these dynamics is crucial for developing context-sensitive policies and programs that enhance well-being of older adults fragile environments while acknowledging local realities.

This research is grounded in two key theoretical perspectives presented in the conceptual framework in Figure 1: the Socioecological Model (SEM) (10) and Stress and Coping Theory (11). These frameworks provide a comprehensive understanding of the interplay between individual, interpersonal, community, and societal factors in using digital technology among older adults in Myanmar, particularly within the context of rural Myanmar during ongoing political crisis. The Stress and Coping Theory examines how older adults in Myanmar navigate the barriers to digital technology utilization to maintain social cohesion amidst the ongoing political crisis. Problem-focused coping strategies include learning new digital skills by self-learning, through community training, seeking help from younger family members, putting financial effort to purchase digital devices, and relocating to the accessible area to use digital technology for communication and accessing information and resources. Emotion-focused coping strategies are aimed at managing the emotional distress associated with

these barriers, involving acceptance of digital limitations, using alternative way for social cohesion over using digital technology, maintaining emotional stability and well-being.

In the context of this study, several key terms are used to frame the research focus. Older adults refer to individuals aged 60 years and above. Digital technology encompasses a broad range of digital information technology devices, tools, and systems that facilitate communication and access to information and services. Specifically, in this study, it refers to mobile phones (both keypad phones and smartphones), digital applications, and internet platforms that

older adults may use to maintain social connections and engage with their surroundings. Social cohesion is defined as the strength of relationships and the sense of solidarity among community members. For older adults, this includes maintaining social contact with family and peers, participating in community life, and accessing information and resources necessary for engagement and well-being. Lastly, barriers denote any obstacles that hinder or limit older adults from effectively using digital technology to foster social cohesion. These terms guide the analysis and interpretation throughout the research.

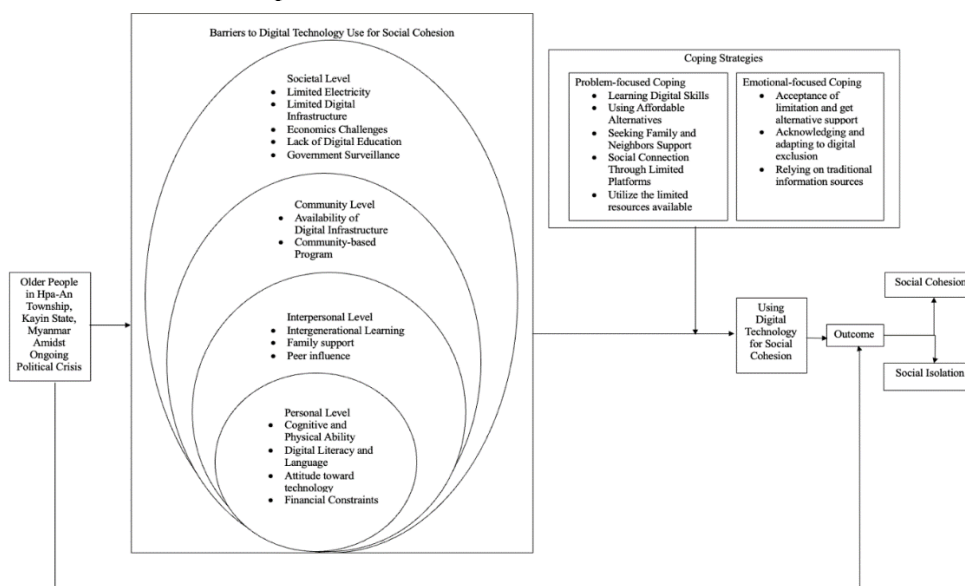


Figure 1 Conceptual Framework

METHODOLOGY

The qualitative research method was employed to gain in-depth insights into the experiences, barriers, and coping strategies of older adults regarding digital technology use for social cohesion. Given the unstable political context of the study location, interviews were conducted via online platform using Zoom application.

A total of (30) older adults for the data saturation, and aged 60 and above were recruited from Hpa-An in Kayin State which is located near the Thailand-Myanmar border (12). Using purposive quota sampling, participants were chosen to reflect a wide variety of demographic

and socioeconomic backgrounds and living situations in rural settings. Initially, a local research assistant was trained by the principal investigator. Second, the participants were recruited through the Older People Self-help Groups from Hpa-an township, Kayin state, Myanmar. The research assistant distributed the participants information sheet, got consent, and made appointment for the in-depth interview. The interview was conducted by the principal investigator and the data collection was started on 16 May 2025 after the approval of Institutional Review Board and finished on 6 June 2025.

For data analysis, the spoken words were transcribed into written form and recorded the participants' facial expressions and nuances.

Following transcription, the interview responses from field notes and transcripts were examined using a thematic analysis approach. On the excel sheet, responses were identified and categorized into relevant themes based on the conceptual framework. Each participant was given a code, and similarities and differences among themes were examined. Then, the final qualitative data analysis was produced.

RESULTS

Study participants socio-demographic characteristics

The interviewed participants were 17 females and 13 males, ranging in age from 60 to 80 years from eighteen (18) villages. The majority twenty-six (26) participants were currently married, while four (4) participants were widowed and (2) participants were single. Twenty-seven (27) participants reported having children, with only three (3) participants remaining childless. Among those with children, several reported that their offspring were residing abroad. Specifically, children of 13 participants were working in Thailand, and one participant had a child working in Malaysia. Others reported children living either in the same household, in nearby villages, or in other townships within Myanmar, indicating a diverse pattern of intergenerational living arrangements.

Despite their age, many participants remained economically active. Seventeen participants reported still engaging in some form of income-generating work, primarily in agriculture, farming, or informal labor. This demographic profile highlights the socioeconomic diversity of the sample, including variations in age, gender, income, and digital engagement. Notably, the transnational migration of adult children especially to Thailand and Malaysia suggests the importance of cross-border remittances and communication in the everyday lives of older adults in rural Myanmar.

Digital Technology Use Among Older Adults in Hpa-an Township

Older adults in rural Myanmar have increasingly turned to digital technologies such as mobile phones, keypad phones, and in some

cases, smartphones as essential tools to maintain and strengthen social ties during the ongoing political crisis. All participants reported having used digital technology for social cohesion at some point, with mobile phones being the most common device. Most owned smartphones, while a few still used keypad phones. The primary use of digital technology included communication with family and friends via phone calls and messaging apps, as well as access to news, entertainment, and social media platforms such as Facebook, Viber, and YouTube. Despite physical distance and disrupted infrastructure, these technologies serve as vital channels for social connection, emotional support, community belonging, and information exchange, and critical tools for accessing timely information in a volatile socio-political landscape.

Many participants reported using basic calling and messaging functions to stay in touch with family, children and grandchildren who migrated to urban centers or abroad for safety and employment, and to receive daily updates from relatives.

“The reason that made me to use phone is to connect with friends and family...” ID 26, married woman aged 66, Mu Kawa Village

Several older adults indicated that they rely on social media or word-of-mouth through digital chats to monitor local safety, receive updates on military movements, or learn about market prices.

“...I use Facebook to read news and watch political news...” ID10, widow aged 75, Kaw La Pala Village

“...I read Facebook to know what’s happening around the country, which roads are safe, and whether there are any conflicts near our area...” ID13, married man age 73, Win Kyan Village

This reflects how older adults in Myanmar utilize digital technologies to sustain family and social relationships, participate in peer networks, access real-time information, and maintain a sense of community belonging. These tools have become integral not only to their social lives but also to their emotional well-being and personal security amid ongoing crisis.

Barriers to Digital Technology Use for Social Cohesion

Personal-Level Barriers

At the personal level, older adults in rural Myanmar encounter a complex mix of barriers that hinder their engagement with digital technologies, limiting their ability to maintain social cohesion. Age-related physical and cognitive decline—such as poor eyesight, memory loss, and hearing difficulties—often makes using mobile phones and digital platforms difficult. One participant shared,

“I can't see well when I use phone, so I need to wear glasses. My grandkids patiently taught me how to use but I need to read often as I am forgetful...” ID 14, married women aged 61, Win Kyan Village

Others echoed this sentiment, noting that even when training was available, their declining faculties prevented effective participation.

“If there is training, I want to attend but I'm very forgetful...” ID 15, single woman aged 61, Naung Kyan Village

A lack of digital literacy and language proficiency further compounds these challenges. Many older adults in the study had little or no prior exposure to digital devices, leading to anxiety about making mistakes or damaging phones. The English language interface on many phones created an additional barrier. Moreover, older adults limited their use to phone calls, avoiding text messages, social media, or the internet due to unfamiliarity.

“I'm afraid to touch the buttons mistakenly... My phone language is Burmese as I can only understand Burmese...” ID02, widower aged 70, Pha-un village

Attitudinal barriers were also prevalent. Several participants expressed little interest in learning digital skills, often believing that phone calls were sufficient and they felt they were “too old to learn.”

“I wouldn't attend training as I know enough to call phones in any cases of health, social, and community matters” ID 05, married man aged 61, Taung Thu Kone Village

Financial constraints were another

significant issue. Many relied on remittances from children abroad to afford phones and top-ups. The cost of data, power banks, and devices remained prohibitive for those without external support, limiting consistent digital access. One participant shared,

“I asked my son from abroad to buy me a phone to contact family...” ID02, widower aged 70, Pha-un village

Interpersonal-Level Barriers

At the interpersonal level, older adults' digital engagement was shaped significantly by the availability and consistency of family support. Many participants relied on their children, grandchildren, or neighbors for assistance with using phones, accessing the internet, or navigating social media. However, this support was not always consistent. Some family members lacked patience or were too busy to help regularly, particularly when older adults needed repeated guidance due to memory issues. When family members were unavailable, some turned to neighbors for help, though this was not always reliable. Participants expressed that,

“I don't know how to use internet, so I ask my kids for help... My kids are not very patient in teaching me.” ID 27, married man aged 67, Mu Kawa Village

“My daughter doesn't have much time to teach me. Sometimes she is not patient...” ID 01, married man aged 66, Pha Un Village

Peer support networks were also notably weak. While a few elders benefited from kind neighbors or local youth, most participants reported minimal knowledge sharing or collective learning among their peers. This absence of shared learning reduced opportunities for motivation and discouraged others from exploring digital tools. One participant stated,

“My friends do not know how to use internet and social media like Facebook. I also don't know to use Facebook...” ID 30, woman aged 63, Zin Pyone Village

These interpersonal gaps reinforced digital exclusion and limited older adults' independence.

Community-Level Barriers

At the community level, older adults in rural Myanmar faced significant structural and infrastructural barriers to digital inclusion. Across all study villages, essential resources such as mobile phone towers, retail outlets, repair services, and digital training centers were largely absent. Many elders reported that phones and top-up cards were only available in nearby towns, making access difficult due to transportation challenges and financial constraints. With no formal phone rental systems or subsidies for the elderly, those without phones often relied on neighbors for communication. The lack of Wi-Fi access also forced older adults to rely solely on mobile data, which was both expensive and unreliable. As one participant noted,

“There’s SIM card selling in the village shop, but we have to go to other villages for the mobile phone... There’s no phone tower in our village...” ID 16, married woman aged 65, Kaw Dawn Village

Furthermore, community-based digital training opportunities were nonexistent. While some informal help came from younger villagers, no structured programs existed for older adults.

“There is no computer training for kids and not also for adults...” ID 2, widower aged 70, Pha Un Village

These infrastructural gaps and lack of formal support systems severely limited older adults’ ability to develop and maintain digital skills, reinforcing their digital exclusion and weakening opportunities for social cohesion.

Societal-Level Barriers

At the societal level, older adults in rural Myanmar face compounded challenges due to political instability, limited infrastructure, and economic hardship. Frequent electricity outages and unreliable internet access make digital engagement inconsistent. In many villages, electricity is available for only short periods, prompting reliance on costly alternatives like generators or solar panels—often unaffordable for older adults. Additionally, the lack of mobile phone towers and poor signal strength force some to walk

long distances to make calls or use internet services. Even with devices in hand, these infrastructural gaps render technology largely ineffective.

“We don’t have regular electricity in our village... Today, we had only one minute of electricity... It is expensive for us to install a good solar battery...” ID 6, married man aged 62, Taw Kyi Village

“There’s no phone tower in the village. The connection is available only sometimes...” ID 21, married woman aged 62, Taw Kyi Village

Economic difficulties further intensify the digital divide. The high cost of phones and internet, often marked up in rural areas, prevents many from owning or using devices regularly. With no state subsidies or installment plans, most elders rely on family support. Moreover, digital education programs are typically designed for youth in urban areas, leaving older adults with few learning opportunities.

“We have to pay 31,000 MMK per month for Wi-fi and 10% extra to buy phone top-up bill in the village than the town...” ID 14, married women aged 61, Win Kyan Village

Adding to these constraints, government surveillance and fear of arrest discourage digital exploration. Older adults reported deleting VPNs or avoiding apps due to safety concerns. This climate of fear, coupled with structural inequality, results in widespread digital exclusion and prevents older adults from accessing digital tools that could foster social cohesion.

“I have concern about mistakenly sharing political posts and the consequences...” ID 2, widower aged 70, Pha Un Village

“I use VPN. I have concern about the restriction of using VPN so I delete them when I go travelling...” ID 14, married woman aged 61, Win Kyan Village

Coping Strategies

Problem-Focused Coping

Older adults in rural Myanmar actively employed problem-focused coping strategies to overcome digital barriers. Many adapted personally by self-learning through trial and error or observing others. Common adjustments

included increasing font sizes, using glasses, or switching phone language to Burmese.

“If I don't know how to use phone, I just have to learn by myself and ask other friends. When I first use a phone, I just pressed randomly so sometimes the connection lost...” ID 10, widow aged 75, Kaw La Pala Village

“I can't see well, so I need to wear glasses. My smartphone can change to Burmese language...” ID 16, married woman aged 61, Win Kyan Village

Some elders managed costs by relying on children to buy devices or top-up bills, limiting data use, or selling goods like poultry. To avoid extra fees, they often visited wholesale shops or borrowed phones from neighbors to access news and social media.

“I've been using a second smartphone from my grandkid for a year...” ID 14, married woman aged 61, Win Kyan Village

“As I couldn't afford a phone, I asked my son from abroad to buy me a phone to contact with elderlies...” ID 2, widower aged 70, Pha-um Village

Even the support is inconsistent, intergenerational support was a key resource, with many participants relying on children, grandchildren, or nieces to teach basic functions, install apps, and troubleshoot issues. When family support was lacking, some turned to neighbors or local youths.

“When I have to top up my phone bills, I have to wait for my offsprings to top-up for me. If I couldn't wait, I watch the news/facebook from my neighbours... The neighbours' kids also help in using phones...” ID 16, married woman aged 65, Kaw Dawn Village

“I ask others for help to video call my son... My nieces encourage me to use smartphone... They sometimes conveyed me the news from internet...” ID 17, widow aged 78, Kaw Mu Note Village

Informal peer training also emerged within older people's groups, where knowledge of apps like Viber or Zoom was shared to participate in online-learning sessions provided by other humanitarian actors or non-government organizations.

“In our older people group, some people do

not know how to use Viber. So, we have to teach them how to use Viber and create an account...” ID 01, married man aged 66, Pha Un Village

In response to unreliable electricity, elders used solar panels, power banks, or charged devices at monasteries or neighbors' homes. To address poor network signals, some walked to higher ground or specific locations for better connectivity.

“If there's urgent need to use phone but no electricity, I have to use cycle battery to recharge...” ID 11, married man aged 76, Naung Kyan Village

“When there is no connection, we have to move to the places where there is connection...” ID 9, widower aged 67, Kaw Kyaik Village

Under surveillance fears, many practiced digital caution—deleting VPNs before travel and avoiding political content or unknown calls.

“I use VPN. I have concern about the restriction of using VPN so I delete them when I go travelling...” ID 14, married woman aged 61, Win Kyan Village

“I have experienced cold/scam calls, but I blocked them...” ID 11, married man aged 76, Naung Kyan Village

These strategies illustrate older adults' resilience in navigating digital challenges to maintain social connection and independence.

Emotion-Focused Coping

Older adults in rural Myanmar adopted various emotion-focused coping strategies to manage the psychological impact of digital exclusion. A common approach was acceptance—many elders acknowledged their physical or cognitive limitations and chose to engage only with familiar phone functions, such as voice calls or listening to the radio. This selective use allowed them to avoid frustration and maintain a sense of independence. Some expressed contentment with their current digital knowledge, resisting further training out of fear of embarrassment or simply feeling “too old to learn more.”

“I'm satisfied with what I know... I only want to make phone calls, and read the

news... When there is no internet connection, I listen to the radio.” ID 08, married man aged 60, Kaw Sai Village

“If I got training for digital tools, I don't want to learn because I'm old and...”

Others found emotional comfort in familiar routines such as watching sermons, listening to news or meditation videos, or receiving calls from family. These activities supported emotional stability and reinforced a sense of connection. The support of younger family members further contributed to their confidence and reduced anxiety about using technology.

“I listen to the news from radio like BBC... I only listen to news when I sleep.” ID 05, married man aged 61, Taung Thu Kone Village

Avoidance was also a common strategy, especially in politically sensitive contexts. Many refrained from answering unknown calls, deleted VPNs before travel, or avoided sharing political content online to stay safe.

“I have heard of people getting arrested because of posting political posts and VPNs. But I only watch, so I don't have concern about it...” ID 8, married man aged 60, Kaw Sai Village

“I'm not afraid of getting scammed because I only top-up 5000MMK and 10000MMK a month which is only used for calling...” ID 5, married man, Taung Thu Kone Village

In times of disconnection, participants often turned to traditional communication—waiting for visitors or using word-of-mouth. These emotion-focused strategies helped older adults preserve well-being, self-worth, and social connection despite limited digital access.

“Sometimes I just wait for someone to visit me instead of calling, because I feel calmer that way.” ID17, widow aged 78,

“I asked my daughter to drive the bike to get information in-person when the signals were cut off.” ID 16, married woman aged 65, Kaw Dawn Village

Overall, emotional-focused coping among

older adults in rural Myanmar reflects a blend of self-preservation, selective engagement, and social-emotional reliance. These strategies allowed them to maintain psychological well-being and social cohesion, even in the absence of full digital participation.

These findings highlight the layered complexity of digital inclusion among older adults in rural Myanmar particularly in Hpa-an Township, Kayin State. While individual effort and family support facilitated some level of digital engagement, broader structural issues such as affordability, infrastructure, and political constraints continued to hinder full participation in digital society.

DISCUSSION

This study reaffirms global findings that digital technology can strengthen social cohesion among older adults (13). In Kayin State, Myanmar, participants used mobile phones, particularly for phone calling, and text messaging, and internet applications like Viber, Messenger, and Facebook, to stay in touch with family, access news, and feel socially connected. This was especially vital for those whose families were separated by migration or conscription. These results align with studies emphasizing the importance of technology in sustaining emotional and informational ties during crisis (14).

Guided by the socioecological model, this study identified multilevel barriers. At the personal level, cognitive decline, visual impairment, and digital illiteracy limited access, echoing the previous studies (15). Financial limitations were a major obstacle, exacerbated by Myanmar's inflation and economic instability. Interpersonally, while some family members assisted older adults with technology, many participants reported frustration, impatience, or lack of support from younger relatives. Peer influence was minimal, and shared learning among older adults was rare. Community-level challenges were linked to weak rural infrastructure, including the lack of training centers, mobile towers, repair services, and phone shops (6). Most digital programs catered to youth, sidelining older learners. At the societal level,

political instability magnified digital exclusion. Participants reported internet blackouts, surveillance, and fear of online activity repercussions—concerns supported by the literatures (16). These broader political constraints reflect patterns observed in other authoritarian contexts.

Coping mechanisms reflected Lazarus's Stress and Coping Theory. Problem-focused strategies included seeking help, adjusting phone settings, learning by trial-and-error, and investing in power banks or solar panels—consistent with (5) and (15). Emotion-focused strategies were also prominent. Many participants resigned themselves to their limitations, describing themselves as “too old” or “forgetful.” Others avoided social media, sticking to basic functions like voice calls or YouTube sermons, mirroring emotion-regulation behaviors described by (17). In some cases, fear led to app deletion or VPN avoidance during travel to reduce surveillance risks. Despite challenges, participants showed resilience, a desire to remain connected, and a willingness to learn. Informal adaptations—like sharing phones or peer mentoring—offered alternative pathways to engagement. These findings echo (18), who highlight grassroots digital coping in crisis contexts.

Among all barriers, digital literacy and structural barriers emerged as the most significant obstacles to meaningful digital engagement. Although all participants possessed mobile devices, most could only make or receive basic voice calls and were unable to use other communication tools such as messaging apps or video platforms. Even when affordability was not a constraint, poor mobile signals, irregular internet access, and frequent power outages severely limited functionality. These findings suggest that ownership alone does not equate to digital inclusion. Bridging the gap requires not only access but also skills training and infrastructure investment, particularly in conflict-affected rural areas like Kayin State. The study also emphasizes the need for locally adapted, conflict-sensitive interventions. Unlike studies from stable environments, this research illustrates compounded vulnerabilities in conflict-affected Myanmar.

These findings strongly align with several Sustainable Development Goals (SDGs). Specifically, SDG 3.4 emphasizes the promotion of mental health and well-being—supported here through digital contact with family. SDG 9.c advocates for universal and affordable internet access, directly related to infrastructural deficits faced by older adults. SDG 10.2 calls for inclusion regardless of age, while SDG 11.7 highlights the importance of inclusive spaces—physical or digital—for older persons. Moreover, SDG 16.7 underscores participatory decision-making, which remains limited for older adults with low digital literacy. Finally, addressing these issues requires SDG 17.17-aligned multi-stakeholder partnerships to foster sustainable digital inclusion in fragile settings.

This study has several limitations. Some older adults hesitated to participate due to fear of surveillance or digital barriers. Unstable internet during interviews caused frustration and may have affected responses. The study's short duration limited insights into long-term digital use and evolving coping strategies. It focused solely on social cohesion, excluding other digital benefits like healthcare or education. Additionally, no government-level recommendations are made, as Myanmar's political climate restricts feasible policy suggestions. Instead, the study centers on personal, interpersonal, community, and societal barriers and coping strategies within older adults' control, excluding structural issues beyond their agency.

This study is the first in Myanmar to examine how older adults use digital technology for social cohesion amid conflict. Using the socioecological model and stress and coping theory, it explores barriers across personal, interpersonal, community, and societal levels. It reveals how intersecting challenges—like age, infrastructure gaps, and insecurity—limit digital engagement. Importantly, it highlights coping strategies older adults adopt to navigate these constraints. By applying theoretical frameworks in a conflict-affected context, the study offers valuable insights into digital inclusion under crisis, contributing to the growing literature on how vulnerable populations access and use technology amid instability and social

fragmentation.

CONCLUSION

In conclusion, while digital technology offers immense potential to enhance social cohesion among older adults, achieving true digital inclusion requires a multi-layered and context-sensitive approach. In conflict-affected and resource-limited settings like Myanmar, digital barriers are particularly acute but not insurmountable. Inclusive interventions—grounded in the lived experiences of older adults—are vital for sustainable progress. These findings echo regional demographic trends across ASEAN countries such as Thailand, Malaysia, and Vietnam, which are also experiencing aging populations. ASEAN's Strategic Framework (2020–2025) emphasizes empowering older persons through community-based initiatives and intergenerational support, reinforcing that digital tools are not just for connectivity but for mental well-being, autonomy, and dignity (19).

Globally, the UN Decade of Healthy Ageing (2021–2030) highlights digital inclusion as a critical pillar in creating age-friendly environments, particularly in fragile states (20). As societies increasingly digitize essential services, older adults must adapt—not just to thrive but to survive. Digital engagement is now a functional necessity, not an optional skill.

This study supports global research linking digital connectivity with reduced loneliness, emotional resilience, and family cohesion (21). Bridging the digital divide is a matter of social justice, contributing directly to multiple SDGs and shaping an inclusive future for aging populations worldwide.

RECOMMENDATION

The study reveals older adults in rural and conflict-affected areas of Myanmar face intersecting digital barriers—from personal limitations to structural inequalities—yet demonstrate resilience through selective use, family reliance, and adaptive routines. To bridge the digital divide, age-appropriate digital literacy programs should be developed, using visual aids, simple instructions, and repetitive practice. These efforts support SDGs 3.4, 10.2, and 11.7 by

promoting mental health, inclusion, and accessible public spaces. Strengthening intergenerational support through family-led tutoring and peer learning networks aligns with SDG 16.7. Community-based digital hubs and digital facilitator training can further promote inclusion, guided by successful regional models like Thailand's community centers. NGOs and private companies can play vital roles in delivering solar-powered solutions, subsidized devices, and rural-friendly ICT access, advancing SDGs 9.c and 17.17. Lastly, digital safety training is crucial to address surveillance fears, ensuring older adults can use technology securely and confidently, particularly in politically sensitive environments.

ETHICAL DECLARATION

This study is conducted within the community rather than in research units or government agencies. The participant consent form serves as a fundamental and sufficient requirement. Approval was obtained from the Institutional Review Board (IRB) at the Institute for Population and Social Research, Mahidol University. Therefore, IRB approval in Myanmar is waived. Each participant's informed consent was acquired by providing them with information about the study, how the findings will be used, and any potential risks or opportunities associated with taking part, and the video recording was made during the interview. Additionally, at any point during the research project, participants were aware of their right to withdraw from the study. Participants' information is kept completely private and used exclusively for academic research. The documents are locked, kept on password-protected electronic devices. After the research project is over, the participants' personal data will be deleted. In addition to conducting interviews with empathy, acceptance, and a nonjudgmental attitude, participants were valued as unique individuals above and beyond the profit.

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KNOWLEDGE OF INFECTION PREVENTION AND CONTROL (IPC) MEASURES AND ASSOCIATED FACTORS AMONG PRIVATE-SECTOR DENTISTS IN YANGON, MYANMAR: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Infection prevention and control (IPC) is essential to safeguard patients and dentists, particularly in dental settings where exposure to blood, saliva, and aerosols poses a high risk of cross-infection. Despite global recognition of IPC's importance, knowledge gaps persist, especially in low-and middle-income countries (LMICs) such as Myanmar. However, knowledge regarding IPC-measures among private-sector dentists in Myanmar remains unexplored. Therefore, this study aims to assess IPC knowledge levels and its associated factors among private-sector dentists in Yangon, Myanmar.

Methodology: A cross-sectional study used a convenience sampling approach, distributing a validated, self-administered questionnaire online via Google-Forms to dentists practicing privately in Yangon, Myanmar. A total of 396 responses were collected. The questionnaire was adapted from previous IPC KAP studies and reviewed for content validity by public health and dental experts. Descriptive statistics summarize participant characteristics and inferential statistics assessed associations between IPC knowledge levels and sociodemographic factors.

Results: Among 396 respondents, 75.8% were male. Most were aged 30-39 years (52.3%), followed by ≥ 40 years (25.5%), and ≤ 29 years (22.2%). The majority were ever married (63.1%) and held a bachelor's degree (80.1%). Regarding experience years, 29.1% had ≤ 5 years, 39.6% had 6-10 years, and 31.3% had >10 years. Over half (55.3%) earned below 1,000,000 MMK monthly. Knowledge levels were poor (57.3%), moderate (32.1%), and good (10.6%). Knowledge level was significantly associated with age ($p < 0.001$), marital status ($p = 0.003$), and years of experience ($p < 0.001$). Multinomial logistic regression showed mid-aged and younger dentists had higher knowledge than those aged ≥ 40 ($p = 0.003$, $p = 0.006$). Dentists with fewer years of experience had lower knowledge than those with more experience ($p < 0.001$, $p = 0.012$).

Conclusion: The level of IPC knowledge among private-sector dentists in Yangon was suboptimal, with over half of participants lacking knowledge in DUWL flushing, PPE sequence, and HBV surface survival, while most were aware of hand hygiene and TB transmission. Younger and Mid-aged dentists had better knowledge, while more experienced dentists had lower scores. Regular, targeted IPC-training for older and more experienced dentists is recommended, with support from dental association and policy makers.

Keywords: Infection prevention and control (IPC), Dentists, Private-sector, Knowledge level, Myanmar

INTRODUCTION

Healthcare-associated infection (HCAIs) are major global public health issues which cause significant morbidity, mortality and increased healthcare costs, particularly in low-and-middle income countries (LMICs). According to World Health Organization (WHO), nearly 3 million healthcare workers worldwide experience occupational exposure to bloodborne pathogens

annually, with 2 million cases involving HBV. In addition, healthcare workers in LMICs have a 20 times greater risk than those in high income countries of acquiring nosocomial infections due to limited resources, weaker surveillance and gaps in infection prevention infrastructure (1, 2). Dental healthcare settings are especially high-risk environments because dental procedures frequently generate blood-contaminated aerosols

and direct contact with blood and saliva which place both patient and providers at risk for the transmission of blood-borne and respiratory pathogens such as Hepatitis-B, Hepatitis-C, Human Immunodeficiency Virus, Tuberculosis (TB) and other infectious diseases (3, 4).

Effective IPC in dentistry depends on robust knowledge of protocols such as hand hygiene, personal protective equipment (PPE) usage, sterilization and disinfection of instruments, safe injection practices and management of clinical waste (5). These standards, promoted by international organizations including the Center of Disease and Control (CDC) and World Health Organization (WHO), are designed to minimize occupational exposures and prevent outbreaks (5, 6). However, the effectiveness of these measure relies on practitioners' knowledge and consistent application in daily practice (7).

In LMICs, the burden of HCAs is aggravated by significant gaps in knowledge and practice of IPC among healthcare professionals. Several studies highlight that although general awareness of IPC guidelines is moderate to high actual knowledge is frequently inadequate especially in private-sector and resource limited settings (8, 9). For example, a systematic review from Iran reported that both dentist and dental students demonstrated suboptimal knowledge and inconsistent application of IPC practices (9). The studies from Nigeria and other LMICs have reported varying levels of IPC knowledge and compliance among oral healthcare workers (9, 10). These deficiencies in IPC knowledge have been directly linked to increased occupational exposures, higher risk of cross-infection and outbreaks in dental settings (3, 8).

In Myanmar, the majority of dental care is delivered by the private-sector (11). Myanmar faces unique challenges including limited regulatory oversight, workforce shortages, supply chain disruptions and high out of pocket expenditure for healthcare (11, 12). Existing studies in Myanmar have largely focused on compliance among nurses or public hospital workers rather than private-sector dentists (13). The lack of data on IPC knowledge in this key provider represents a critical gap which can give the risk for dental associated outbreaks. Therefore, this study aims to access the

knowledge of infection prevention and control measures and associated factors among private-sector dentists in Yangon, Myanmar.

METHODOLOGY

Study Design and Participants

A cross-sectional study was conducted among private-sector dentists in Yangon, Myanmar. A convenience sample of 396 private-sector dentists in Yangon was recruited via online platforms and professional network group on social media. The target population included dentists registered licenses with the Myanmar Dental Council and practicing primarily in private dental clinics within Yangon more than 1 year. Dentist working as dual role both in public and private-sector or outside Yangon were excluded. A total of 396 eligible dentists who completed the survey were included in the study.

Instrument Development

Data were collected using a structured, self-administered questionnaire developed primarily from a literature review of IPC practices and the CDC summary of Infection Prevention Practices in Dental Setting (5). The questionnaire consisted of two main sections:

1. Sociodemographic characteristics: age, gender, marital status, education level, years of practice, and monthly income.

2. IPC Knowledge: Assessed with 14 multiple-choice questions covering essential aspects of IPC. Which cover participant's awareness and understanding of Infection Prevention and Control (IPC) principles in dental settings, including hand hygiene, use of personal protective equipment (PPE), sterilization and disinfection of instruments, safe handling of needles and sharps, dental unit waterline management, waste disposal, environmental infection control, immunization, bloodborne pathogen transmission, and response to occupational exposures.

The questionnaire was reviewed by public health and dental experts to ensure content validity. It was pilot-tested among 39 dentists from Mandalay to assess reliability, Reliability was assessed using KR-20 with score above 0.65 was achieved.

Data Collection Procedure

The survey was distributed online via Google forms in June 2025. Eligible participants were invited through professional dental networks and social media platforms. Participation was voluntary and anonymous, with electronic informed consent obtained before survey initiation.

Scoring and Variables

Knowledge scores were calculated by assigning one point for each correct answer. Total knowledge score was categorized as poor, moderate, or good based on Bloom cut-off point. Only sociodemographic variables (age, gender, marital status, educational level, years of practice, and monthly income) were included as independent variables.

Statistical Analysis

Descriptive statistics were used to summarize sociodemographic characteristics and knowledge levels. Associations between knowledge level and independent variables were assessed using Chi-square or Fisher’s exact tests. Multinomial logistic regression using the enter method was used to identify independent predictors of knowledge level, with the poor knowledge group as the reference category. Odds

ratios (ORs) and 95% confidence intervals (CIs) were reported. All statistical analyses were conducted using SPSS version 29.0.2.0. A p-value less than 0.05 was considered statistically significant.

Ethical Considerations

The study received ethical approval (COA No. 188/68) from the Research Ethic Review Committee, College of Public Health Sciences, Chulalongkorn University. All responses were anonymous and confidential.

RESULTS

Sociodemographic Characteristics

A total of 396 private-sector dentists participated in the study. As shown in Table 1, the majority were ages 30-39 years (52.3%), followed by ≥ 40 years (25.5%) and ≤ 29 years (22.2%). Most participants were male (75.8%) and (63.1%) were ever married. Regarding education (80.1%) held a bachelor’s degree and (19.9%) held postgraduate degree. Years of practice were distributed as follows: ≤ 5 years (29.0%), 6-10 years (39.6%) and > 10 years (31.3%). Over half (55.3%) reported a monthly income of ≤ 1,000,000 MMK and 44.7% earned above this threshold.

Table 1 Sociodemographic Characteristics of Participants(n=396)

General Characteristic	Number	%
Age (Years)		
≤29 years	88	22.2
30-39 years	207	52.3
≥40 years	101	25.5
Gender		
Male	300	75.8
Female	96	24.2
Male: Female Ratio = 3.1:1		
Marital Status		
Never Married	146	36.9
Ever Married	250	63.1
Education Level		
Bachelor’s degree	317	80.1
Postgraduate Degree	79	19.9
Practicing Year		
≤ 5	115	29.1
6 to 10 years	157	39.6
>10 years	124	31.3

General Characteristic	Number	%
Monthly Income		
≤1,000,000	219	55.3
>1,000,000	177	44.7
*1USD=2099 MMK		

IPC Knowledge Responses

Participants' knowledge of IPC was assessed with 14-questions covering various domain of IPC. As shown in Table-2, most dentists (90.7%) knew the primary purpose of handwashing is to prevent infection, and 85.1% recognized that Mycobacterium Tuberculosis is airborne pathogens. 61% correctly identified that impression trays are not considered critical instruments, and 65.9% recognized saliva, blood and contaminated instruments as potential transmission sources. Only 17.4% knew that dental unit waterlines (DUWLs) should be flushed after each patient, while 28.8% were aware that Legionella Pneumophila can harbor in DUWLs and 42.7% identified the primary risk of

DUWLs contamination as the spread of Legionella and Pseudomonas. Regarding PPE, 37.4% answered the correct donning sequence, and 34.6% understood that the one-hand technique for needle recapping is IPC procedure. For occupational injury management, 92.2% knew that percutaneous injuries should be washed immediately and reported. Only 28% correctly identified that handwashing before invasive procedures should last 40-60 seconds. 75.8% recognized autoclaving between patients as the best way to prevent cross-contamination, while only 21.5% were aware that HBV can survive on surface for up to a week. Lastly, 56.6% correctly stated that patients with hepatitis B can be safely treated under IPC practices.

Table 2 Correct Responses to IPC Knowledge Items (n=396)

Items	Correct Answer	
	Number	%
Primary purpose of handwashing is to prevent infection	359	90.7
Impression trays as non-critical instruments in dentistry	243	61.4
Mycobacterium tuberculosis is airborne transmitted-pathogen through person-to- person contact in dental settings	337	85.1
(DUWLs) should be flushed after each patient.	69	17.4
One hand technique as part of standard IPC practice	137	34.6
Legionella pneumophila can harbor in (DUWLs)	114	28.8
The correct order for PPE-donning sequence	148	37.4
The percutaneous injuries proper management	365	92.2
The primary risk associated with contamination of (DUWL) is that Spread of Legionella and Pseudomonas	169	42.7
Handwashing ideal time before invasive procedures	111	28.0
The most effective method to prevent cross-contamination from dental handpieces	300	75.8
HBV can survival time on environmental surface	85	21.5
Saliva, blood, and contaminated instruments are all potential transmission sources	261	65.9
Patients with hepatitis B can be safely treated under IPC practices	224	56.6

Of the 396 private-sector dentists surveyed, 10.6% demonstrated good knowledge

of IPC, 32.1% had moderate knowledge, and the majority 57.3% had poor knowledge (Table 3).

Table 3 Distribution of IPC Knowledge Levels

Level of knowledge	Number	%
Good (>11 scores)	42	10.6
Moderate (8 – 11 scores)	127	32.1
Poor (< 8 scores)	227	57.3

Analysis of associations between sociodemographic characteristics and knowledge level showed that age, marital status, and years of practices were significantly related to IPC knowledge. Based on the Table 4, Dentists aged 30-39 years were most likely to have good, while those age 40 years or older had the lowest proportion of good knowledge ($p < 0.001$). Never-married dentists were significantly more likely to possess good IPC knowledge compared to their ever-married counterparts ($p < 0.003$). Years of

professional practice also showed a significant association ($p < 0.001$), with dentists practicing for five years or less having the highest proportion of good knowledge, whereas those with six to ten years of practice had the lowest. No significant associations were found between knowledge level and gender ($p = 0.082$), educational attainment ($p = 0.34$), or monthly income ($p = 0.748$). No significant associations were found for marital status.

Table 4 Association between Sociodemographic Characteristics and IPC Knowledge Level (Chi-Square Analysis, $n = 396$)

Characteristics	Total sample	Knowledge Level						p-value
		Poor		Moderate		Good		
		No.	%	No.	%	No.	%	
Age (years)	Chi-square =	19.226						<0.001**
≤29 years	88	39	44.3	40	45.5	9	10.2	
30-39 years	207	121	58.5	69	33.3	17	8.2	
≥40 years	101	67	66.3	18	17.8	16	15.8	
Gender	Chi-square =	5.011						0.082
Male	300	181	60.3	91	30.3	28	9.3	
Female	96	46	47.9	36	37.5	14	14.6	
Marital Status	Chi-square =	11.901						<0.003*
Never Married	146	69	47.3	62	42.5	15	10.3	
Ever Married	250	158	63.2	65	26	27	10.8	
Education	Chi-square =	6.755						0.34
Bachelor	317	183	57.7	106	33.4	28	8.8	

Characteristics	Total sample	Knowledge Level						p-value
		Poor		Moderate		Good		
		No.	%	No.	%	No.	%	
Postgraduate	79	42	53.16	19	24.06	18	22.78	
Monthly Income	Chi-square =	0.581						0.748
≤1,000,000	219	126	57.5	72	32.9	21	9.6	
>1,000,000	177	101	57.1	55	31.1	21	11.9	
Practice Year	Chi-square =	21.959						<0.001**
≤ 5	115	60	52.2	45	39.1	10	8.7	
6 to 10 years	157	99	63.1	51	32.5	7	4.5	
>10 years	124	68	54.8	31	25.0	25	13.2	

p<0.05*, p<0.001**

Sociodemographic variables that had a p-value < 0.05 in the Chi-square tests—specifically age, marital status, and years of practice—were entered into a multinomial logistic regression model using the enter method to determine their independent association with IPC knowledge level. The reference category for the dependent variable was set as “poor knowledge.”

The analysis showed that dentists aged ≤29 years were significantly more likely to have moderate IPC knowledge compared to those aged ≥40 years (OR = 5.18, 95% CI: 1.78–15.10, p = 0.003). Similarly, dentists aged 30–39 years also had significantly higher odds of moderate knowledge compared to the older age group (OR

= 2.80, 95% CI: 1.33–5.86, p = 0.006). No statistically significant associations were observed between age group and good knowledge level.

In terms of years of experience, dentists with ≤5 years of practice had significantly lower odds of good knowledge compared to those with more than 10 years of experience (OR = 0.14, 95% CI: 0.03–0.65, p = 0.012). Likewise, those with 6–10 years of experience also had reduced odds of good knowledge (OR = 0.15, 95% CI: 0.05–0.44, p < 0.001). No significant associations were found between years of experience and moderate knowledge level (Table-5).

Table 5 Multinomial Logistic Regression Analysis of Sociodemographic Predictors of IPC Knowledge Level among Participants

Predictor	Outcome	B	S.E.	p-value	Exp(B)	95% CI	
						Lower	Upper
Age Group							
Young (≤29)	Moderate vs Poor	1.645	0.546	0.003*	5.179	1.776	15.104
	Good vs Poor	1.596	0.897	0.075	4.933	0.850	28.634
Middle-age (30-39)	Moderate vs Poor	1.028	0.378	0.006*	2.796	1.334	5.861
	Good vs Poor	0.509	0.466	0.275	1.663	0.667	4.150

Predictor	Outcome	B	S.E.	p-value	Exp(B)	95% CI	
						Lower	Upper
Experience							
Low (≤ 5 years)	Moderate vs Poor	-0.780	0.466	0.094	0.458	0.184	1.143
	Good vs Poor	-1.957	0.778	0.012*	0.141	0.031	0.648
Medium (6-10years)	Moderate vs Poor	-0.402	0.350	0.251	0.669	0.337	1.330
	Good vs Poor	-1.879	0.536	<0.001**	0.153	0.053	0.437

Variables with $p < 0.05^*$, $p < 0.01^{**}$ included. Reference: "poor" knowledge, old age group (≥ 40 years), High experience (> 10 years)

DISCUSSION

This study found that knowledge of IPC among private-sector dentists in Yangon was generally low, with over half demonstrating poor knowledge and only a minority achieving a good level. This pattern closely mirrors reports from other LMICs, where dental professionals frequently exhibit inadequate IPC knowledge and inconsistent application (9, 14). The observed deficiencies may be attributed to limited access to continuing professional development, insufficient postgraduate training opportunities and challenges in resource availability-factors that are well documented barriers to workforce capacity and quality of care in Myanmar's dental sector (11). The predominance of male practitioners and limited postgraduate training reflect broader trends in Myanmar's dental workforce, which is small, lacks auxiliary professionals, and is increasingly concentrated in the private-sector (11). Economic diversity observed among respondents with nearly half earning moderate incomes which highlights the potential impact of financial constraints on access to essential IPC resources and training.

Respondents scored highest on fundamental topics such as the purpose of handwashing, airborne transmission of tuberculosis and management of percutaneous injuries. This pattern is consistent with studies in Iran, Malaysia, and Saudi Arabia where basic IPC concepts are more widely understood but gaps persist in the application of more advanced infection control measures (7, 15, 16). However, notable gaps persisted in areas like handwashing duration, DUWL management, needle recapping techniques, and awareness of hepatitis B virus survival. These findings echo trends reported in

previous studies, highlighting a persistent need for targeted education and reinforcement of IPC best practices (7, 9). While bivariate analysis found significant associations between knowledge level and age, marital status, and years of practice, only age and years of experience remained significant in multinomial logistic regression. Notably, younger and middle-aged dentist demonstrated higher odds of moderate knowledge than those 40 and above. This pattern consistent with studies showing that compliance may plateau or even decline among older dentists, potentially due to reduced engagement with ongoing training or "knowledge decay" (17). Interestingly, this study found that grater years of experience were associated with lower knowledge scores, contrasts with research from Iran, where longer experience was linked to better IPC knowledge (7). This discrepancy may reflect differences in access to ongoing education or generational differences in training emphasis.

In summary, while this study highlights significant gaps in IPC knowledge among private-sector dentists in Yangon, it also identifies key factors such as age, experience, and access to training that can inform the design of targeted interventions. Addressing these factors will be crucial for improving IPC practices and ultimately enhancing patient and provider safety in Myanmar's dental sector.

To improve IPC knowledge among dentists, structured and regular continuing education programs should be implemented. These should focus on practical components such as DUWL maintenance, PPE protocols, and environmental disinfection. Trainings can be delivered through hands-on workshops, online modules, and mandatory refresher courses

supported by dental councils and professional associations.

However, increasing knowledge alone is not sufficient to improve practice. To ensure translation into behavior, training must be paired with monitoring, resource provision, supportive supervision, and clinic-level enforcement of IPC protocols. Embedding IPC expectations into daily workflow and incentivizing compliance are also critical strategies.

This study has practical implications for policymakers and professional bodies. Its findings can be used to design evidence-based, targeted IPC interventions for private dental settings. These may include competency-based assessments, integration of IPC modules into licensure renewal, and regional training campaigns tailored to address identified knowledge gaps.

CONCLUSION

This study revealed that knowledge of IPC among private-sector in Yangon, is generally suboptimal with the majority demonstrating poor or moderate knowledge and only a small proportion achieving a good level. Significant knowledge gaps exist in key areas such as environmental and equipment-related IPC measures. Age group and years of professional experience were found to be significant predictors of knowledge level, while marital status, gender, education, and income were not independently associated with IPC knowledge. These findings underscore the urgent need for targeted educational interventions and regular refresher training to strengthen IPC knowledge among private dentists in Myanmar, ultimately improving infection control practices and safeguarding both patients and dental professionals.

LIMITATIONS

This study is one of the first to comprehensively assess IPC knowledge and associated factors among private-sector dentists in Yangon. The relatively large sample size and include practitioners from all districts of Yangon, enhances the representativeness of the findings. As this study was cross-sectional, it cannot show cause and effect. There is also a chance of self-

reporting and selection bias, which could affect the results.

RECOMMENDATION

It is recommended to provide regular and targeted IPC training for private dentists, with specific focus on equipment and environmental control practices. Key areas should include dental unit waterline (DUWL) flushing, handpiece sterilization, proper PPE usage, needle recapping techniques, and surface disinfection protocols. IPC should be included as an important part of ongoing professional training. Engage dental professional associations, regulatory bodies and government agencies to advocate for and support ICP initiatives. Access to guidelines should be improved through digital and printed materials. Similar research should also be done in other regions and in the public sector. Given the persistent gaps in IPC knowledge and practice among dental professionals, especially in low-resource settings, there is a clear need for structured intervention studies that assess the impact of specific educational and training programs.

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SOCIO-DEMOGRAPHIC AND EMPOWERMENT PREDICTORS OF SAFER-SEX NEGOTIATION AMONG MARRIED WOMEN IN BANGLADESH: FINDINGS FROM THE 2017-2018 BDHS

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ABSTRACT

Background: The ability of married women to negotiate safer-sex practices is critical for ensuring their reproductive autonomy and sexual health. In Bangladesh, deeply ingrained socio-cultural norms and unequal gender power dynamics within marriages significantly affect women's negotiating abilities. Prior studies in Bangladesh have primarily explored general aspects of women's empowerment and reproductive autonomy but have not explicitly assessed the nuanced relationships between socio-demographic factors, empowerment, and women's capacity for safer-sex negotiation within marital relationships.

Objective: This study aims to identify the socio-demographic and empowerment-related factors influencing married women's ability to negotiate safer-sex practices in Bangladesh, utilizing clearly defined and validated empowerment measures.

Methodology: A cross-sectional analysis was conducted using data from the 2017–2018 Bangladesh Demographic and Health Survey (BDHS), involving 20,127 ever-married women aged 15–49. Women's safer-sex negotiation ability was operationalized through two DHS questions: whether a wife is justified in asking her husband to use a condom if he has a sexually transmitted disease, and whether she can refuse sex if her husband has other sexual partners. Empowerment was assessed using a composite measure derived from women's participation in household decision-making (personal healthcare, major purchases, family visits) and rejection of justifications for wife-beating (going out without permission, neglecting children, arguing, refusing sex, burning food). Empowerment scores categorized respondents into low, medium, and high levels. Statistical analyses included descriptive statistics, bivariate logistic regression ($p < 0.25$), and multivariate logistic regression using STATA version 17.

Results: Multivariate analysis revealed significant associations between safer-sex negotiation and higher education levels (Higher Education AOR=1.50, 95% CI: 1.26–1.79), urban residence (AOR=1.33, 95% CI: 1.23–1.45), current employment (AOR=1.23, 95% CI: 1.14–1.33), and medium (AOR=1.55, 95% CI: 1.39–1.72) to high empowerment (AOR=2.23, 95% CI: 1.99–2.50). Conversely, older age (45–49 years AOR=0.77, 95% CI: 0.67–0.87), rural residence (AOR=0.75, 95% CI: 0.69–0.82), and belonging to richer wealth quintiles (AOR=0.85, 95% CI: 0.74–0.96) showed reduced likelihood. Regional disparities were also notable, with women in Sylhet, Barisal, and Chittagong having significantly lower odds compared to Dhaka.

Conclusion: This study highlights the critical roles of education, urban residence, employment, and empowerment in enhancing married women's safer-sex negotiation abilities. Persistent barriers, including older age, rural settings, and wealth-related paradoxes, underscore the complexity of socio-cultural influences. Targeted interventions emphasizing women's education, economic empowerment, and culturally sensitive community programs, especially in rural and

conservative settings, are essential for improving women's reproductive autonomy and sexual health outcomes.

Keywords: Bangladesh, Demographic and Health Survey (DHS), Gender equality, Safer-sex negotiation, Sexual autonomy, Women's empowerment

INTRODUCTION

Clear and mutually respectful communication between partners about sexual preferences, protective practices, and boundaries is essential for promoting sexual health(1). Effective negotiation of safer sex involves open discussions about condom use and other preventive measures to reduce sexual health risks(2). However, the process of negotiating safer-sex practices is often undermined by unequal power relations, ingrained gender disparities, and restrictive cultural norms, especially in traditionally patriarchal societies(3).

Evidence from prior studies indicates that individuals' perceptions about condoms and their comfort in communicating about condom use significantly influence actual safer-sex behaviors(4-5). Negative peer influences and unfavorable social perceptions have been shown to increase the likelihood of risky sexual activities, whereas positive peer norms and supportive attitudes tend to facilitate safer practices like consistent condom use(6-8). In countries with strong patriarchal norms such as Bangladesh, married women frequently face substantial barriers to negotiating safer sex due to socio-cultural expectations that favor male dominance. Younger women – who are often expected to be submissive – encounter more obstacles in advocating for safer-sex practices compared to older women, who often possess greater autonomy gained through education and better access to health resources(9-11).

Perceptions related to gender-based violence and prevailing cultural practices also

significantly limit women's empowerment in sexual relationships. In many cases, acceptance of intimate partner violence is associated with lower educational attainment, economic dependence, and entrenched patriarchal social structures(12-14). These frameworks reinforce traditional notions of masculinity, normalize domestic violence, and thereby diminish women's control over sexual decision-making, including the ability to insist on condom use(15-16). Other barriers – such as the stigma surrounding discussions of sexual health and women's limited decision-making autonomy regarding condom use – underscore the critical importance of educational programs and community-based initiatives to raise awareness and reduce HIV/AIDS-related stigma(10,17-20). Such interventions can help create a more enabling environment for women to engage in safer-sex negotiations without fear or shame.

Research Objectives

To estimate the proportion of married Bangladeshi women who perceive justification for negotiating safer sexual practices.

To identify and describe the sociodemographic characteristics and empowerment indicators among married women in Bangladesh.

To examine the associations between sociodemographic characteristics, empowerment indicators, and perceptions regarding justification for negotiating safer sexual practices among married women in Bangladesh.

Research Gap

This study addresses critical gaps in existing literature by:

- Emphasizing the underexplored connection between women's empowerment and their perceived justification for engaging in safer sexual negotiations within marital contexts in Bangladesh.

- Providing detailed analysis of specific sociodemographic factors that significantly shape women's perceptions of safer-sex negotiation, thereby contributing nuanced insights to existing scholarly discussions.
- Highlighting the intersectionality between empowerment, sociodemographic contexts, and sexual health behaviors, a topic currently insufficiently explored in research specific to Bangladesh.

Study aim: The present study analyzes data from the 2017–2018 BDHS to identify the proportion of married women in Bangladesh with positive perceptions towards safer-sex negotiation and examines factors influencing these perceptions. Specifically, the study investigates the association of women's socio-demographic characteristics (age, education, urban/rural residence, wealth) and empowerment levels with their willingness to negotiate safer sex.

METHODOLOGY

Data Source

Data were sourced from the 2017–2018 Bangladesh Demographic and Health Survey (BDHS), a nationally representative household survey.

Sample

The study sample comprised married women aged 15–49 years.

Data Processing

Datasets from the BDHS Individual Recode (IR) files were merged and cleaned using STATA version 17. The final dataset included

responses from 20,127 ever-married women, excluding those with missing data.

Data Analysis

Descriptive Analysis

Sociodemographic characteristics (age, residence, division, occupation, education, religion, media exposure, wealth) were analyzed. Empowerment was assessed using eight binary indicators, and perceptions regarding safer-sex negotiation were evaluated through two binary questions.

Empowerment Index

An empowerment index was constructed from eight binary indicators, categorizing scores into low, medium, and high empowerment levels based on quantile divisions.

Measurement of Women's Empowerment:

Women's empowerment was conceptualized as a multidimensional construct involving two key domains: decision-making autonomy and attitudes toward wife-beating.

Indicators for Measurement:

Decision-making autonomy was assessed through three questions:

Who usually makes decisions about healthcare for yourself? (You, your husband, jointly)

Who usually makes decisions about major household purchases? (You, your husband, jointly)

Who usually makes decisions about visits to your family or relatives? (You, your husband, jointly)

Responses were recoded into binary outcomes (Yes/No), where "Yes" represented women making decisions alone or jointly with their husbands, and "No" indicated husband alone or someone else.

Attitudes toward wife-beating were evaluated through five scenarios, each asking if a husband is justified in beating his wife if she:

Goes out without informing him
 Neglects the children
 Argues with him
 Refuses sex
 Burns food
 Responses were binary, with "Yes" indicating agreement (negative indicator of empowerment) and "No" indicating disagreement (positive indicator of empowerment).

Composite Empowerment Score:

A composite empowerment index was created by combining these eight binary indicators (3 decision-making + 5 attitudes toward wife-beating). Empowerment levels were then categorized into:
 Low empowerment: 0–3 positive responses
 Medium empowerment: 4–6 positive responses
 High empowerment: 7–8 positive responses
 This categorization allowed a nuanced understanding of women's empowerment, capturing both their autonomy within the

household and their rejection of gender-based violence.

Classification of Perceptions

Positive perceptions were defined by affirmative responses to both safer-sex negotiation questions; otherwise, perceptions were classified as negative.

Bivariate Analysis

Simple logistic regression was conducted to identify associations between independent variables and perceptions. Variables with p-values less than 0.25 were selected for further analysis.

Multivariable Analysis

Multivariable logistic regression was performed using variables identified in the bivariate analysis. Results were presented as Adjusted Odds Ratios (AORs) with corresponding 95% confidence intervals (CIs).

RESULTS

Descriptive Analysis:

Table 1 Descriptive analysis of sociodemographic factors associated with: (n=20,127)

Category	Freq.	Percent
Women's Age		
25-34	7,034	34.95%
15-24	5,465	27.15%
35-44	5,282	26.24%
45-49	2,346	11.66%
Khulna	2,630	13.07%
Rajshahi	2,576	12.80%
Rangpur	2,492	12.38%
Sylhet	2,229	11.07%
Mymensingh	2,167	10.77%
Barisal	2,154	10.70%
Type of Place of Residence		
Rural	12,753	63.36%
Urban	7,374	36.64%
Highest Educational Level		
Secondary	7,764	38.58%
Primary	6,340	31.50%

Category	Freq.	Percent
No Education	3,202	15.91%
Higher	2,821	14.02%
Religion		
Islam	18,136	90.11%
Hinduism	1,861	9.25%
Buddhism	84	0.42%
Christianity	46	0.23%
Wealth Index Combined		
Richest	4,497	22.34%
Richer	4,088	20.31%
Middle	3,883	19.29%
Poorer	3,833	19.04%
Poorest	3,826	19.01%
Employment (Husband/Partner worked in last 7 months)		
Employment	18,482	91.83%
Unemployment	1,645	8.17%
Husband/Partner's Education Level		
Higher Education	5,966	29.64%
Secondary Education	5,579	27.72%
No Education	5,209	25.88%
Primary Education	3,373	16.76%
Exposure to Media: Reading Magazine		
No	19,326	96.02%
Yes	801	3.98%
Listen to Music		
No	19,326	96.02%
Yes	801	3.98%
Watching Television		
Yes	10,994	54.62%
No	9,133	45.38%

Sample Characteristics: A total of 20,127 ever-married women aged 15–49 was analyzed. Respondents had a mean age of approximately 31 years, with the largest group (around one-third) aged 25–34 years. Most lived in rural areas (63%), aligning with Bangladesh’s demographic distribution. Predominantly Muslim (90.1%), the sample included approximately 9.3% Hindu women,

with Buddhists and Christians comprising less than 1% collectively. Education levels varied, with about 25% having no formal schooling and the remainder attaining primary education or higher. Nearly half (48%) were employed within the past year, while household wealth was evenly distributed across quintiles.

Table 2 Percentage of positive and negative answers of participants in indicators of women empowerment questions (n=20,127)

Indicators of women empowerment questionnaire	Yes (%)	No (%)
1) Who usually makes decisions about health care for yourself: you, your husband, or you and your husband jointly?	14,462 (71.85%)	5,665 (28.15%)
2) Who usually makes decisions about making major household purchases? you, your husband, or you and your husband jointly?	13,643 (67.78%)	6,484 (32.22%)
3) Who usually makes decisions about visits to your family or relatives?	14,193(70.52%)	5,934(29.48 %)
4)In your opinion, is a husband justified in hitting or justified beating his wife in the following situations: a) If she goes out without telling him?	1,550 (7.70%)	18,577(92.30%)
5)In your opinion, is a husband justified in hitting or justified beating his wife in the following situations: b) If she neglects the children?	1,949(9.68%)	18,178(90.32%)
6)In your opinion, is a husband justified in hitting or justified beating his wife in the following situations: c) If she argues with him?	2,728(13.55%)	17,399(86.45%)
7)In your opinion, is a husband justified in hitting or justified beating his wife in the following situations: d) If she refuses to have sex with him?	563(2.80%)	19,564(97.20%)

Table 3 Percentage of level of empowerment (n=20,127)

Level of empowerment	N	%
Low	1,919	9.53
Medium	8,884	44.14
High	9,324	46.33

Empowerment Levels: Women's empowerment, assessed through participation in household decision-making and rejection of domestic violence, was generally high. Approximately 46.3% demonstrated high empowerment, 44.1% medium empowerment, and only 9.5% were classified as having low empowerment. Over 90% showed at least moderate

empowerment levels, signifying substantial autonomy among married women. However, the relationship between empowerment and perceptions of safer-sex negotiation was nuanced, suggesting that high empowerment does not uniformly predict attitudes toward safer-sex negotiation.

Table 4 Descriptive analysis of married women's perception toward negotiating safer sex with their husband: (n=20,127)

Dependent Variables	Yes (%)	No (%)
If a wife knows her husband has a disease that she can get during sexual intercourse, is she justified in asking that they use a condom when they have sex?	16,045(79.72%)	4,082(20.28%)
Is a wife justified in refusing to have sex with her husband when she knows he has sex with other women?	19,335 (96.06%)	792(3.94%)

If respondents answer “yes” to both question then it’s positive attitude, if not then shows negative attitude

Table 5 Perceptions toward safer-sex negotiation (N = 20,127)

Attitude Toward Safer-Sex Negotiation	Frequency (n)	Percentage (%)
Positive Attitude	15,733	78.17%
Negative Attitude	4,394	21.83%
Total	20,127	100.00%

Perceptions Towards Safer-Sex Negotiation: The respondents exhibited overwhelmingly positive attitudes toward safer-sex negotiation. Specifically, 79.7% supported a wife's right to request condom use if the husband has a sexually transmitted infection (STI), while 96.1% endorsed a wife's right to refuse intercourse if her

husband engages with other partners. Combining both indicators, 96.06% had positive perceptions overall, highlighting strong normative support. Only 3.9% disagreed or were unsure, indicating minimal resistance to these protective behaviors.

Most married women (78.17%) demonstrated positive attitudes toward safer-

sex negotiation, recognizing their right to request condom use if their partner has an STI and refuse sex if their partner engages in extramarital relationships. However, a notable minority (21.83%) expressed negative attitudes, indicating persistent

socio-cultural barriers and highlighting the need for continued efforts to enhance women's sexual autonomy and empowerment in Bangladesh.

Inferential Findings:

Table 6 Multiple Logistic Regression Results for Attitude Toward Safer-Sex Negotiation

Sociodemographic Factor	Variable	Reference Category	Adjusted Odds Ratio	Std. Err.	95% CI Lower	95% CI Upper	p-value
Division	Barisal	Reference: Dhaka	0.796	0.056	0.694	0.912	0.002
	Chittagong	Reference: Dhaka	0.878	0.056	0.775	0.995	0.048
	Khulna	Reference: Dhaka	1.164	0.08	1.018	1.332	0.024
	Mymensingh	Reference: Dhaka	2.745	0.242	2.309	3.263	<0.001
	Raj Shahi	Reference: Dhaka	1.32	0.093	1.15	1.515	<0.001
	Rangpur	Reference: Dhaka	1.144	0.082	0.995	1.316	0.053
	Sylhet	Reference: Dhaka	0.674	0.045	0.592	0.768	<0.001
Women's Age	25-34	Reference: 15-24	0.894	0.042	0.815	0.981	0.024
	35-44	Reference: 15-24	0.822	0.044	0.741	0.913	0.0
	45-49	Reference: 15-24	0.766	0.052	0.671	0.874	0.0
Education	Primary Education	Reference: No Education	1.224	0.066	1.1	1.361	0.001
	Secondary Education	Reference: No Education	1.343	0.083	1.19	1.516	<0.001
	Higher Education	Reference: No Education	1.498	0.134	1.258	1.785	<0.001
Religion	Hinduism	Reference: Islam	0.943	0.057	0.838	1.062	0.408

Sociodemographic Factor	Variable	Reference Category	Adjusted Odds Ratio	Std. Err.	95% CI Lower	95% CI Upper	p-value
Wealth Index	Buddhism	Reference: Islam	0.926	0.241	0.556	1.542	0.789
	Christianity	Reference: Islam	1.806	0.866	0.705	4.621	0.226
	Poorer	Reference: Poorest	0.998	0.057	0.891	1.117	0.974
	Middle	Reference: Poorest	0.969	0.06	0.86	1.093	0.649
	Richer	Reference: Poorest	0.845	0.055	0.744	0.959	0.024
	Richest	Reference: Poorest	0.986	0.075	0.85	1.145	0.875
Husband's Employment Residence	Employed	Reference: Unemployed	1.001	0.067	0.877	1.142	0.984
	Rural	Reference: Urban	0.751	0.032	0.692	0.815	<0.001
Husband's Education	Higher Education	Reference: No Education	1.034	0.053	0.935	1.143	0.605
	Secondary Education	Reference: No Education	1.052	0.06	0.94	1.177	0.556
	Primary Education	Reference: No Education	1.118	0.087	0.961	1.302	0.123
Women's Employment Reading Magazines Listening to Music Watching TV	Employed	Reference: Unemployed	1.232	0.047	1.143	1.327	<0.001
	Yes	Reference: No	1.235	0.14	0.988	1.544	0.056
Empowerment Level	Yes	Reference: No					
	Yes	Reference: No	1.013	0.043	0.933	1.1	0.794
Empowerment Level	Medium empowerment	Reference: Low	1.546	0.086	1.387	1.724	<0.001
	High empowerment	Reference: Low	2.229	0.129	1.99	2.496	<0.001

Geographic division significantly influenced attitudes toward safer-sex negotiation among married women in Bangladesh. Women residing in Mymensingh (AOR = 2.75) and Rajshahi (AOR = 1.32)

were notably more likely to exhibit positive attitudes compared to those from Dhaka, while women from Sylhet (AOR = 0.67), Barisal (AOR = 0.80), and Chittagong (AOR = 0.88) demonstrated significantly lower

odds. Women's age also showed a notable inverse relationship: older age groups, specifically 45–49 years (AOR = 0.77) and 35–44 years (AOR = 0.82), were significantly less likely to hold positive attitudes toward safer-sex negotiation than the youngest group (15–24 years). Educational attainment emerged as a strong positive predictor; women with higher education (AOR = 1.50), secondary education (AOR = 1.34), and primary education (AOR = 1.22) showed increasingly greater odds of positive attitudes compared to women with no formal education. Interestingly, women in the richer wealth quintile (AOR = 0.85) had significantly lower odds of positive attitudes compared to those in the poorest quintile. Additionally, rural residence was associated with lower odds (AOR = 0.75) of having positive attitudes compared to urban residence. Employment was positively associated with attitudes toward safer-sex negotiation, with employed women having significantly higher odds (AOR = 1.23) compared to unemployed women. Finally, women's empowerment was strongly correlated with attitudes toward safer-sex negotiation; women with high (AOR = 2.23) and medium (AOR = 1.55) empowerment levels had substantially increased odds of holding positive attitudes.

DISCUSSION

The findings from this study align closely with existing international literature, underscoring the critical roles of women's socioeconomic status, educational attainment, and empowerment levels in influencing attitudes toward safer-sex negotiation among married women. The robust positive association observed between women's education and their attitudes toward safer-sex negotiation is consistent with previous research in similar South Asian contexts (21, 22). Education likely enhances women's sexual autonomy by providing essential

knowledge and skills for effective negotiation of safer-sex practices within marital relationships.

Geographic division emerged as a significant determinant in shaping women's attitudes toward safer-sex negotiation. Women residing in Mymensingh (AOR = 2.75) and Raj Shahi (AOR = 1.32) exhibited substantially higher odds of having positive attitudes compared to women in Dhaka. Conversely, significantly lower odds were observed among women from Sylhet (AOR = 0.67), Barisal (AOR = 0.80), and Chittagong (AOR = 0.88). These regional disparities likely reflect localized socio-cultural norms, varying degrees of access to education and healthcare services, and differential effectiveness of public health interventions across these geographic divisions.

Age demonstrated a significant inverse association with attitudes toward safer-sex negotiation, with older women (45–49 years: AOR = 0.77; 35–44 years: AOR = 0.82) exhibiting lower odds compared to younger women (15–24 years). This finding potentially reflects generational differences in reproductive health awareness and changing societal norms concerning women's sexual autonomy.

Women living in rural areas were significantly less likely (AOR = 0.75) to exhibit positive attitudes toward safer-sex negotiation compared to their urban counterparts. This rural-urban disparity underscores persistent structural barriers, including conservative cultural norms and limited access to sexual and reproductive health services, aligning with findings reported from other developing regions (23, 24).

Employment status was positively correlated with attitudes toward safer-sex negotiation; employed women demonstrated significantly higher odds (AOR = 1.23) compared to those unemployed. This result highlights the integral role of economic participation in bolstering women's autonomy

and enhancing their negotiating power within marital relationships, aligning with prior research (25).

Intriguingly, women from the richer wealth quintile had significantly lower odds (AOR = 0.85) of possessing positive attitudes toward safer-sex negotiation compared to women from the poorest quintile. This counterintuitive finding suggests that economic empowerment alone may not directly translate into enhanced sexual autonomy, potentially due to persistent patriarchal norms or entrenched gender-role expectations within higher socioeconomic groups.

Finally, women's empowerment level displayed a strong positive association with attitudes toward safer-sex negotiation. Women with high (AOR = 2.23) and medium (AOR = 1.55) empowerment levels exhibited markedly increased odds of positive attitudes. This underscores the vital importance of comprehensive women's empowerment initiatives as key strategies for promoting sexual autonomy and improving reproductive health outcomes.

The present study analyzes data from the 2017–2018 BDHS to identify the proportion of married women in Bangladesh with positive perceptions towards safer-sex negotiation and examines factors influencing these perceptions. Specifically, the study investigates the association of women's socio-demographic characteristics (age, education, urban/rural residence, wealth) and empowerment levels with their willingness to negotiate safer sex. The discussion directly fulfills this aim by interpreting how these socio-demographic and empowerment factors significantly influence married women's attitudes toward safer-sex negotiation.

CONCLUSION

In conclusion, married Bangladeshi women's attitudes toward safer-sex negotiation are shaped by a complex interplay of socio-demographic and empowerment factors. Notable geographic disparities exist – for instance, women in Mymensingh division have significantly higher odds of positive attitudes than those in Sylhet. Younger, more educated, employed, and highly empowered women exhibit greater willingness to negotiate safer sex, whereas older age, rural residence, and even higher household wealth correlate with more reluctance – suggesting that economic gains alone do not ensure sexual autonomy. These findings call for targeted interventions: policymakers should bolster female education and empowerment initiatives (especially in rural and underperforming regions) and challenge patriarchal norms across all socio-economic groups. By addressing these disparities and strengthening women's autonomy, such efforts can enhance married women's negotiation power within marriage and ultimately improve safe-sex practices and reproductive health outcomes.

RECOMMENDATION

Educational Interventions: Implement targeted sexual and reproductive health education programs emphasizing women's rights and negotiation skills, particularly in rural areas and divisions with significantly lower positive attitudes (Sylhet, Barisal, Chittagong).

Empowerment and Employment Initiatives: Enhance employment opportunities and women's empowerment programs as pathways to improved negotiation capabilities and sexual autonomy, ensuring these

initiatives include robust sexual and reproductive health components.

Culturally Sensitive Community Programs:

Develop division-specific, culturally sensitive advocacy campaigns addressing negative gender norms and promoting supportive community environments for safer-sex negotiations.

Youth-Centric Strategies: Capitalize on younger women's greater openness to negotiation through early educational interventions targeting adolescents and young married couples.

Further Research: Conduct qualitative research to explore nuanced cultural attitudes toward safer-sex negotiation within economically affluent yet culturally conservative households, particularly in regions exhibiting lower attitudes despite higher socioeconomic status.

ETHICAL DECLARATION:

This study was exempted from ethical review by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (Certificate of Approval No. 074/68, Study Title No. 680047). The exemption complies with the Office for Human Research Protections (OHRP) Exempt Categories under 45 CFR part 46.101(b). The research was conducted following the approved proposal guidelines. Any amendments required prior submission to the committee for approval. Permission to access and utilize the 2017–2018 Bangladesh Demographic and Health Survey (BDHS) dataset was officially granted by the Demographic and Health Survey (DHS) program through its website (dhsprogram.org).

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DETERMINANTS OF HEAT-RELATED ILLNESS AMONG MYANMAR MIGRANT WORKERS IN MAE SOT DISTRICT, THAILAND

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ABSTRACT

Background: Climate change intensifies heatwaves and raises summer temperatures, leading to a global rise in heat-related illnesses (HRIs), which pose serious growing public health concern including higher mortality and reduced work capacity. In Thailand, rising temperatures have led to higher rates of occupational heat stroke, especially among vulnerable groups like outdoor workers and migrants, due to both their work and living conditions. Mae Sot District hosts approximately 81,000 Myanmar migrants, many of whom are employed in physically demanding outdoor sectors, placing them at heightened risk of heat-related health issues due to prolonged exposure.

Objective: To assess the prevalence of heat-related illness and to determine the association between heat-related illness and its determinants among Myanmar migrant workers in Mae Sot.

Methods: A cross-sectional study was conducted in June 2025 among 200 Myanmar migrant outdoor workers in Mae Sot District using snowball sampling. Data were collected through face-to-face interviews using expert-validated, and reliability-tested questionnaires (Cronbach's alpha). Chi-square tests assessed associations between independent variables and presence of heat-related illness.

Results: The prevalence of self-reported HRI was 55.5%. Significant associations were found with sex, alcohol consumption, duration of heat exposure, and attitude toward heat prevention. Females, non-alcohol drinkers, those exposed ≥ 5.4 hours/day, and participants with a positive attitude were more likely to report the symptoms. No significant associations were observed for age, underlying disease, job type, working hours, use of head protection, income, hydration practices, and knowledge levels.

Conclusions: Over half of the Myanmar migrant workers reported experiencing HRI. Female workers and those with longer heat exposure experienced a higher prevalence of symptoms, underscoring the need for gender-sensitive health interventions and measures to limit prolonged heat exposure. Surprisingly, non-drinkers reported more symptoms, suggesting further study to explore behavioral differences and better understanding the relationship between them. Additionally, the higher symptom prevalence among those with a positive attitude suggests a gap between awareness and practice. Thus, practical measures—like rest breaks, shaded areas, and promoting adaptive behaviors—are essential to reduce heat-related risks.

Key Words: Heat-Related Illness/ Occupational Heat Stress/ Heat Impacts/ Vulnerability Factors/ Myanmar Migrants

INTRODUCTION

Climate change is driving environmental and social challenges by increasing summer temperatures and intensifying the frequency of heatwaves, posing severe health risks worldwide (1). Heat-related illnesses (HRIs) are emerging as a significant public health concern, increasing mortality and widespread

socioeconomic consequences, such as reduced work capacity and productivity (2).

Prolonged heat exposure can cause a range of acute health effects, from mild symptoms to severe conditions. The most immediate risks of heat are physical; excessive water and salt loss through sweating can lead to heat exhaustion. Without treatment, heat exhaustion can escalate to heat stroke, a life-

threatening failure of the body's cooling system that is fatal in nearly two-thirds of cases during heatwaves (3).

Between 2011 and 2020, global surface temperatures rose by approximately 1.1°C compared to pre-industrial levels, with projections estimating increases up to 4.4°C by 2100 under high emissions scenarios (4). Thailand's temperatures have steadily increased, with 2024 being its hottest year in 74 years, reaching over 40°C with high humidity (5). This warming trend is expected to increase the incidence of heat-related illnesses in Thailand.

Extreme high-temperature events are the leading cause of weather-related deaths among all-natural disasters (6). From 2000 to 2019, studies showed around 489,000 heat-related deaths annually, with 45% occurring in Asia and 36% in Europe (2). According to the Ministry of Public Health (Thailand), annual rate of occupational heat stroke rate from 2022 to 2024 were 0.21, 0.45 and 0.64 per 100,000 population, respectively (7) and there were 61 deaths due to heat stroke in 2024 which is relatively high compared with 37 deaths in 2023 (8). These trends coincide with increasing temperatures in the region and signal an urgent need for preventive strategies. Under high-emission scenarios, Southeast Asia is expected to see an additional 200–300 heat-related deaths per 100,000 people annually between 2030 and 2079 (9).

While high temperatures can affect the entire population, they disproportionately impact vulnerable groups such as children, the elderly, people with chronic illnesses or disabilities, outdoor workers, those in poorly ventilated environments, the homeless, and individuals living in poverty or isolation (1). Studies reported high rates of heat-related symptoms among outdoor workers: 48% of sugarcane farmers in Thailand (10), 83.4% of rice farmers in Vietnam (11), and 77% of mining workers in Australia (12).

Thailand's economic growth has driven a demand for migrant labor, particularly from Myanmar, Cambodia, and Lao PDR, with 75% of migrants originating from Myanmar (13). As of July 2024, an estimated 4.1 million Myanmar migrants are living in Thailand, including 1.8 million in an irregular situation (14). According to the IOM report, approximately 81,000

Myanmar migrants are in Mae Sot, making it a significant area for migrant presence (15). Myanmar migrants work in various sectors including agriculture, construction, domestic work, fishing, garment factory, hospitality, manufacturing and seafood processing (13).

Myanmar migrant workers are especially vulnerable to occupational heat stress due to their physically demanding jobs, work environment, socio-economic vulnerability, limited access to heat prevention information due to language barriers, and fear of seeking healthcare due to precarious legal status. High temperatures also impair cognitive and physical performance, reduce productivity by up to 50% at temperatures above 34°C, and increase workplace accident risks (16).

While extreme heat affects many populations, marginalized and economically disadvantaged groups like Myanmar migrant outdoor workers in Thailand are disproportionately impacted and have limited ability to adapt. However, there is a significant research gap concerning heat-related illnesses in migrant labor populations. This study aims to address this gap by assessing the prevalence and determinants of heat-related illnesses among Myanmar migrants in Mae Sot District. The findings will provide information for guiding public health interventions, informing policy, and advancing academic understanding of climate-related challenges in border areas.

METHODOLOGY

Study Design

A cross-sectional study was conducted in Mae Sot District, Tak Province—a key hub for trade and migration between Thailand and Myanmar. Mae Sot has become home to thousands of Burmese migrants, especially after Myanmar's 2021 military takeover. As of 2023, Mae Sot had the highest number of Myanmar migrants at 81,000, with 93,070 new arrivals reported in Tak Province during July–August 2023 (15). The district has a tropical monsoon climate, with consistently high temperatures often reaching 40°C during the hottest months (17).

The study was conducted in four sub-districts, namely Phra That Pha Daeng, Mae Pa, Mae Sot and Mae Tao. 200 Myanmar outdoor migrant outdoor workers aged 18 years and above from these four districts were collected by using the snowball sampling method.

Participants who have lived in the Mae Sot district for less than six months and those who were unable to complete the interview are excluded from this study. The initial participants (seeds) were selected from diverse backgrounds, considering occupation type, age, gender, and geographic distribution to enhance the representativeness of the sample and mitigate selection bias. A questionnaire reliability test involving 30 participants was separately done in the Mae Ku sub-district, located in Mae Sot district. Cronbach's alpha values for knowledge and attitude were 0.82 and 0.84, respectively. Data were collected using an interview-administered questionnaire using the Enketo web form.

Research Instrument

A structured questionnaire was developed by adapting standard questionnaires from previous literature (10, 11, 18-20). The dependent variable was the presence of heat-related illness, defined by self-reported symptoms of heavy sweating and dizziness experienced in the past month. These are symptoms commonly experienced after heat exposure, according to the literature. Symptom frequency was recorded on a Likert scale ("never," "sometimes," "regularly- at least once per week"), with "sometimes" and "regularly" were grouped into one variable, denoted "ever". Participant reported "ever" having both heavy sweating and dizziness; they were defined as having heat-related illness in this study.

Independent variables were grouped by three components: sensitivity factors, work-related factors and adaptive capacity according to vulnerability theory (21). Sensitivity factors included sex, age, history of alcohol consumption and presence of any underlying diseases, with age categorized by the median and others measured as categorical variables. Occupational factors included outdoor job type, working hours, daily heat exposure duration, and use of head protection. Working hours and heat exposure were measured on ratio scales and categorized by median cutoffs, while use of head protection was self-reported as "always," "sometimes," or "never."

Adaptive capacity included monthly family income, hydration habits, knowledge and attitude levels. Monthly income was recorded as a ratio scale and dichotomized by the median value. Hydration habits were

assessed by daily fluid intake in liters and classified into 2 groups using a median cutoff. Knowledge was assessed through 16 true/false/not sure items, scored as 1 for correct and 0 for incorrect or unsure answers, covering knowledge about symptoms, vulnerable populations, risk behaviors, and preventive behaviors. Total scores were summed and classified into poor or high knowledge based on the mean cutoff score of 10. Attitudes were measured using 9 items on a five-point Likert scale, with total scores dichotomized at the median value of 36 into negative or positive attitudes.

Data Collection Procedures

The data collection was performed after the protocol was approved by the Mahidol University – Central Institutional Review Board (MUCIRB). The community leaders in selected sub-districts were informed of this study's purpose and detailed procedures, and the researcher sought permission to collect data. Four data collectors were recruited in this study. The study subjects were gathered during their spare time with the assistance of community leaders, and face-to-face interviews were conducted using an Enketo web form powered by Kobo Toolbox. We performed data collection in June 2025.

Statistical Analysis

200 participants were included in the data analysis, and IBM Statistical Package for Social Science (SPSS) version 26 was used to analyze the data. Descriptive analyses were employed to describe the characteristics of respondents. Additionally, Chi-square analysis was performed to examine the association between independent variables and the presence of heat symptoms. Variables with a p-value < 0.05 were considered statistically significant.

Ethical Considerations

Ethical approval for this study was obtained from the Mahidol University Central Institutional Review Board (MUCIRB) on June 10, 2025. The protocol number was MU-CIRB 2025/202.2204. The objectives of the study and confidentiality considerations were clearly stated on the first page of the questionnaire.

RESULTS

Table 1 presents the characteristics of the study participants. Among the participants,

67.5% were male and 32.5% were female. The mean age was 39 years (SD = 10.93; range: 19–61 years), with 48.5% were between the ages of 19 and 39, and the others were between 40 and 61. Regarding the health risk behavior, 26.5% reported alcohol consumption, while 73.5% did not. In terms of health status, 29.5% of participants had at least one pre-existing health condition, while 70.5% reported none.

Regarding work-related factors, the majority were construction workers (52.5%), followed by agricultural workers (30.5%) and street vendors (5%). The remaining participants were engaged in other occupations such as delivery, livestock processing, and various informal jobs. Among the participants, a large majority (87.5%) reported working 8 hours or more per day, with a median working time of 8 hours (range: 3–13 hours). Regarding daily heat exposure, 54.0% were exposed to outdoor heat for less than 5.4 hours, while 46.0% experienced heat exposure of 5.4 hours or more (mean = 5.4, SD = 1.93). Encouragingly, 85% of workers reported always using head protection.

In terms of adaptive capacity, 62.5% reported earning 8,000 THB or more per month, while 37.5% earned less than 8,000 THB. In terms of hydration habits, 70.5% reported drinking water three liters per day, while 29.5% drank water fewer than three liters daily. Regarding heat-related knowledge and attitude, 51.5% of respondents had a high level of knowledge (\geq median), and 67.0% had a high level of attitude toward heat-related illness prevention.

The prevalence rate of heat-related illness, including both heavy sweating and dizziness, was 55.5% among outdoor migrant workers, which means a little over half of the respondents reported experiencing heat-related symptoms. Table 2 shows the distribution of respondents by symptom type: 33% of participants always experience heavy sweating at least once per week, while 47.5% experience it sometimes, and 19.5% never do. For dizziness, only 11.5% always experience it weekly, but a majority of 52% sometimes feel dizzy, and 36.5% never experience dizziness.

Table 1 Characteristics of Respondents (n=200)

Components	Variables	Number	Percent (%)
Sensitivity Factors	Sex		
	Male	135	67.5
	Female	65	32.5
	Age (years)		
	<39	97	48.5
	\geq 39	103	51.5
	(Mean=39; S.D= 10.9; Min=19; Max=61)		
	Alcohol drinking		
	no	147	73.5
	yes	53	26.5
Pre-existing health conditions	no	141	70.5
	yes	59	29.5
Work-related factors	Type of Outdoor Job		
	Agriculture	61	30.5
	Construction	105	52.5
	Street Vendor	10	5.0
	Others (Delivery, livestock processing, and various informal jobs)	24	12.0
	Working hours		

	<8	25	12.5
	≥8	175	87.5
	(Median=8; QD=0; Min=3; Max=13)		
	Duration of heat exposure (hours per day)		
	<5.4	108	54.0
	≥5.4	92	46.0
	(Mean=5.4; SD=1.934; Min=2; Max=9)		
	Use of head protection at work		
	sometimes	30	15.0
	always	170	85.0
Adaptive capacity	Monthly income (THB)		
	<8000	75	37.5
	≥8000	125	62.5
	(Median=8000; QD=3000; Min=1500; Max=48000)		
	Hydration habits (liters per day)		
	<3	59	29.5
	≥3	141	70.5
	(Median=3; QD=1; Min=1; Max=8)		
	Level of knowledge		
	Poor (< Mean)	97	48.5
High (≥ Mean)	103	51.5	
	Level of Attitude		
	Negative (< Median)	66	33.0
	Positive (≥ Median)	134	67.0

Table 2 Percentage of respondents who suffered the heat-related illness (n=200)

Type of Symptoms	Always (at least one per wk), N (%)	Sometimes, N (%)	Never, N (%)
Heavy sweating	66 (33.0 %)	95 (47.5 %)	39 (19.5 %)
Dizziness	23 (11.5 %)	104 (52 %)	73 (36.5 %)

Table 3 Association between Sensitivity factors and heat-related illness (n=200)

Variables	Number	Presence of Symptoms, N (%)		P-value*
		No	Yes	
Sex				.000*
Male	135	74 (54.8%)	61 (45.2%)	
Female	65	15 (23.1%)	50 (76.9%)	
Age (years)				.740
<39	97	42 (43.3%)	55 (56.7%)	
≥39	103	47 (45.6%)	56 (54.4%)	
Alcohol drinking				.039*
no	147	59 (40.1%)	88 (59.9%)	
yes	53	30 (56.6%)	23 (43.4%)	
Pre-existing health conditions				.184
no	141	67 (47.5%)	74 (52.5%)	

yes	59	22 (37.3%)	37 (62.7%)
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Table 4 Association between Work-related factors and heat-related illness (n=200)

Variables	Number	Presence of Symptoms, N (%)		P-value*
		No	Yes	
Type of Outdoor Job				.248
Agriculture	61	21 (34.4%)	40 (65.6%)	
Construction	105	53 (50.5%)	52 (49.5%)	
Street Vendor	10	4 (40.0%)	6 (60.0%)	
Others	24	11 (45.8%)	13 (54.2%)	
Working hours				.076
<8	25	7 (28.0%)	18 (72.0%)	
>=8	175	82 (46.9%)	93 (53.1%)	
Duration of heat exposure				.000*
<5.4	108	62 (57.4%)	46 (42.6%)	
>=5.4	92	27 (29.3%)	65 (70.7%)	
Use of head protection at work				.796
sometimes	30	14 (46.7 %)	16 (53.3 %)	
always	170	75 (44.1 %)	95 (55.9 %)	

Table 5 Association between Adaptive Capacity and heat-related illness (N=200)

Variables	Number	Presence of Symptoms, N (%)		P-value*
		No	Yes	
Monthly income (THB)				.485
<8000	75	31 (41.3%)	44 (58.7%)	
>=8000	125	58 (46.4%)	67 (53.6%)	
Hydration habits (liters)				.695
<3	59	25 (42.4%)	34 (57.6%)	
>=3	141	64 (45.4%)	77 (54.6%)	
Level of knowledge				.052
Poor (< Median)	97	50 (51.5%)	47 (48.5%)	
High (≥ Median)	103	39 (37.9%)	64 (62.1%)	
Level of Attitude				.009*
Negative (< Median)	66	38 (57.6%)	28 (42.4%)	
Positive (≥ Median)	134	51 (38.1%)	83 (61.9%)	

*Chi-square test

Chi-square analysis indicated that sex, alcohol consumption, duration of heat exposure and level of knowledge were significant factors associated with the presence of heat-related illness. In contrast, no significant associations were found between sensitivity factors (age and pre-existing health conditions), work-related factors (type of outdoor job, working hours, use of head protection), adaptive capacity (income, hydration habits and level of knowledge), and presence of heat-related illness. The prevalence

of symptoms was significantly higher among female participants (76.9%) compared to males (45.2%) ($p < 0.001$) (Table 3). Regarding alcohol consumption, a significantly greater proportion of symptoms was found among those who did not consume alcohol (59.9%) compared to current drinkers (43.4%) ($p = 0.039$) (Table 3). Participants with longer durations of heat exposure (≥ 5.4 hours/day) reported a significantly higher rate of symptoms (70.7%) than those exposed for less than 5.4

hours (42.6%) ($p < 0.001$) (Table 4). Additionally, a significant association was

observed with attitude level; those with a high level of attitude toward heat illness prevention had a higher prevalence of symptoms (61.9%) compared to those with a negative attitude (42.4%) ($p = 0.009$) (Table 5).

DISCUSSION

This study identified a high prevalence of heat-related symptoms among Myanmar migrant workers in Mae Sot District, with over half of the respondents reporting heat-related illness (55.5%). These findings are consistent with previous studies among outdoor workers in Southeast Asia, where similar symptoms have been widely reported due to prolonged exposure to high temperatures with the prevalence rate of 48% of sugarcane farmers in Thailand (10), 83.4% of rice farmers in Vietnam (11). Moreover, this prevalence also aligns with findings from similar research among migrant workers in other low- and middle-income countries (LMICs). For instance, a study among seasonal and migrant farmworkers in Ethiopia found a high prevalence of heat-related illnesses (60.9%), indicating that such symptoms are common among migrant laborers exposed to extreme environmental conditions. Migrant workers from LMICs are particularly vulnerable due to several overlapping disadvantages, including poor living conditions, lack of access to passive or active cooling systems, and minimal social protection or training in occupational health (22). Additionally, studies comparing migrant workers in Qatar have shown that LMICs have significantly higher physiological heat strain than upper-middle-income or high-income countries—by 52% and 80%, respectively—due to higher workloads,

fewer rest breaks, and clothing practices (23). These findings support the current study's results, highlighting that heat-related symptoms are not only prevalent but also reflective of deeper structural inequalities and vulnerabilities among LMIC migrant labor populations.

In analyzing the determinants of heat-related illness, several significant associations were observed. Sex was a major factor, with females being more likely to report symptoms than males (76.9% vs. 45.2%, $p < 0.001$). This aligns with previous research in Thailand and Bangladesh (10, 24), which showed that women may be more vulnerable due to differences in physiological responses. Alcohol consumption was also significantly associated with symptom presence ($p = 0.039$). Respondents who consumed alcohol had a lower proportion of reported symptoms than non-drinkers, which contrasts with literature suggesting alcohol exacerbates dehydration and thermoregulatory impairment (25, 26). This finding may be due to other confounding factors, and further research is recommended to explore these potential explanations and better understand the relationship between alcohol consumption and heat-related health outcomes. Duration of heat exposure showed a strong association with symptom occurrence ($p < 0.001$). Workers exposed to ≥ 5.4 hours of heat per day had a significantly higher rate of symptoms (70.7%) compared to those with lower exposure (42.6%). This supports evidence from multiple studies across Thailand, Vietnam, and Australia indicating that prolonged outdoor exposure is a critical risk factor for heat stress and related health impacts (10, 12, 24).

Interestingly, attitude level was significantly associated with the presence of heat-related symptoms ($p = 0.009$), with those having more positive attitudes being more likely to report symptoms. This finding contrasts with the previous studies showing positive attitude toward heat-related illnesses (HRIs) is associated with a lower prevalence of these conditions, as it motivates individuals to adopt effective protective behaviors (19, 20). While this may seem counterintuitive—since a positive attitude is typically expected to promote protective behaviors—it could reflect increased recognition and reporting among more heat-aware individuals. Another possibility is reverse causality, where individuals who have previously experienced symptoms develop stronger concerns and thus report higher attitude scores. Additionally, the finding highlights that attitudes alone may not be sufficient to prevent heat-related illness without corresponding protective practices. Therefore, it is essential to strengthen the promotion of adaptive behaviors and implement practical workplace interventions—such as scheduled rest breaks, access to shaded or cooled rest areas, and monitoring of heat safety practices—to effectively reduce heat-related health risks among outdoor workers.

No significant associations were observed with age, income, hydration habits, pre-existing health conditions, type of outdoor job, working hours, and knowledge level. While previous studies have identified these factors as relevant, their effect may have been diminished due to homogeneity within the sample or other unmeasured confounders.

CONCLUSION AND RECOMMENDATIONS

In this study, slightly more than half of respondents (55.5%) reported having the heat-related illness. Chi square analysis revealed that prolonged exposure, gender, behavioral factors, and adaptive capacity—particularly in terms of attitude were strongly associated and play significant roles in symptom occurrence. Based on the high prevalence of heat-related symptoms and identified risk factors among Myanmar migrant workers in Mae Sot District, urgent measures are needed to reduce heat stress and its health impacts in this vulnerable population. Female workers and those with longer heat exposure experienced a higher prevalence of symptoms, underscoring the need for gender-sensitive health interventions and measures to limit prolonged heat exposure. Surprisingly, non-drinkers reported more symptoms, suggesting further study to explore behavioral differences and better understanding the relationship between them. Additionally, the higher symptom prevalence among those with a positive attitude suggests a gap between awareness and practice. Attitudes alone may not be sufficient to prevent heat-related illness without corresponding protective practices. Therefore, it is essential to strengthen the promotion of adaptive behaviors and implement practical workplace interventions—such as scheduled rest breaks, access to shaded or cooled rest areas, and monitoring of heat safety practices—to reduce heat-related risks. Further research is needed to assess the effectiveness of these interventions and better understand heat exposure risks in this population.

LIMITATIONS

Heat-related illness and other variables such as working hours, hydration habits, and adaptive practices were based on self-reported responses, which may be subject to recall bias. Some participants may have underreported or overreported symptoms or behaviors. Nevertheless, this limitation was somewhat minimized by using short recall periods and experienced interviewers. Moreover, the sample was limited to Myanmar migrant outdoor workers in Mae Sot District, which may affect the generalizability of the findings to other migrant populations or geographic areas.

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DEVELOPING THE THAI VERSION OF “SOCIAL CONNECTIVITY OF MOTHERS WITH PEOPLE IN THE COMMUNITY SCALE”

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ABSTRACT

Introduction: Becoming a parent is a crucial turning point in a woman's life and raising children to be socially and emotionally well-adjusted requires sufficient support from those around them. In Thailand, rapid urbanization and declining birth rates have raised concerns about maternal isolation and loneliness. To address these issues, there is a need for culturally appropriate tools to identify socially isolated mothers and connect them with support networks at an early stage.

Objective: This study aimed to adapt and revise the Thai version of the “Social Connectivity of Mothers with People in the Community Scale,” originally developed for Japanese mothers facing similar challenges.

Methodology: The Japanese version of the scale was translated into Thai by two different translation companies. The Thai version was then reverse translated by the original developers of the scale. Next, seven Thai women with parenting experience participated in a pilot test to revise the 17 items of the scale, making them easier to understand and reflecting the institutional and cultural aspects of parenting in Thailand. The survey asked about "items that were difficult to answer and their content" and "actual examples of mothers' connections with others in Thailand." This pilot test was conducted in April 2025.

Results: The ages of the pilot test participants were 30-39 (5 mothers) and 40-49 (2 mothers). Their parenting experience ranged from 4 to 15 years. Comments on the scale included "Please revise it to simpler Thai," "Please explain examples of local events," and "I did not understand the meaning of interacting with the community through my children." Additionally, it was noted that "individual household economic conditions and social status influence relationships within the community." Based on these results, the Thai-language version of the scale was revised to consist of 17 items while maintaining its original structure.

Conclusion: The adapted scale incorporates culturally and contextually relevant expressions aligned with Thailand's parenting systems. Further testing with a larger, population-based sample is recommended to evaluate its reliability and validity for broader application.

Keywords: Parenting, Mother, Isolation, Loneliness, Scale

INTRODUCTION

Becoming a parent marks a profound life transition, often accompanied by significant mental and physical strain (1, 2). Simultaneously, many mothers experience alterations in social networks, with loneliness affecting over one-third during pregnancy and postpartum (3). Maternal loneliness has been linked to postpartum depression, childrearing anxiety, reduced breastfeeding, and diminished maternal self-efficacy, all of which can impact children's early social and emotional development (4-6).

In the Asia-Pacific region, loneliness has emerged as a risk factor for child maltreatment and violence (7). Cultural norms in Thailand, such as acceptance of corporal punishment, encapsulated in the proverb "If you love a cow, tie it up; if you love a child, beat them", further complicate maternal roles (8, 9). Bangkok-based studies report that over 80 % of university students experienced physical or emotional punishment in childhood, with urban stress and weakened familial and community support cited as contributing factors (10). Moreover, loneliness in parenting and insular social networks are established risk factors for child abuse (11, 12).

Conversely, strong social connectivity has protective effects: it enhances maternal well-being, supports healthy child development, and helps prevent maltreatment (13, 14). Peer support from other mothers is particularly effective in reducing isolation and bolstering emotional resilience, especially among vulnerable groups such as teenage or single mothers and those struggling with breastfeeding (15-17).

However, modern social shifts, such as urban migration, nuclear family structures, and declining birth rates, have disrupted traditional support systems. Rural areas in Thailand still sustain some community-based support, but urban centers like Bangkok seldom do (18). Additionally, public childcare is limited: 62.1 % of children aged 0–2 is cared for at home, mostly by mothers or grandparents, leaving fewer opportunities for mothers to connect with peers during childrearing (19, 20).

Against this backdrop, the "Social Connectivity of Mothers with People in the Community Scale" was developed in Japan to measure the capacity of mothers to build supportive community connections through childrearing (21). Japan, like Thailand, is experiencing the effects of declining fertility and urbanization, and has already recognized maternal isolation and loneliness as significant public health issues. Thus, this scale represents a culturally informed response to real-world challenges, designed to identify socially at-risk mothers and guide preventive interventions.

Among various existing tools worldwide, few scales focus on mothers' social connectivity within their communities. Most available instruments assess social support (22) from specific sources (e.g., family or friends), parenting confidence (23), Loneliness (24), or risks such as child abuse (25). However, these tools often lack sensitivity to the broader community context or are unsuitable for general maternal populations. The Japanese "Social Connectivity of Mothers with People in the Community Scale" was selected because it uniquely captures both the structural and functional aspects of maternal connections within the community. Unlike

existing tools that primarily identify current problems or deficits, this scale measures mothers' interpersonal capacity, enabling the assessment of their potential risk for future social isolation and loneliness. This predictive orientation makes it a valuable tool for informing and guiding preventive interventions.

In Thailand, maternal isolation and loneliness remain under-investigated from a public-health standpoint. Yet, demographic trends, such as ultra-low fertility (26) and rapid urbanization, suggest that these issues may soon demand greater attention (27). Proactively adapting the Japanese scale to Thai cultural and social contexts can enable early detection of maternal isolation, offering a timely tool for community-based interventions as the problem emerges.

Therefore, this study aims to translate and culturally adapt the scale into Thai, ensuring relevance to Thai mothers lived experiences. The objective is to create a validated tool that promotes maternal well-being by detecting and addressing risks of social isolation in Thailand's evolving social landscape.

Original version of the scale

The "Social Connectivity of Mothers with People in the Community Scale" was originally developed for Japanese mothers raising young children (21). It comprises 17 items across four subscales: (1) Confidence in interacting with people, (2) Positive feelings toward social connectivity, (3) Interest in interacting with people, and (4) Kindness toward other parents and children. The scale has

demonstrated good internal consistency, with Cronbach's alpha coefficient of 0.84. A cutoff score of 30 points or below indicates a risk of loneliness, with a sensitivity of 0.92, making it highly effective for screening mothers at risk. However, due to its moderate specificity (0.50) and relatively high false-positive rate (28), the scale is recommended as a supplementary tool in public health settings rather than as a standalone diagnostic instrument.

METHODOLOGY

Translation of the scale into Thai

The scale developed by Honda, Kita (21) was translated into Thai by two separate translation companies specializing in professional translation services. Each company assigned two staff members to the task: one Thai native fluent in Japanese and one Japanese native fluent in Thai. All translators hold at least a bachelor's degree. Initially, the Thai translators produced the Thai version of the scale, which was subsequently reviewed by the Japanese translators. Through a process of mutual verification, the finalized Thai translations were delivered. Thereafter, the scale developer, first author, conducted a back-translation of the Thai versions into Japanese to verify semantic consistency with the original Japanese version.

Assessment of the Face Validity of the Thai Version of the Scale

A pilot test was conducted to examine the face validity of the developed Thai version of the scale. According to the COSMIN guidelines (29), a pilot study with seven participants from the target population should

be conducted during the translation process. In alignment with this recommendation, seven Thai women with childrearing experience were recruited to participate in the present study. Participants were selected using a snowball sampling method. Among them, two were employed at a Japanese company in Bangkok, and the remaining five were staff members at a hospital in Chiang Mai.

The participants were asked two main questions regarding the 17 items comprising the translated scale:

1. *“Do you think these questions are easy for mothers to answer? If there are any items or expressions that are difficult to understand, please specify them.”*

2. *“With respect to Thai mothers’ ‘connections with others,’ are there any aspects you consider important that are not covered by these 17 items?”*

In addition, demographic information about the participants was collected. The pilot study was conducted in April 2025.

Finalization of the Scale

According to Beaton, Bombardier (30), it is recommended that the finalization of a translated scale be conducted with input from subject matter experts. In the present study, based on the results of the pilot test, the draft Thai version of the scale was finalized through consultation with a researcher experienced in both quantitative and qualitative research.

RESULTS

Participant characteristics are presented in Table 1. The ages of the participants ranged from 30 to 39 years (five mothers) and 40 to 49 years (two mothers), with parenting experience spanning from 4 to 15 years.

Table 1 Demographic characteristics of participants (N=7)

ID	Mother	Age	Experience of parenting
A	Yes	30 - 39	4 y
B	Yes	30 - 39	7 y
C	Yes	40 - 49	15 y
D	Yes	40 - 49	14 y
E	Yes	30 - 39	-
F	Yes	30 - 39	-
G	Yes	30 - 39	-

Regarding the face validity of the scale, participants made several suggestions. Some noted that the language should be revised to simpler Thai, while others requested the inclusion of examples of local events. One participant mentioned difficulty in understanding the concept of interacting with the community through one’s children. Furthermore, one participant commented that,

since the Likert scale consisted of four response options, a middle (neutral) option should be added.

In response to the question concerning important elements related to Thai mothers’ connection with the community, two participant pointed out that individual household economic conditions and social status influence relationships within the

community.

Based on these findings, the Thai version of the scale was revised to consist of

17 items while maintaining the original structure (Table 2).

Table 2 Thai version of the “Social Connectivity of Mothers with People in the Community Scale”

No.	Items
1	ฉันสามารถสร้างความสัมพันธ์อันดีกับคนอื่นได้
2	ส่วนใหญ่ฉันจะเจอคนที่เข้ากันได้ ไม่ว่าจะอยู่ในสถานการณ์ใด
3	ส่วนใหญ่ ฉันจะเป็นฝ่ายเริ่มสนทนากับผู้อื่นก่อน
4	แม้จะได้พบเจอกับคนใหม่ๆ ฉันก็สามารถสนุกกับความสัมพันธ์แบบสบาย ๆ ในสถานการณ์นั้นได้
5	ถ้าเจอบทที่เข้ากันได้ ส่วนใหญ่ฉันจะเป็นฝ่ายเริ่มขอแลกเปลี่ยนข้อคิดเห็น
6	ผู้คนในละแวกบ้านของฉันใส่ใจฉันและลูก ๆ ของฉัน
7	ฉันคิดว่าย่านที่ฉันอยู่อาศัยนั้น มีสามารถแวดล้อมที่ปลอดภัยสำหรับการเลี้ยงดูลูก ๆ
8	เจ้าหน้าที่หน่วยงานของรัฐให้ความใส่ใจฉันและลูก ๆ ของฉัน
9	*หน่วยงานของรัฐ: ศูนย์สุขภาพ ศูนย์ช่วยเหลือการเลี้ยงบุตร สถานรับเลี้ยงเด็ก ฯลฯ
10	ฉันมีความสุขเวลาไปเยี่ยมบ้านพักอาศัย
11	เวลาฉันได้คุยกับคุณแม่คนอื่น ๆ ฉันรู้สึกเบาใจว่าการเลี้ยงลูกของฉัน “จริงๆแล้วก็คือเหมือนกัน”
12	การเลี้ยงลูกทำให้ฉันรู้สึกว่าคุณมีส่วนร่วมทำอะไรบางอย่างเพื่อชุมชน
13	ฉันอยากรู้จักและพูดคุยกับคนในชุมชนมากขึ้น โดยมีลูกเป็นตัวเชื่อมความสัมพันธ์
14	ฉันอยากเข้าร่วมกิจกรรมในชุมชนที่เกี่ยวข้องกับเด็กให้ได้มากที่สุดเท่าที่จะทำได้
15	ฉันสนใจในมาตรการของรัฐบาลที่เกี่ยวข้องกับการเลี้ยงดูบุตร
16	*มาตรการของรัฐบาล: หมายถึง บริการด้านการบริหารจัดการ เช่น การจัดตั้งศูนย์รับเลี้ยงเด็ก และเงินช่วยเหลือเลี้ยงดูบุตร
17	ฉันอยากมีน้ำใจกับผู้คนในชุมชนที่กำลังเลี้ยงดูลูกหลาน
18	ฉันอยากปฏิบัติต่อเด็กคนอื่นอย่างใจดี เช่นเดียวกับที่ฉันปฏิบัติต่อลูกของตัวเอง
19	ฉันอยากสอนเด็กคนอื่นให้รู้จัก “ความสำคัญของการปฏิบัติตามกฎระเบียบ” เช่นเดียวกับที่ฉันสอนลูกของตัวเอง

มาตราส่วนลิเคิร์ต: 0 ไม่เห็นด้วย, 1 ไม่ค่อยเห็นด้วย, 2 เห็นด้วย, 3 เห็นด้วยอย่างยิ่ง

DISCUSSION

This study successfully developed a draft Thai version of the “Social Connectivity of Mothers with People in the Community Scale,” which retained the original structure while incorporating culturally relevant language and concepts specific to the Thai parenting context. The face validity assessment provided valuable feedback that helped tailor the scale to better reflect the lived experiences of Thai mothers.

Participants’ comments highlighted

the importance of using simple language and including contextual examples such as local events and social institutions. These suggestions are consistent with previous findings emphasizing the role of culturally adapted materials in improving the accessibility and accuracy of psychosocial measurement tools (30).

The observation that economic conditions and social status influence community relationships echoes prior research in both Thai and Japanese contexts (12, 27, 31), suggesting that social

connectivity is shaped not only by personal dispositions but also by structural inequalities.

In Thailand, where nuclear family structures are increasingly common and public childcare remains limited, mothers may rely more heavily on informal networks. The revised items, such as those focusing on kindness to other children or participation in community activities via one's child, reflect these social dynamics and values rooted in collectivist norms.

Moreover, the mention of government services and community safety aligns with public health goals in Thailand, highlighting the intersection between individual connectivity and systemic support structures.

A major strength of this study lies in its adherence to established cross-cultural adaptation procedures, including both forward and backward translation and user-based feedback. However, this pilot study involved only seven participants, which may limit the generalizability of the findings.

CONCLUSION

The drafting of a Thai version of the scale marks a significant step toward identifying socially isolated mothers in Thailand and facilitating early intervention through community-based approaches.

RECOMMENDATION

Future studies should focus on psychometric testing with a larger and more diverse sample of mothers with children up to two years old, as this is the target population for the scale, to examine its construct validity, internal consistency, and reliability. Longitudinal studies may also help to explore whether improvements in social connectivity, as measured by the scale, are associated with reductions in maternal isolation and child maltreatment risk.

ETHICAL DECLARATION

This project has been approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (COA. No. 200/68).

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PPORT: UNDERSTANDING TELEMENTAL HEALTH ACCEPTANCE IN YANGON, MYANMAR

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ABSTRACT

Introduction: In Myanmar, mental health has deteriorated sharply following the 2021 military coup, with political unrest, economic crisis, and displacement, intensifying psychological distress. Despite growing needs, access to mental health services remains limited. Telemental health (TMH) services offer a promising solution by extending access. However, little is known about the acceptance of TMH among Myanmar people.

Objectives: To examine the associations of sociodemographic characteristics, technological factors, and the level of acceptance of TMH among adults in Yangon Region, Myanmar.

Methodology: A cross-sectional descriptive study was conducted among 445 adults residing in Yangon Region. A self-administered online questionnaire assessed sociodemographic characteristics, technological factors, and acceptance of TMH. Descriptive statistics summarized distributions of variables, and multivariate logistic regression analyses identified factors significantly associated with the acceptance of TMH.

Results: Chi-square analysis showed significant associations between TMH acceptance and age, gender, marital status, educational level, in-person mental health consultation history, accessibility to mental health services, privacy during TMH usage, internet connectivity, technology confidence, and privacy & confidentiality concerns ($p \leq 0.05$). In multivariate analysis, higher TMH acceptance was predicted by being female (AOR = 16.77; 95% CI: 8.21–34.26; $p < 0.001$) and having a college or higher education (AOR = 3.15; 95% CI: 1.57–6.31; $p = 0.001$). Previous in-person mental health consultation (AOR = 7.75; 95% CI: 3.71–16.15; $p < 0.001$) and good internet connectivity (AOR = 2.19; 95% CI: 1.20–3.99; $p = 0.01$) were also significant positive predictors. In contrast, being single (AOR = 0.44; 95% CI: 0.22–0.87; $p = 0.02$) and having high privacy and confidentiality concerns (AOR = 0.54; 95% CI: 0.29–0.98; $p = 0.04$) negatively predicted TMH acceptance. Although the overall p-value for age was borderline ($p = 0.05$), younger age groups 18 to 28 (AOR = 3.27; 95% CI: 1.23–8.70; $p = 0.02$) and 29 to 44 (AOR = 2.81; 95% CI: 1.12–7.03; $p = 0.03$) were significant predictors compared to those aged 45 and above.

Conclusion: This study highlights that TMH acceptance is significantly shaped by sociodemographic and technological factors. Improving TMH acceptance requires expanding internet access, enhancing privacy protections, and promoting digital literacy among older adults and lower-educated groups. Service providers should also ensure user-friendly platforms, offer support, and reduce stigma, especially among men. Integrating culturally sensitive approaches, such as tailoring content to reflect the values, beliefs, and norms of diverse communities and integrating TMH with in-person care, may further support engagement and adoption.

Keywords: Telemental health, Acceptance, Technological factors, Myanmar

INTRODUCTION

Mental health is a fundamental component of overall well-being, influenced by a complex interaction of biological, psychological, and social factors (1). Globally, one in eight people lives with a mental disorder (2). The mental health crisis is particularly acute in Myanmar, where ongoing political and economic turmoil has deepened the population's mental health vulnerabilities. Since the 2021 military coup, the country has been grappling with widespread violence, internal displacement, economic hardship, rising crime, and forced conscription. These conditions have created a pervasive atmosphere of fear, trauma, and psychological distress across the country. Additionally, the mental health infrastructure has been severely disrupted, with the harassment and arrest of healthcare workers further weakening an already fragile system (3).

Despite the growing burden, access to mental health care in Myanmar remains extremely limited. With only two psychiatric hospitals, in Yangon and Mandalay regions, most rural areas depend on under-resourced primary health centers (4). The healthcare budget for mental health is less than 1%, making it nearly impossible to meet the rising demand (4).

To address these limitations, Telemental Health (TMH) has emerged as a potential solution. TMH uses communication technologies, including videoconferencing, mobile apps, websites, and text messaging, to deliver mental health services remotely (5). During the COVID-19 pandemic, TMH adoption surged globally, and the World Health Organization now recommends it as part of national public health emergency responses, stressing the importance of equitable access (6). Myanmar has also begun to embrace TMH as a viable solution to bridge the mental health treatment gap. The Ministry of Health of the National Unity Government has launched telehealth programs, and other TMH services have arisen, offering free or low-cost psychiatric consultations and therapy services (7).

However, the success of client-centered innovations like telemental health (TMH) depends on user acceptance and understanding of potential barriers. As public acceptance increases, so does the likelihood of service uptake

(8). Therefore, acceptability plays a central role in the implementation and evaluation of healthcare interventions (9). While international research suggests that sociodemographic characteristics such as age, gender, education, and income may influence TMH acceptance, these associations remain underexplored in Southeast Asian contexts, particularly in Myanmar.

Women are more likely to accept and feel comfortable with TMH, citing convenience and accessibility as key benefits (10). Their higher rates of help-seeking behavior also contribute to greater TMH use (11). Married individuals show a 14% increase in TMH usage, potentially due to greater social support (12).

Higher education levels are positively associated with telehealth acceptance, likely due to greater awareness of its benefits, reduced stigma, and improved digital literacy (8). Educated individuals are also more likely to have employment, internet access, and health coverage, all of which facilitate telehealth use (13). Conversely, lower education correlates with concerns over privacy and a lack of in-person interaction (14).

Although older adults generally have more mental health visits (15), they use TMH less frequently due to digital inexperience, disabilities, and access issues (11). Barriers are especially prominent among older adults and low-income groups (16). Higher income is linked to more successful telehealth use (17).

The presence of a regular care provider encourages telehealth use (14), but privacy remains a concern, especially in overcrowded households or environments lacking private space (18). TMH enhances access by overcoming geographic and logistical barriers and may reduce stigma (19). Patients with prior mental health care experience, whether online or in-person, tend to find TMH acceptable and effective (18), often perceiving little difference between the two formats.

In addition to sociodemographic characteristics, other key factors have been shown to influence the acceptance of TMH. Privacy concerns and trust in the confidentiality of digital platforms significantly affect users' willingness to engage in telehealth, particularly in contexts where mental health stigma is high (20).

Reliable internet connectivity also plays a crucial role, as it facilitates stable communication and uninterrupted consultations; conversely, poor or inconsistent access to broadband can become a major barrier to utilization (21). Furthermore, individuals who are more confident using technology are more likely to accept TMH, while technology-related anxiety often discourages engagement (22).

Understanding the factors influencing TMH acceptance is essential for health administrators to improve service quality, promote equity, and provide cost-effective mental health care to meet Myanmar's growing needs. Information on user acceptance and its determinants is critical for developing consumer-oriented TMH policies.

Thus, this study aims to examine the associations between sociodemographic characteristics, technological factors, and the level of acceptance of TMH services among adults in Yangon Region, Myanmar.

METHODOLOGY

Study Design

This study employed a cross-sectional design to capture data on sociodemographic and technological factors associated with the use of telemental health (TMH) services. Data were collected at a single point in time during June 2025, providing a snapshot of the population's perspectives.

Study Area and Population

The study was conducted in Yangon Region, one of Myanmar's largest and most economically significant areas, characterized by a diverse population with varied socioeconomic and demographic backgrounds. The study population included adults aged 18 years and older who had resided in Yangon Region and had used TMH services. Participants were eligible if they were aged 18 or older, had lived in Yangon Region for at least six months, and had used TMH services at least once. Individuals were excluded if they were professionals or volunteers currently or previously involved in mental health services, or if they had cognitive impairments that could affect memory, comprehension, or decision-making abilities.

Sample Size

Using Yamane's formula, the required sample size was calculated to be 400. After adjusting for a 10% non-response rate, the final sample size was set at 445. Following the application of inclusion and exclusion criteria, all 445 responses were included in the final analysis. Participants were recruited using convenience sampling via online platforms, including Facebook, Messenger, Viber, and Telegram.

Measurement Tool

Data were collected using a self-administered online questionnaire developed in Google Forms. The questionnaire was divided into four main sections: screening questions, sociodemographic characteristics, technological factors, and acceptance of TMH services. The sociodemographic section consisted of ten items designed to capture participants' background characteristics. These included age, gender, level of education, employment status, household income, marital status, and living arrangement. In addition, this section gathered information regarding participants' privacy during TMH usage, history of in-person mental health consultations, and accessibility to mental health services.

Technological factors were assessed using three components. First, internet connectivity was measured using four items developed by the research team and rated on a five-point Likert scale ranging from 0 to 4. A median score was calculated to classify participants into low (score < 9) and high (score \geq 9) connectivity groups. Second, technology confidence was assessed using six items adapted from existing literature, also rated on a five-point Likert scale. Participants were categorized as having low (score < 18) or high (score \geq 18) levels of technology confidence based on the median. Third, privacy and confidentiality concerns were evaluated using four items created by the researchers, measured on the same Likert scale. Total scores ranged from 0 to 20, with higher scores indicating greater concern. Based on the median, participants were classified into low (< 10) and high (\geq 10) concern groups.

Acceptance of TMH services was measured using the Digital Health Acceptability Questionnaire, which is grounded in the

Theoretical Framework of Acceptability. This instrument included ten items, each rated on a five-point Likert scale (0–4), yielding a total possible score between 0 and 40. The median score was used to categorize participants into groups with low (score < 29) or high (score ≥ 29) acceptance of TMH.

The questionnaire's content validity was reviewed by three experts from the College of Public Health Sciences, Chulalongkorn University, resulting in a high IOC score of 0.95. It was then translated into Myanmar language and reviewed by a Burmese public health expert for cultural appropriateness. A pilot test with 30 Yangon residents was conducted to assess clarity and reliability. Cronbach's alpha scores indicated good internal consistency: 0.74 for Internet Connectivity, 0.93 for Technology Confidence, 0.82 for Privacy Concerns, and 0.83 for TMH Acceptance.

Data Collection

The survey was distributed via social media posts, community-focused groups, and TMH networks. Posts included eligibility criteria, confidentiality statements, a survey link, and contact information. Data collection lasted four weeks in June 2025. Weekly response rates were monitored, and mobile top-up lucky draws were offered to boost the engagement. To prevent duplicates, participants provided their phone numbers, which were used only for verification. Survey data were automatically recorded in Google Forms and exported for analysis.

Data Analysis

Data were entered into Excel, cleaned, and analyzed using SPSS. Descriptive statistics summarized sociodemographic and technological variables by providing frequencies and percentages. Bivariate and multivariate analyses were conducted to explore associations. The chi-square test was first used to examine the relationship between independent variables and TMH acceptance. Variables found to be significant in the bivariate analysis were further examined using logistic regression to determine their effect on the level of TMH acceptance. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported, and a p-value of < 0.05 was considered statistically significant.

RESULTS

Table 1 presents the sociodemographic characteristics of the 445 participants from the Yangon Region of Myanmar. Most participants were aged 18–44 (80.4%), and over half were female (57.1%). Around 59.1% held a college degree, and 62.7% were employed. The most common monthly household income range was 250,000–499,999 MMK (27.4%). A majority were single (60%) and lived with family (79.8%). Regarding digital privacy, 79.3% reported having a private space for using TMH services. However, only 34.8% had a history of in-person mental health consultations. When asked about access to mental health services, half (50.9%) either disagreed or remained neutral.

Table 1 Sociodemographic characteristics of participants (N=445)

Characteristics	Frequency (n)	Percent (%)
Age (years)		
18 - 28	162	36.4
29 - 44	196	44
≥ 45	87	19.6
Gender		
Male	148	33.3
Female	254	57.1
Others (LGBTQ)	43	9.7
Education		
Secondary School	14	3.1

Characteristics	Frequency (n)	Percent (%)
High School	87	19.6
College	263	59.1
Postgraduate	81	18.2
Employment status		
Unemployed	34	7.6
Retired	5	1.1
Dependent	54	12.1
Student	73	16.4
Employed	279	62.7
Average household income		
Less than 250,000 MMK per month	72	16.2
250,000 to 499,999 MMK per month	122	27.4
500,000 to 999,999 MMK per month	104	23.4
1,000,000 to 1,499,999 MMK per month	51	11.5
1,500,000 to 1,999,999 MMK per month	25	5.6
2,000,000 MMK per month and above	71	16
Marital status		
Single	267	60
Married	149	33.5
Divorced/ Separated	23	5.2
Widowed	6	1.3
Living arrangement		
Living with family member(s) or caregiver(s)	355	79.8
Living with or friend(s) or roommate(s)	42	9.4
Living alone	48	10.8
Privacy during TMH usage		
Yes	353	79.3
No	44	9.9
In-person Mental Health Consultation History		
Yes	155	34.8
No	290	65.2
Accessibility to Mental Care Services		
Strongly Disagree	21	4.7
Disagree	95	21.3
Neutral	111	24.9
Agree	190	42.7
Strongly Agree	28	6.3

Table 2 presents the classification of participants based on internet connectivity, technology confidence, and privacy and confidentiality concerns, each divided into low and high levels. Just over half of the participants

(56.9%) reported having high internet connectivity, and the majority (62.7%) expressed high technology confidence. Regarding privacy and confidentiality concerns, most participants (58.9%) indicated high levels of concern.

Table 2 Technological Factors (N=445)

Variables	Frequency (n)	Percent (%)
Internet Connectivity		
Low internet connectivity (score <9)	192	43.1
High internet connectivity (score ≥9)	253	56.9
Technology Confidence		
Low confidence (score <18)	166	37.3
High confidence (score ≥18)	279	62.7
Privacy & Confidentiality concerns		
Low concern (score <10)	183	41.1
High concern (score ≥10)	262	58.9

Table 3 summarizes the acceptance levels of TMH, divided into low and high levels based on the median score. Approximately half of

the participants (50.7%) demonstrated a high level of acceptance toward TMH.

Table 3 Acceptance of Telemental Health (TMH) (N=445)

Acceptance of TMH	Frequency (n)	Percent (%)
Low acceptance (score <29)	219	49.2
High acceptance (score ≥29)	226	50.7

Table 4 presents the bivariate analysis between sociodemographic characteristics, technological factors, and the level of TMH acceptance. Age was significantly associated with TMH acceptance ($p = 0.007$), with a higher proportion of participants aged 29 to 44 reporting high acceptance compared to those aged 45 and above. Gender was also significantly associated with TMH acceptance ($p < 0.001$), with a higher proportion of females reporting high acceptance compared to males and LGBTQ identities. Educational level had a strong association ($p < 0.001$), as participants with a college education and above were more likely to report high TMH acceptance. Marital status was significantly related to acceptance ($p = 0.029$), with single

participants reporting higher levels of acceptance than married individuals. Participants who reported having privacy during TMH usage were significantly more likely to accept TMH ($p = 0.01$), as were those with previous in-person mental health consultation experience ($p = 0.01$). Perceived accessibility to mental health services was significantly related to acceptance ($p < 0.001$), with those who found services less accessible being more accepting of TMH. Technological factors also showed significant relationships. Participants with good internet connectivity ($p < 0.001$), high confidence in using technology ($p < 0.001$), and lower privacy and confidentiality concerns ($p < 0.001$) reported higher TMH acceptance.

Table 4 Bivariate Analysis between Sociodemographic Characteristics, Technological Factors, and Acceptance of TMH (N=445)

Variables	Levels of TMH Acceptance				p-value
	Low		High		
	n	%	n	%	
Age (years)					0.007*
18 - 28	73	33.3	89	39.4	

Variables	Levels of TMH Acceptance				p-value
	Low		High		
	n	%	n	%	
29 - 44	90	41.1	106	46.9	
≥ 45	56	25.6	31	13.7	
Gender					<0.001*
Male	128	58.4	20	8.8	
Female	64	29.2	190	84.1	
Others (LGBTQ)	27	12.3	16	7.1	
Educational level					<0.001*
High School and lower	72	32.9	29	12.8	
College and above	147	67.1	197	87.2	
Employment status					0.563
Unemployed	18	8.2	16	7.1	
Not in labor force (Student, Dependent, Retired)	59	26.9	71	31.4	
Employed	142	64.8	139	61.5	
Household income					0.226
Less than 500,000 MMK per month	109	49.8	102	45.1	
500,000 to 1,499,999 MMK per month	78	35.6	77	34.1	
1,500,000 MMK per month and above	32	14.6	47	20.8	
Marital status					0.029*
Single	145	66.2	122	54	
Married	61	27.9	88	38.9	
Divorced/ Separated/ Widowed	13	5.9	16	7.1	
Living arrangement					0.186
Living with family member(s) or caregiver(s)	172	78.5	183	81	
Living with friend(s) or roommates(s)	26	11.9	16	7.1	
Living alone	21	9.6	27	11.9	
Privacy during TMH usage					0.01*
Yes	168	84.8	185	93	
No	30	15.2	14	7	
In-person mental health consultation history					0.01*
Yes	29	13.2	126	55.8	
No	190	86.8	100	44.2	
Accessibility to mental health services					<0.001*
Easily accessible (Strongly agree and agree responses)	142	64.8	85	37.6	
Not easily accessible (Strongly disagree, disagree, neutral)	77	35.2	141	62.4	
Internet connectivity					<0.001*
Low internet connectivity	129	58.9	63	27.9	
High internet connectivity	90	41.1	163	72.1	
Technology confidence					<0.001*
Low confidence	105	47.9	61	27	

Variables	Levels of TMH Acceptance				p-value
	Low		High		
	n	%	n	%	
High confidence	114	52.1	165	73	<0.001*
Privacy & confidentiality concerns					
Low concern	63	28.8	120	53.1	
High concern	156	71.2	106	46.9	

*p-value <0.05 means statistically significant

Table 5 presents the binary logistic regression analysis of the independent variables related to the level of acceptance of TMH. Several variables were found to be significant predictors of high TMH acceptance. Age showed a borderline statistically significant association with TMH acceptance ($p = 0.05$). Participants aged 18 to 28 and 29 to 44 were 3.27 and 2.81 times more likely to accept TMH, respectively, compared to those aged 45 and above (AOR = 3.27, 95% CI: 1.23–8.70, $p = 0.02$; AOR = 2.81, 95% CI: 1.12–7.03, $p = 0.03$). Gender also had a strong influence, with females being 16.77 times more likely to accept TMH than males (AOR = 16.77, 95% CI: 8.21–34.26, $p < 0.001$). Regarding marital status, single participants were less likely to accept TMH than married participants (AOR = 0.44, 95% CI: 0.22–0.87, p

= 0.02). Education level was another significant factor, as participants with a college degree or higher were more likely to accept TMH than those with a high school education or below (AOR = 3.15, 95% CI: 1.57–6.31, $p = 0.001$). Participants with a history of in-person mental health consultation showed significantly greater acceptance of TMH (AOR = 7.75, 95% CI: 3.71–16.15, $p < 0.001$). Technological factors also played a role. Those with good internet connectivity were 2.19 times more likely to accept TMH than those with poor connectivity (AOR = 2.19, 95% CI: 1.20–3.99, $p = 0.01$). Conversely, high concerns about privacy and confidentiality reduced the likelihood of TMH acceptance by 46% compared to those with low concerns (AOR = 0.54, 95% CI: 0.29–0.98, $p = 0.04$).

Table 5 Multivariate Analysis between Sociodemographic Characteristics, Technological Factors, and Acceptance of TMH (N=445)

Variables	High Level of TMH Acceptance			
	AOR	97% CI		p-value
		Lower	Upper	
Age (years) [ref - 45 years and above]				0.05
18 to 28	3.27	1.23	8.70	0.02*
29 to 44	2.81	1.12	7.03	0.03*
Gender [ref - Male]				<0.001*
Female	16.77	8.21	34.26	<0.001*
Other (LGBTQ)	1.82	0.60	5.57	0.29
Marital status [ref – Married]				0.06*
Single	0.44	0.22	0.87	0.02*
Divorced/ Separated/ Widowed	0.74	0.23	2.38	0.61
Educational level [ref - High school and below]				
College and above	3.15	1.57	6.31	0.001*
Privacy during TMH usage [ref - No]				
Yes	1.61	0.59	4.44	0.36
In-person mental health consultation history [ref – No]				

Variables	High Level of TMH Acceptance			
	AOR	97% CI		p-value
		Lower	Upper	
Yes	7.75	3.71	16.15	<0.001*
Accessibility to mental health services [ref - Easily accessible]				
Not easily accessible	1.69	0.93	3.05	0.09
Internet connectivity [ref- Poor]				
High Internet Connectivity	2.19	1.20	3.99	0.01*
Technology confidence [ref – Low]				
High Technology Confidence	1.19	0.65	2.17	0.58
Privacy & Confidentiality concerns [ref – Poor]				
High Privacy & Confidentiality Concerns	0.54	0.29	0.98	0.04*

n = number of participants, AOR = adjusted odd ratio, 95% CI = 95% confidence interval, *p-value <0.05 means statistically significant

DISCUSSION

This study aimed to examine the relationship between sociodemographic characteristics, technological factors, and the level of acceptance of TMH services among adults in Yangon Region, Myanmar. Based on data from 445 participants, approximately half (51%) reported a high level of TMH acceptance. The findings indicate that younger age (particularly 18–28 and 29–44), being female, higher education, a history of mental health consultation, and good internet access were all significant positive predictors of TMH acceptance. In contrast, being single and concerns around privacy and confidentiality negatively influenced acceptance.

Age was a significant predictor, with participants aged 18–28 and 29–44 being more likely to accept TMH compared to those aged 45 and above. This finding aligns with previous research indicating that younger adults are more frequent TMH users than older individuals aged 65 and above (11). Younger people are generally more familiar with digital platforms, making them more comfortable using virtual mental health services. In contrast, older adults may face digital barriers, such as technology confidence and fear about using devices (23), and may also have more negative attitudes toward help-seeking behavior (24).

Gender also played a significant role. Female participants were much more likely to accept TMH than their male counterparts. This could be because women tend to value the

convenience and flexibility of telehealth, which supports their multiple roles at work and home (10). Additionally, women are more likely to seek mental health support than men (11). Masculinity norms often discourage men from acknowledging emotional or psychological struggles. Some avoid seeking help as they do not want to burden others or admit vulnerability (25).

Educational attainment had a strong influence on TMH acceptance. Participants with college-level education or higher were significantly more likely to accept TMH. Previous research supports this, indicating that individuals with higher education levels are more informed about healthcare options and may perceive telehealth as a flexible and efficient service (8). Moreover, higher education often correlates with reduced stigma about mental illness and more proactive health behaviors (26). In contrast, people with lower education levels may have greater concerns about the lack of face-to-face interaction or privacy in virtual care (14).

Having prior experience with mental health consultations was another important predictor. This study found that individuals with a history of in-person mental health visits were more likely to accept TMH services. This may be due to a belief that remote and in-person consultations are equally effective (18). Moreover, patients who had previously received in-person support and were later assessed remotely by psychiatrists reported confidence in the clinicians' expertise, despite the consultation being via videoconference (27).

Internet connectivity was also a crucial factor. Participants with good internet access were significantly more likely to accept TMH. A stable internet connection allows smooth communication and data exchange, both of which are essential for quality teleconsultations (28). Prior studies have found similar results, where patients with reliable internet were more open to telehealth compared to those living in areas with poor broadband coverage (29). Limited connectivity can disrupt video quality and communication, negatively impacting the therapeutic experience (21, 30).

Interestingly, marital status also influenced TMH acceptance. While a previous cross-sectional study found no association between marital status and telehealth use (31), this study found that being single significantly reduced TMH acceptance. This may reflect delayed help-seeking behaviors in single individuals, possibly due to a lack of emotional support from a partner (32), probably due to a lack of support from a significant other. Other research supports this, with married adults showing 14% higher odds of using telehealth services than singles (33).

Lastly, concerns over privacy and confidentiality were significant barriers to TMH acceptance. Many users worry that their personal information might not be protected during virtual consultations (34). These fears can reduce engagement and concentration during sessions (30). Consistent with earlier findings, this study showed that participants with high privacy concerns were less likely to accept TMH. However, previous studies suggest that when users are assured that their data is secure, their confidence in telehealth increases (35).

CONCLUSION

In this study, several key factors were found to significantly influence the acceptance of TMH services. Younger adults (particularly 18–44 years), females, individuals with higher education, those with prior mental health consultation experience, and people with stable internet connectivity were more likely to accept TMH. Conversely, being single and concerns about privacy and confidentiality were significant barriers that reduced acceptance. These findings

emphasize how sociodemographic and technological factors affect TMH acceptance.

RECOMMENDATION

To improve acceptance, policymakers should prioritize expanding reliable broadband infrastructure to improve internet access and enforce robust data privacy regulations to ease user concerns. Clear communication about confidentiality protections is vital to build user trust. Digital literacy programs should be offered in communities, especially for older adults and those with lower educational attainment, to build confidence in using TMH platforms. Service providers need to offer user-friendly platforms, technical support, and transparent privacy policies. Culturally sensitive content and flexible scheduling may increase accessibility for women and LGBTQ populations. For men, tailored education is important to reduce stigma and promote mental health awareness. Integrating TMH with in-person care could facilitate smoother transitions and support sustained engagement with mental health services.

We would like to recommend conducting in-depth qualitative studies to explore the underlying reasons behind acceptance or resistance to TMH. We would also like to suggest conducting studies in other regions of Myanmar to compare acceptance levels and influencing factors across different areas and populations. Future research should include other age groups to capture a broader range of perspectives on TMH services. Additionally, combining online and offline recruitment strategies would help reach individuals with limited internet access or digital literacy.

LIMITATIONS

First, the cross-sectional study design only captures data at one point in time and therefore limits cause-and-effect relationships. There is also a risk of recall bias, as participants may not accurately remember or report their past behaviors and experiences. Second, a self-administered online questionnaire may lead to response bias if participants misinterpret the questions. Additionally, relying on an online survey may exclude individuals with limited internet access or low digital literacy, which could affect the diversity of the sample. Since the

study was conducted only in the Yangon Region, the findings may not be fully generalizable to the wider population of Myanmar.

STRENGTHS

This cross-sectional study provided a snapshot of the current acceptance of TMH services in Yangon. The self-administered questionnaire allowed participants to respond privately and anonymously, reducing social desirability bias and encouraging honest answers on sensitive topics such as mental health. The findings offer valuable insights for policymakers to understand current acceptance levels and guide strategies and policies to improve TMH adoption. This study also serves as a foundation for future longitudinal or qualitative research at TMH in Myanmar.

ETHICAL DECLARATION

Ethical approval was obtained from the Research Ethics Review Committee for Research involving Human Research Participants, Group I, Chulalongkorn University (COA No. 164/ 68).

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DIGITAL HEALTH LITERACY OF MIDDLE-AGED WOMEN IN URBAN YANGON, MYANMAR: BRIDGING ACCESS AND ACTION

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ABSTRACT

Introduction: Middle-aged women (35-64) are central health decision-makers within families, yet remain underrepresented in health research. As urban digital infrastructure expands, they increasingly turn to online platforms for health information. However, access alone does not guarantee effective use. Digital health literacy (DHL), the ability to find, evaluate, and apply online health information, is critical for informed decision-making. In Yangon, where social and technological transitions coexist, middle-aged women continue to face challenges that hinder their ability to fully benefit from digital health resources. Despite their pivotal role, limited research has examined their DHL status or the key factors that shape this capacity.

Objective: To assess the level of digital health literacy and identify associated factors among middle-aged women residing in urban Yangon, Myanmar.

Methodology: A cross-sectional study was conducted among 444 middle-aged women residing in urban Yangon. A structured online questionnaire assessed sociodemographic characteristics, sociocultural attitudes, internet-related factors, and digital health literacy. DHL was measured using a validated instrument across three domains: information acquisition and evaluation, interaction, and application. Total scores were dichotomized at the median into high and low levels. Descriptive statistics were reported, and Chi-square tests were performed to examine associations between DHL and selected variables. Statistical significance level of $p < 0.05$ was applied.

Results: While 98% of participants reported daily internet use, only 52% demonstrated high digital health literacy, indicating inadequate capacity to use digital health information effectively in nearly half of the participants. High DHL was significantly associated with higher education ($p < 0.001$), greater income ($p = 0.002$), better perceived health status ($p = 0.021$), and favourable attitudes toward online health platforms ($p = 0.001$). In contrast, low DHL was strongly associated with language barriers ($p = 0.004$), cultural conservatism ($p = 0.003$), and poor digital literacy ($p < 0.001$).

Conclusion: Despite widespread internet use, middle-aged women in Yangon demonstrate uneven digital health literacy. Access alone does not ensure the ability to seek, understand, evaluate, and apply online health information effectively. This study highlights that DHL is influenced by the interplay of education, income, language proficiency, culture, and digital capabilities. Bridging this gap requires culturally and linguistically tailored strategies that strengthen foundational digital skills and promote effective engagement with digital health resources.

Keywords: digital health literacy, middle-aged women, urban health, Myanmar

INTRODUCTION

Digital health has fundamentally reshaped how people access, interpret, and apply health information. Globally, individuals increasingly rely on the internet to seek medical

advice, track symptoms, manage chronic conditions, and make informed decisions about their health (1). However, having access to digital platforms does not automatically translate to

effective health engagement. This distinction has brought digital health literacy (DHL), defined as the ability to seek, understand, evaluate, and apply online health information (2), into sharp focus as a key determinant of health outcomes in the digital age.

In low- and middle-income countries (LMICs), bridging the digital divide remains a persistent challenge. While infrastructure and mobile connectivity are expanding, inequities in digital skills, education, language proficiency, and sociocultural readiness continue to undermine meaningful participation in digital health (3). The Transactional Model of eHealth Literacy (TMeHL) offers a holistic framework to understand how these dimensions interact. TMeHL conceptualizes DHL as shaped by the interplay of individual characteristics (e.g., digital skills, language, motivation), sociocultural values, and broader structural influences (e.g., access, education, income). These layers interact to determine not only whether people can find health information online, but whether they can interpret and apply it in real-life settings (4).

In this context, middle-aged women represent a vital yet underexamined population. Not only are they at a life stage marked by increased health vulnerabilities, including the onset of chronic conditions and menopausal changes, they also are key health decision-makers within families (5). As healthcare systems in LMICs increasingly integrate digital tools, such as mobile health (mHealth), telemedicine, and social media platforms, this demographic turns more frequently to digital sources for health-related guidance. However, persistent barriers remain, including limited digital literacy, low self-efficacy in evaluating online information, language difficulties, and deep-rooted preferences for traditional or face-to-face care (6).

These challenges are especially visible in Myanmar, a country undergoing rapid sociopolitical and infrastructural changes (7). While cities like Yangon, Myanmar's commercial and digital hub, have seen rising levels of internet penetration, digital inequality persists, particularly among older and lower-income women. While smartphones and online health platforms are common, these women struggle to navigate and critically evaluate online content.

Factors such as economic constraints, and limited internet freedom, especially after the 2021 military coup, further compound these challenges. For women, the flood of unregulated health content on platforms like Facebook and TikTok presents both an opportunity and a risk: a source of information, but also of misinformation.

Despite this, DHL among middle-aged women remains poorly understood and rarely studied in the Myanmar context. Most digital health research in Southeast Asia has focused on health professionals (7) or aging population (8), neglecting the gendered and transitional dynamics in digital health use. Furthermore, few studies have examined specific factors that affect DHL. Without localized evidence, digital health interventions risk reinforcing existing inequalities by privileging those already digitally literate.

Given the complexity of DHL and its multiple dimensions, selecting an appropriate measurement tool is critical for accurately capturing participants' abilities. However, in this study's limited setting, only perception-based questionnaires were feasible. The widely used eHealth Literacy Scale (eHEALS), developed by Norman and Skinner, assesses perceived skills in finding, understanding, and applying online health information through eight self-report items (2). While adaptable to various contexts, it does not directly measure actual competencies and lacks defined score thresholds. To address these limitations, this study adopted the Digital Health Literacy Assessment Scale for Community-Dwelling Older Adults (8), a validated, eHEALS-based instrument grounded in the TMeHL. This 15-item scale covers three domains: acquisition and evaluation, interaction, and application, offering a more comprehensive measure. Though designed for older adults in China, its focus on navigation, evaluation, and application makes it equally relevant for middle-aged women in Yangon, who face similar challenges in engaging with online health information.

This study aims to assess the level of digital health literacy among middle-aged women in urban Yangon and identifying the sociodemographic, sociocultural, and internet-related factors associated with it. Grounded in the TMeHL framework, the research examines how

various forms of access, capacity, and context influence these women's ability to benefit from digital health resources. Understanding these dynamics is essential not only for promoting equitable digital health uptake, but also for supporting women as central agents of health in their households and communities.

METHODOLOGY

Study design

A quantitative cross-sectional design was employed to assess digital health literacy (DHL) and its influencing factors among middle-aged women in urban Yangon, Myanmar.

Study area and population

The study was conducted in urban districts of Yangon, Myanmar's largest metropolitan city and its most digitally connected region. The study population included women aged 35–64 years residing in urban Yangon for at least 6 months, with access to the internet and fluency in Burmese or English. Women with physical/cognitive impairments or professional healthcare training were excluded.

Sample size

According to the 2019 Intercensal Population Survey, the total population of middle-aged women (ages 35–64) residing in urban Yangon was 1,065,285. Using Yamane's formula for finite population sampling at a 5% margin of error, the required sample size was calculated to be 400. After accounting for a 10% non-response rate, the final target sample size was increased to 444 participants. Participants were recruited through convenience sampling via social media platforms (Facebook and Messenger), followed by snowball sampling to expand outreach.

Measurement tool

Data were collected through a self-administered online questionnaire adapted from validated instruments and translated into Burmese. The questionnaire comprised four sections: sociodemographic characteristics, sociocultural attitudes, internet-related factors, and digital health literacy. The Transactional Model of eHealth Literacy (TMeHL) conceptualizes DHL as shaped by the dynamic

interaction between task-oriented factors (such as language abilities and communication sources such as virtual or in-person) and user-oriented factors (including internet usage, digital literacy, demographics, and sociocultural attitudes). Variables in the study were grouped accordingly to reflect these domains.

Sociodemographic section included seven items: age, marital status, living arrangement, education level, employment status, monthly household income, and perceived health status. Sociocultural factors assessed cultural acceptance, language barriers, and attitudes toward online health platforms. Internet-related variables included frequency of internet use, time spent online per day, and digital literacy. Digital literacy was measured using an 11-item validated scale rated on a 4-point Likert scale (1-4), with total scores ranging from 11 to 44 (9). Where established thresholds were unavailable, median and interquartile range (IQR) were used to guide categorization.

Digital health literacy was measured using the 15-item Digital Health Literacy Assessment Scale for Community-Dwelling Older Adults, a validated revision of the eHEALS grounded in the TMeHL framework (8). Each item was rated on a 5-point Likert scale (1-5), yielding total scores ranging from 15 to 75. Although initially conceptualized as a continuous variable, the non-normal distribution of scores prompted dichotomization at the median value of 58, scores < 58 were categorized as low DHL, and scores ≥ 58 as high DHL.

The questionnaire underwent content validation by a panel of three public health experts using the Item-Objective Congruence (IOC) method, achieving a strong IOC score of 0.91. The final version was professionally translated into Burmese using forward and backward translation to ensure linguistic accuracy. Reliability was assessed through a pilot test with 30 participants from the target population. Internal consistency, measured using Cronbach's Alpha (α), met or exceeded the acceptable threshold of 0.70 across all subscales.

Data collection

Data collection was conducted in early July 2025 using a self-administered online survey via Google Forms. Participants were recruited

through Facebook and Messenger, targeting groups popular among middle-aged women in Yangon. Posts included a brief study description, eligibility criteria, consent statement, and survey link. A screening section was used to confirm eligibility before proceeding to the main survey. Informed consent was obtained electronically. Responses were monitored in real time, with periodic reminders posted to encourage participation. To prevent duplicate or automated responses, participants were asked to provide a telephone number at the survey's end. Numbers were anonymized prior to analysis. Data were exported to Excel and then transferred to SPSS for cleaning and analysis, with all identifiers stored separately to ensure confidentiality.

Data analysis

Data were analyzed using SPSS. Descriptive statistics (frequencies, percentages, means, medians, and interquartile ranges) were used to summarize participant characteristics and

key variables. Due to non-normal distribution, continuous variables were categorized using theoretical and data-driven thresholds. Bivariate analysis using the chi-square test identified associations between independent variables and digital health literacy (DHL).

RESULTS

Table 1 presents the sociodemographic profile of the 444 middle-aged women included in the study. The majority of participants (60.1%) were in the 35–44 age group. Most were married (61.5%) and living with family (88.1%). In terms of education, 75.2% had attained college or university-level education and above. Regarding employment, 41.9% were self-employed, followed by 37.8% formally employed and 20.3% non-employed. More than half (54.3%) reported a monthly household income above 1,500,000 MMK. Most participants (63.7%) perceived their health status as good.

Table 1 Sociodemographic characteristics (n = 444)

Variables	Number	(%)
Age (years)		
35-44	267	60.1
45-54	118	26.6
55-64	59	13.3
Marital status		
Married	273	61.5
Single	98	22.1
Separated/Divorced/Widowed	73	16.4
Living arrangement		
Living alone	27	6.1
Living with family	391	88.1
Living with non-family	26	5.9
Education level		
High school and below	110	24.8
College and above	334	75.2
Employment status		
Formally employed (Government/Private)	168	37.8
Self-employed	186	41.9

Variables	Number	(%)
Non-employed (Retired/Dependent)	90	20.3
Monthly household income		
≤1,500,000 MMK	203	45.7
>1,500,000 MMK	241	54.3
Perceived health status		
Poor perceived health (≤ 50.00)	161	36.3
Good perceived health (> 50.00)	283	63.7

Table 2 depicts that in terms of sociocultural factors, 32.2% of participants preferred face-to-face care, while only 25.5% were fully open to engaging with digital health services. Language barriers were prevalent, with nearly half of participants (39.4%) reporting high

difficulty understanding health content in English. Attitudes toward online health platforms also varied: while 66.0% expressed a favourable view, a significant proportion (34.0%) still held unfavourable attitudes.

Table 2 Sociocultural factors (N = 444)

Variables	Number	(%)
Cultural acceptance		
Prefer face-to-face care (3-5)	143	32.2
Moderate openness to digital health (6-7)	188	42.3
Open to digital health (8-9)	113	25.5
Language barrier		
Low barrier (2-5)	269	60.6
High barrier (6-8)	175	39.4
Attitude toward online health platforms		
Unfavourable attitude	151	34.0
Favourable attitude	293	66.0

As shown in Table 3, internet use was high across the sample, with 98.0% of participants using the internet daily. However, only 34.9% spent more than 5 hours online per day, while 27.0% reported limited use of 2 hours

or less. Notably, despite frequent access, digital literacy was low overall: 68.2% scored in the poor digital literacy category (≤33), highlighting a disconnect between internet exposure and actual skill proficiency.

Table 3 Internet-related factors (N =444)

Variables	Number	(%)
Frequency of internet use		
Sometimes	9	2.0

Variables	Number	(%)
Daily	435	98.0
Time spent of the internet per day		
≤ 2 hours	120	27.0
3-4 hours	169	38.1
≥ 5 hours	155	34.9
Digital Literacy		
Poor (≤ 33)	303	68.2
Good (>33)	141	31.8

Table 4 Scores of Digital Health Literacy (DHL) across three domains (N = 444)

Variables	Mean ± SD
Digital Health Literacy	54.96 ± 10.54
Information Acquisition & Evaluation	3.74 ± 0.68
Information Interaction	3.59 ± 0.71
Information Application	3.49 ± 0.92

Table 5 Level of Digital Health Literacy (DHL) (N= 444)

Digital Health Literacy	Number	(%)
Low (< 58)	213	48.0
High (≥ 58)	231	52.0

Table 4 and 5 shows digital health literacy levels. The median cut-off score of 58 was used as a threshold to categorize participants into 'low' and 'high' DHL groups. Based on this, 52% of participants were classified as having high DHL, while 48% had low DHL. Participants scored similarly across the three domains, with slightly lower scores observed in the information application domain.

Table 6 presents the bivariate associations between digital health literacy (DHL) levels and key sociodemographic, sociocultural, and internet-related factors using the chi-square test. Facilitators of high DHL

included higher educational attainment ($\chi^2 = 82.307$, $p < 0.001$), greater monthly income ($\chi^2 = 12.600$, $p < 0.001$), and better perceived health status ($\chi^2 = 10.972$, $p < 0.001$). Participants with favourable attitudes toward online health platforms ($\chi^2 = 119.695$, $p < 0.001$), daily internet use ($\chi^2 = 9.963$, $p = 0.001$), and longer time spent online per day ($\chi^2 = 15.828$, $p < 0.001$) were also significantly more likely to demonstrate high DHL. On the other hand, barriers significantly associated with low DHL included a preference for face-to-face care ($\chi^2 = 110.986$, $p < 0.001$), high language barriers ($\chi^2 = 90.907$, $p < 0.001$), and poor digital literacy ($\chi^2 = 62.175$, $p < 0.001$).

Table 6 Bivariate analysis between variables and DHL (N = 444)

Variables	Digital Health Literacy				χ^2	P value	Effect size ϕ
	Low (N=213)		High (N=231)				
	N	%	N	%			
Age					4.641	0.098	0.102
35-44	123	46.1	144	53.9			
45-54	54	45.8	64	54.2			
55-64	36	61.0	23	39.0			
Marital Status					5.088	0.079	0.107
Married	120	44.0	153	56.0			
Single	51	52.0	47	48.0			
Separated/Divorced/ Widowed	42	57.5	31	42.5			
Living arrangement					5.057	0.080	0.107
Living alone	12	44.4	15	55.6			
Living with family	183	46.8	208	53.2			
Living with non-family	18	69.2	8	30.8			
Educational level					82.307	<0.001*	0.431
High school and below	94	88.5	16	14.5			
College and above	119	35.6	215	64.4			
Employment status					0.618	0.734	0.037
Formally employed	81	48.2	87	51.8			
Self-employed	92	49.5	94	50.5			
Non-employed	40	44.4	50	55.6			
Monthly household income					12.600	<0.001*	0.168
≤1,500,000 MMK	116	57.1	87	42.9			
>1,500,000 MMK	97	40.2	144	59.8			
Perceived health status					10.972	<0.001*	0.157
Poor	94	58.4	67	41.6			
Good	119	42.0	164	58.0			
Cultural acceptance					110.98	<0.001*	0.500
Prefer face-to-face care	119	83.2	24	16.8			
Moderate openness	69	36.7	119	63.3			
Open to digital health	25	22.1	88	77.9			
Language barrier					90.907	<0.001*	0.452
Low barrier	80	29.7	189	70.3			
High barrier	133	76.0	42	24.0			
Attitude toward online health platforms					119.69	<0.001*	0.519
Unfavourable attitude	127	84.1	24	15.9			

Variables	Digital Health Literacy				χ^2	P value	Effect size ϕ
	Low (N=213)		High (N=231)				
	N	%	N	%			
Favourable attitude	86	29.4	207	70.6			
Frequency of internet use					9.963	0.001*	0.150
Sometimes	9	100.0	0	0.0			
Daily	204	46.9	231	53.1			
Time spent on the internet per day					15.828	<0.001*	0.189
≤ 2 hours	73	60.8	47	39.2			
3-4 hours	83	49.1	86	50.9			
≥ 5 hours	57	36.8	98	63.2			
Digital Literacy					62.175	<0.001*	0.374
Poor	184	60.7	119	39.3			
Good	29	20.6	112	79.4			

* P value < 0.05 = statistically significant

DISCUSSION

This study assessed digital health literacy (DHL) and its influencing factors among middle-aged women in urban Yangon, Myanmar, revealing a notable gap between digital access and effective engagement. Although nearly all participants (98%) reported daily internet use, only 52% demonstrated high DHL, highlighting that access alone does not ensure competence in navigating, evaluating, and applying online health information. Participants scored similarly across the three domains, with slightly lower scores observed in the information application domain, indicating challenges in translating online information into actionable health decisions (8, 10).

Higher educational attainment, greater household income, and positive self-perceived health were significantly associated with higher DHL, consistent with literature linking foundational knowledge, economic resources, and proactive health behaviors to enhanced digital engagement (8, 11-13). Favourable attitude toward online health platforms, including perceived usefulness, ease of use, and trustworthiness, were also linked to high DHL, underscoring the importance of motivation and digital self-efficacy in shaping effective use (14, 15). Moreover, daily frequency and longer time

spent online also supported higher DHL, echoing international evidence that associate digital exposure with greater skill acquisition (8, 16).

Despite high digital access, sociocultural and linguistic factors hindered DHL. A preference for face-to-face care and high language barriers were strongly associated with lower DHL, reflecting cultural conservatism and the lack of linguistically and contextually appropriate digital materials in Myanmar (17-19). Poor digital literacy further compounded these challenges, emphasizing that basic technological skills, including navigation, privacy awareness, and information verification, are essential for meaningful digital health engagement (9, 20).

Guided by the TMeHL framework, our findings underscore the interplay of task-oriented and user-oriented factors in shaping DHL. Task-oriented factors like language proficiency interacted with user-oriented characteristics such as digital literacy, demographic attributes, and sociocultural attitudes. This interaction generated contextual “noise” that impeded effective engagement, including semantic and physiological challenges (e.g., language barriers and low digital proficiency), psychological barriers (e.g., cultural conservatism and preference for face-to-face care), and structural

constraints (e.g., policy restrictions limiting access to reliable digital health resources). By explicitly mapping study variables to TMeHL constructs, the research illustrates how motivation, digital self-efficacy, and contextual limitations collectively influence DHL outcomes among middle-aged women in Myanmar's transitional digital health landscape.

The results also raise concerns about potential exposure to misinformation on social media platforms, particularly in Myanmar's post-coup information landscape. Limited skills in critical evaluation may exacerbate the risk of misinterpreting or acting on inaccurate health information, underscoring the need for interventions that enhance both literacy and discernment.

To address these challenges, public health strategies should move beyond simply expanding access and focus on culturally and linguistically tailored digital health literacy programs. Community-based interventions, integration of DHL training within women's health initiatives, and hybrid care models combining digital and in-person interactions could enhance adoption. Leveraging community health workers to provide guidance and support could help ensure that digital health initiatives are both accessible and effective for middle-aged women. Policy-level actions, including investment in inclusive digital health infrastructure and regulation of online health content, are also crucial to ensure that women across diverse urban and underserved settings can safely and effectively engage with digital health resources.

LIMITATIONS AND FUTURE RESEARCH

This study has several limitations. The cross-sectional design prevents causal inference, and recruitment via convenience and snowball sampling on social media may have introduced selection bias favouring digitally confident participants, limiting generalizability to other age groups, men, or women in peri-urban and rural areas. The online survey excluded non-internet users, potentially underrepresenting individuals with the lowest DHL. Reliance on self-reported data may have introduced recall or social desirability bias. Additionally, dichotomizing DHL at the median, although practical given the

non-normal distribution, may obscure subtle variations in literacy levels. Policy-level barriers and misinformation exposure, particularly in Myanmar's post-coup environment, were not directly assessed.

Future research should address these gaps by employing longitudinal designs to explore causal relationships and by using representative sampling strategies to capture diverse populations. Treating DHL as a continuous variable may provide more nuanced insights into literacy gradients. Multivariate analyses could identify independent predictors of DHL, including motivation, digital self-efficacy, and contextual limitations. Intervention studies, such as community health worker-facilitated programs or culturally and linguistically tailored digital content, could provide practical strategies to enhance digital health engagement.

CONCLUSION

Despite widespread internet use among middle-aged women in urban Yangon, only half of participants demonstrated high proficiency. Access alone does not ensure the ability to navigate, evaluate, and apply online health information effectively. DHL is influenced by educational attainment, income, digital confidence, and sociocultural factors, with persistent language barriers, cultural conservatism, and limited digital proficiency constraining meaningful engagement. Frequent use of digital platforms, often passive or social media-focused, does not automatically translate into effective health-related behaviour, and exposure to misinformation further emphasizes the need for critical evaluation skills. Interventions that strengthen digital skills, provide culturally and linguistically tailored content, and engage community health workers are crucial to bridging the digital health gap. Future research should explore strategies that foster intentional, critical, and sustained use of digital health resources, particularly among populations facing cultural, linguistic, or structural barriers. Policymakers should integrate DHL initiatives into women's health programs and community-based strategies to ensure equitable and effective digital health engagement.

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UNDERSTANDING DETERMINANTS OF AIR POLLUTION AWARENESS AMONG INTERNATIONAL STUDENTS IN THAILAND: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Air pollution is a critical global environmental and public health concern, causing 8.1 million deaths in 2021, with urban areas in Thailand being particularly affected (WHO, 2022). It is a significant health concern in Thailand, particularly in urban areas and northern regions, where recurrent patterns of poor air quality are linked to industrial emissions, vehicular exhaust, and agricultural burning (Moran et al., 2019; Nguyen et al., 2023). These environmental challenges contribute to both acute and chronic health impacts among residents and the international student population, who may face additional barriers to achieving the proper awareness of air pollution (Ramírez et al., 2019).

Objective: To explore the awareness level of air pollution and its determinants among international students in Thailand.

Methodology: This study employed a quantitative cross-sectional design and recruited 420 international students. This survey included demographic characteristics, sources of information, knowledge of air pollution, self-prevention practices, and awareness of air pollution. Chi-square, binary, and multiple logistic regression were used to analyze associated factors.

Results: More than half were at least 25 years old (61.4%), and from non-health-related fields (61%). The majority were undergraduate students (67.1%) and of Myanmar nationality (91.9%), residing in the Bangkok Metropolitan Region (79%). Most participants received information from multiple sources (74.8%). A good awareness level was reported in only 55.7%, while 60.5% had good self-prevention practices. Chi-square analyses revealed that the students' age and gender are significantly associated with the level of air pollution awareness ($p=0.010$ and $p < 0.001$, respectively). The level of education and field of study of the students are also found to be significant factors ($p = 0.003$, $p < 0.001$, respectively). Sources of information of the students are significantly associated with the level of awareness, with the p -value < 0.001 . Whether having poor or good self-preventive actions was also found to be significantly related to the level of awareness, with the p -value < 0.001 .

Multiple logistic regression reported that male students were significantly less likely than female students to have good awareness of air pollution (AOR = 0.452, 95% CI: 0.291–0.700, $p < 0.001$). Students from health-related fields are 1.73 times more likely to demonstrate good awareness compared to those from non-health-related fields (AOR = 1.733, 95% CI: 1.060–2.834, $p = 0.028$). Accessing multiple sources of information was associated with a 2.19 times increase in the likelihood of good awareness compared to relying on a single source (AOR = 2.19, 95% CI: 1.346–3.545, $p = 0.002$). Additionally, students who practiced good self-preventive actions were 2.36 times more likely to have good awareness than those with poor preventive actions (AOR = 2.362, 95% CI: 1.539–3.626, $p < 0.001$).

Conclusion: This study highlights that female students, health-related education, multiple information sources, and effective self-protection practices were associated with better awareness of air pollution. These findings underscore the need for targeted educational strategies, particularly for male students and those in non-health-related fields, to enhance understanding and promote effective responses to the threats of air pollution. Tailored and culturally sensitive interventions are recommended to improve awareness among international students in Thailand.

Keywords: air pollution, awareness, international students, preventive behaviors, Thailand

INTRODUCTION

Air pollution is a critical public health challenge in Thailand, particularly in major urban regions and the northern regions, which experience recurrent episodes of hazardous air quality due to a combination of industrial and vehicle emissions, as well as widespread agricultural burning (AIT, 2024; Institute, 2021; Vichit-Vadakan & Vajanapoom, 2011). The health impacts of air pollution are profoundly significant, contributing to both acute and chronic respiratory conditions, resulting in thousands of premature deaths annually (Archer et al.; Pisithkul et al., 2024). In response to this challenge, the Thai government and international organizations have implemented a range of strategies, interventions, from stricter emission controls to public awareness campaigns and technological interventions such as real-time air quality monitoring websites and applications (The Government Public Relations Department, 2024). Despite these efforts, the persistence and severity of air pollution events highlight the need for more effective interventions and greater public engagement to these challenges. Awareness and knowledge about air pollution are recognized as essential determinants of individual and action to mitigate exposure to air pollution. As of the first semester of the 2022 academic year, Thailand hosted 34,202 international students in higher education institutions (Ministry of Higher Education, 2023). Among university students, factors such as attitudes, health consciousness, and environmental knowledge have been shown to influence behavioral actions and those related to preventing air pollution (Huang et al., 2024; Methavasarakh, 2022). However, the specific determinants of air pollution awareness among international students, which is a growing and diverse population in Thai higher education, remain underexplored (Ministry of Higher Education, 2023). International students may face unique challenges, including language barriers, unfamiliarity with local context and its environmental risks, and varying levels of prior exposure to air pollution issues in their home countries (Nguyen, 2024; Rujiprak, 2016).

Understanding the factors that shape air pollution awareness in this population is crucial for developing targeted educational interventions and

ensuring the well-being of the students residing in Thailand. This cross-sectional study seeks to identify and analyze the determinants of air pollution awareness among international students in Thailand, providing insights that can inform university policies, public health interventions, and collaborative intersectoral efforts to foster a more informed and resilient academic environment (AIT, 2024; Ramírez et al., 2019; Yalçın et al., 2023).

METHODOLOGY

Study Design and Population

A cross-sectional study design is used to explore the determinants of air pollution awareness among international students in Thailand. This design is chosen to capture a snapshot of international students' awareness level and its determinants. However, the limitations are inevitable, such as potential self-reporting bias and from a causality perspective.

The target population of this study is international college students in Thailand, in which 420 participants participated in this study. A convenience sampling method with a snowball approach is used to achieve the targeted sample size of this study (n = 420).

Data collection and measurement tools

The data were collected using a self-reported survey questionnaire distributed online via university networks and social networking platforms. The measurement tools used in this study were a modified questionnaire adapted from previous studies, which is divided into the following sections: Demographic Characteristics, Source of Information, Mode of Transportation, Knowledge of Air Pollution, Self-Prevention and Reduction Actions against Air Pollution, and Awareness of Air Pollution.

Data analysis

The data was entered into Excel for data cleaning and data processing. After that, it was loaded into SPSS Software for further analysis. Descriptive statistics were employed to explore the nature of the collected data. The chi-square test, binary logistic regression, and multiple logistic regression were used to examine the determinants of air pollution awareness among international

students in Thailand.

RESULTS

Descriptive Findings

A total of 420 international students participated in this study. The majority were 25 years and younger (61.4%), while 38.6% were 26 years and above. The sample size consisted of 55.5% females, 43.3% males, and 1.2% others. The majority of participants were from Myanmar (91.9%), while 8.1% were from other nationalities. Regarding the level of education, 67.1% were

pursuing a bachelor's degree, and 32.9% were pursuing a master's degree or higher. In terms of field of study, 39.0% were from health-related fields, while 61.0% were from non-health-related fields. Most students have been staying in the Bangkok Metropolitan Region (79.0%), with the remaining 21.05% living in other areas of Thailand. The length of residence in Thailand varied, with 77.1% having lived in Thailand for more than 12 months, and 22.9% between 6 and 12 months, as stated in Table.1

Table 1 Demographic Characteristics of the participants (n = 420)

Characteristics	Number (n)	Percentage (%)
Age (years)		
25 years and younger	258	61.4
26 years and above	162	38.6
Gender		
Female	233	55.5
Male	182	43.3
Others	5	1.2
Nationality		
Myanmar	386	91.9
Other	34	8.1
Level of Education		
Bachelor	282	67.1
Master and above	138	32.9
Field of study		
Health-related	164	39.0
Non-health-related	256	61.0
Location		
Bangkok Metropolitan Region	332	79.0
Others	88	21.0
Length of residence		
6 – 12 months	96	22.9
More than 12 months	324	77.1

The results for the level of knowledge of air pollution among the students are summarized and presented in Table.2. 53.6% have poor

knowledge of air pollution, while 46.4% of the students demonstrated having good knowledge.

Table 2 Level of Knowledge of air pollution

	Number (n)	Percentage (%)
Poor Knowledge	225	53.6
Good Knowledge	195	46.4

The level of awareness were mostly good among the students (55.7%), and 44.3% have poor awareness of air pollution, as stated in Table 3.

Table 3 Level of Awareness of air pollution

	Number (n)	Percentage (%)
Poor Awareness	186	44.3
Good Awareness		55.7

Regarding self-preventive and reduction actions, 60.5% of the students have good preventive actions, and 39.5% have poor preventive actions, mentioned in Table 4.

Table 4 Level of Self-preventive and reduction actions

	Number (n)	Percentage (%)
Poor preventive actions	166	39.5
Good preventive actions		60.5

74.8% of the students receive information from the multiple sources, while 25.2% rely on a single source, mentioned in Table 5.

Table 5 Source of information

Source of information	Number (n)	Percentage (%)
Single source	106	25.2
Multiple sources		74.8

Inferential/Analytic Findings

The crosstabulation analysis (Table 6.) reveals several significant associations with the level of air pollution awareness among international students in Thailand.

Students' age and gender are significantly associated with the level of air pollution awareness (p=0.010 and p<0.001, respectively). The level of education and field of study of the

students are also found to be significant factors (p = 0.003, p < 0.001, respectively). Sources of information of the students are significantly associated with the level of awareness, with the p-value <0.001. Whether having poor or good self-preventive actions was also found to be significantly related to the level of awareness, with the p-value <0.001.

Table 6 Crosstabulation of demographic factors, source of information, academic adjustment, and social adjustment with level of awareness of air pollution

Variables	95% C.I.		p-value
	Poor Awareness	Good Awareness	
Age (years)			
25 years and younger	127	131	0.010
26 years and above	59	103	
Gender			
Male	97	85	<0.001
Female	85	148	
Others	4	1	
Nationality			
Myanmar	166	220	0.075
Others	20	14	
Level of Education			
Bachelor	139	143	0.003

Master and above	47	91	
Field of study			
Health-related fields	50	114	<0.001
Non-health-related fields	136	120	
Location			
Bangkok Metropolitan Region	154	178	0.092
Others	32	56	
Length of Residence			
6 – 12 months	45	51	0.561
More than 12 months	141	183	
Knowledge level			
Poor knowledge	99	126	0.899
Good knowledge	87	108	
Self-prevention and reduction actions			
Poor preventive actions	97	69	<0.001
Good self-preventive actions	89	165	
Sources of information			
Single source	64	42	<0.001
Multiple sources	122	192	

The binary logistic regression (Table 7.) reveals that gender was a significant predictor ($p < 0.001$). Compared to female students, male students had 0.452 times less likely of having good awareness (AOR = 0.452, 95% C.I.: 0.291-0.700), indicating that female students were significantly more likely to be aware of air pollution and its impacts.

Students from health-related fields were 1.73 times more likely to have good awareness compared to those from non-health-related fields (AOR = 1.733, 95% C.I.: 1.060-2.834, $p = 0.028$). This suggests that exposure to content related to health perspectives may positively influence students' understanding of environmental health issues.

Those who accessed multiple sources of information were 2.19 times more likely to have good awareness than those who relied on a single source (AOR = 2.19, 95% CI: 1.346-3.545, $p = 0.002$). This emphasizes the importance of diverse information exposure in shaping the level of awareness in this population.

Students with good self-prevention actions were found to be 2.36 times more likely to have good awareness compared to those with poor self-preventive actions (AOR = 2.362, 95% C.I.: 1.539-3.626, $p < 0.001$). This suggests a possible relationship where increased awareness may motivate self-preventive action and reinforce awareness in an individual.

Table 7 Association between significant independent variables and level of awareness

Variables	AOR	Lower	Upper	p-value
Age group [ref- 25 years and younger]				
26 years and above	1.280	0.733	2.237	0.386
Gender [ref- Female] Male	0.452	0.291	0.700	<0.001
Others	0.184	0.018	1.894	0.155
Level of Education [ref- Bachelor] Masters and above	0.689	0.376	1.263	0.229

Variables	AOR	Lower	Upper	p-value
Field of study [ref- Non-health-related fields]				
Health-related fields	1.733	1.060	2.834	0.028
Sources of information [ref- Single source]				
Multiple sources	2.185	1.346	3.545	0.002
Self-prevention and Reduction actions [ref- Poor preventive actions]				
Good preventive actions	2.362	1.539	3.626	<0.001

DISCUSSION

Discussion on descriptive findings

The study aimed to explore and understand the level of awareness of air pollution and its determinants among international students in Thailand. The findings of this study suggested several alignments with the previous research. Among the 420 students who participated, the mean age was 25 years (SD = 4.142), with 61.4% being 25 years and younger, and 38.6% being 26 years and above. Female students comprised 55.5%, which is higher than the number of male students who participated (43.3%), while those identified as “Others” accounted for 1.2% of the participants. This is aligned with previous studies, where females are usually more concerned about environmental issues and their impact than males, and demonstrate higher levels of environmental attitudes and behavior than men (McCright, 2010; Milfont & Sibley, 2016). 91.9% of the students from Myanmar participated in this study, whereas 8.1% of the students were from other nationalities, reflecting the demographic landscape of international students at Thai universities. 67.1% of the students are in bachelor’s studies, while 32.9% are pursuing a master's degree or higher. This distribution is relevant given that a higher educational level is associated with increased environmental literacy and critical awareness. 39% of the students are from health-related fields, which has implications for their exposure to air pollution knowledge and risk comprehension, while 61% from non-health-related fields and may have limited engagement with environmental literature and health issues. 79% percent of the students reside in the Bangkok Metropolitan Region, a known highly polluted area, while 21% reside in other areas of Thailand, which could influence their direct exposure and perceived risk.

The majority of the students have been living in Thailand for more than a year (77.1%), and 22.9% have been in Thailand for 6 – 12 months, suggesting that these students had asufficient period to be exposed to local environmental conditions and perspectives about air pollution.

However, despite the exposure, the knowledge level about air pollution, 53.6% of the participants demonstrated poor knowledge, and 46.4% demonstrated good knowledge. This gap between exposure and knowledge may suggest ineffective information dissemination or a lack of understanding of the environmental context. Interestingly, self-preventive and reduction actions varied, with 60.5% of the participants adopting good preventive actions and 39.5% adopting poor preventive actions. This may suggest that students are engaging in riskreducing behaviors out of perceived necessity or social influence, even if their understanding of air pollution is incomplete.

Overall, in terms of awareness of air pollution, 55.7% of the students demonstrated good awareness, while 44.3% showed poor awareness. This highlights a critical opportunity for targeted educational interventions, particularly considering that a significant portion of this population is already adopting preventive measures despite lacking strong foundational knowledge. These findings highlight the need for tailored environmental health education among international students, particularly those in non-health-related fields, and for universities to integrate an inclusive public health communication to bridge both knowledge and actions.

Discussion on analytic findings

The inferential analysis using Chi-square

and binary logistic regression identified key determinants associated with air pollution awareness among international students in Thailand. The cross-tabulation results showed that gender, age, level of education, field of study, sources of information, and self-prevention practices were significantly associated with the awareness level of air pollution, with a p-value less than 0.05. These findings suggest that both individual demographics and other variables play significant roles in shaping the students' environmental awareness.

Further analysis through binary logistic regression revealed that gender was a significant predictor of awareness. Male students had 55% lower odds of demonstrating good awareness compared to female students (AOR = 0.452, $p < 0.001$). This aligns with previous research which consistently shows that females tend to exhibit stronger environmental concern and greater eco-anxiety than males (McCright, 2010; Zelezny et al., 2000). Women are generally more responsive to environmental risk communication and more likely to engage in preventive behavior, which may explain their heightened awareness. Students from health-related fields were 1.73 times more likely to have good awareness compared to students from non-health-related fields (AOR = 1.733, $p = 0.028$). This is supported by prior research indicating that health education significantly enhances environmental literacy, especially regarding air pollution related health impacts (Ccami-Bernal et al., 2024; Cheong et al., 2024). Students with academic exposure to environmental or public health topics tend to integrate and apply that knowledge into their awareness and behavioral responses.

Additionally, the use of multiple sources of information was found to be significantly associated with the level of awareness. Students who accessed information from more than one source were 2.19 times more likely to report good awareness than those relying on a single source (AOR = 2.185, $p = 0.002$). Previous research suggests that information diversity is a critical driving component of environmental awareness, as exposure to various of content helps reinforce accurate risk perception and counter misinformation (Iqbal et al., 2024).

Finally, students with good self-preventive behaviors were 2.36 times more likely

to be aware of air pollution risks compared to those with poor preventive behaviors (AOR = 2.362, $p < 0.001$). This finding echoes previous research, which identified a positive relation between preventive behaviors and environmental awareness (Ningrum & Herdiansyah, 2018). Together, these findings suggest that gender, field of study, sources of information, and self-preventive actions are significant and related determinants of awareness of air pollution among international students.

CONCLUSION

This study identified key determinants of air pollution awareness among international students in Thailand, finding that just over half of the participants had a good level of awareness. Multivariate analyses revealed that female gender, those in health-related fields, use of multiple information sources, and engagement in preventive actions were all independently associated with higher awareness levels. These results suggest that demographic and academic factors, as well as preventive behaviors and information-seeking patterns, play a critical role in shaping environmental awareness. To address gaps in knowledge and awareness, especially among male students, those in non-health-related fields, universities, and public health authorities should prioritize targeted, evidence-based communication and educational interventions tailored to the international student population

ETHICAL DECLARATIONS

The Human Research Ethics Review Committee, Set 1 of Chulalongkorn University, provided ethical approval for the study. Participation in the study was entirely voluntary. All participants were informed about the study, assured of their anonymity and confidentiality, and provided consent before completing the questionnaire. All responses were used solely for academic purposes.

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FOOD ENVIRONMENT AND RELATED FACTORS INFLUENCING JUNK FOOD CONSUMPTION BEHAVIOR AMONG SECONDARY SCHOOL STUDENTS IN BIRATNAGAR, NEPAL

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ABSTRACT

Introduction: Junk food consumption has risen sharply, contributing to obesity and non-communicable diseases among adolescents worldwide, including Nepal. The food environment; availability, accessibility, and marketing of unhealthy foods significantly shapes dietary behaviors but is understudied among Nepalese secondary school students.

Objectives: This study aimed to explore the food environment and related factors influencing junk food consumption behavior among secondary school students in Biratnagar, Nepal.

Methodology: A cross-sectional study was conducted among 419 students (aged 15–19) from four randomly selected schools in Biratnagar, Nepal. Data were collected through interviews using a semi-food frequency and structured questionnaire, and analyzed with descriptive statistics, chi-square tests, and ordinal logistic regression in SPSS v21.

Results: Among respondents, 27.0% were low, 24.6% moderate, and 48.4% high junk food consumers based on monthly intake (median = 2, mean = 2.21, SD = 0.842). Chi-square analysis revealed significant associations between junk food consumption and nutritional status, dietary patterns (fried snacks, sweets), fast-food outlet density, and peer influence ($p < 0.05$). Ordinal logistic regression showed that overweight/obese students (AOR = 1.9, 95% CI: 1.26–2.87), those with high sweets (AOR = 1.9, 95% CI: 1.27–2.88) and fried snack intake (AOR = 1.7, 95% CI: 1.23–2.45), those experiencing peer influence (AOR = 3.4, 95% CI: 1.7–6.7), and those passing fewer than five fast-food outlets on their route to school (AOR = 2.1, 95% CI: 1.34–3.32) were more likely to have higher junk food consumption.

Conclusion: Junk food consumption is highly prevalent among Biratnagar secondary students, influenced by nutritional status, dietary patterns, peer influence, and food environment. Higher odds among those passing fewer outlets may relate to travel distance and transport affecting exposure. These findings highlight the need for school- and community-based interventions to promote healthy eating.

Keywords: Adolescents, Food environment, Junk food, Nepal, Peer influence, Secondary school

INTRODUCTION

Junk food characterized by high energy density, low nutrient content, and excessive amounts of unhealthy fats, added sugars, and sodium has become a staple in diets across both developed and developing nations over the past few decades (1,2). Daily intake of such foods, including fast meals, sugary beverages, confectionery, and snack chips, undermines balanced nutrition and is strongly linked to obesity, cardiovascular disease, type 2 diabetes,

and even impaired cognitive function and mental health (2). Although convenient and heavily promoted, these products displace whole grains, fruits, and vegetables, reducing dietary diversity and fiber intake key factors in chronic disease prevention (8).

Low- and middle-income countries are experiencing a rapid “nutrition transition” whereby traditional dietary patterns give way to westernized, processed-food driven diets (3).

Urbanization, busy lifestyles, and sophisticated marketing strategies have fostered a global environment in which approximately 70% of young adults report regular junk-food consumption, with nearly half of U.S. adolescents and over fifty percent of Sri Lankan youth eating fast food daily (4,10). In Southeast Asia, this shift is particularly problematic: countries such as Bhutan report ubiquitous availability of fried staples in school settings, and many urban centers now feature clusters of fast-food outlets along students' commutes (4). Consequently, the region grapples with a double burden of persistent undernutrition alongside rising rates of overweight and noncommunicable diseases.

The concept of the food environment encompasses physical availability, economic affordability, and promotional exposure to various food options factors that collectively shape food choices and consumption patterns (11). When schools and their surrounding neighborhoods are saturated with junk-food outlets and aggressive advertising, adolescents face constant cues to purchase energy-dense, nutrient-poor items during breaks or in route to classes (12,13). Studies have shown that proximity to convenience stores and fast-food restaurants significantly increases the likelihood of unhealthy purchases, reinforcing habits that may persist into adulthood.

In Nepal, the adolescent population constitutes approximately 24.1%, representing about a quarter of the total population (5). A study conducted in Nepal in 2016 revealed that the prevalence of overweight among adolescent students aged 16-19 years was 12.2%, an increase compared to a previous study in Nepal, which reported a prevalence of 8.1% (6). Similarly, A 2022 national survey found that in rural areas, 0.5% of adolescents aged 15-19 were overweight and 3.8% were obese, while in urban areas, the rates were 0.7% and 5.9%, respectively (9). In Pokhara, over 60% of secondary school students regularly consumed junk food, mainly salty snacks and sweets, despite existing micronutrient deficiencies (7). While past research in Nepal has examined junk food consumption and related health outcomes, limited studies have explored the role of food environments. Therefore, the study aimed to explore the food environment and related factors influencing junk food

consumption behavior among secondary school students in Biratnagar, Nepal.

METHODOLOGY

Study Design and Setting

A cross-sectional survey was conducted in Biratnagar metropolitan city, which comprises 19 wards and over 70 secondary schools. Wards 3, 7, and 13 were purposively selected for their mixed urban and semi-urban profiles. Four secondary schools were then chosen via simple random sampling.

Study population

The study population was secondary school students aged 15 – 19 years old of Biratnagar metropolitan city, Nepal. The target population was the students of class 9, 10, 11 and 12, whose age were between 15-19 years old from the selected schools.

Sample size and sampling method

The required sample size was calculated using Yamane's formula $n=N/(1+Ne^2)$, where N is the total population of secondary school students in the selected schools (2,724) and e is the desired margin of error (0.05). This yielded an initial estimate of 349 participants. To allow for up to 20% non-response or incomplete data, the sample was increased by 20%, giving a final target of 419 students.

A multistage sampling strategy was then employed. First, three wards no. (3, 7, and 13) in Biratnagar were chosen purposively for their mix of urban and semi-urban characteristics. Within these wards, four secondary schools; Shree Pokhariya secondary school (school 1), Jaycee secondary school (school 2), Star secondary school (school 3), and Shree Satyanarayan secondary school (school 4) were selected by simple random sampling. Sample allocation to each school was performed proportionally to its total enrolment (107 students from School 1, 95 from School 2, 96 from School 3, and 121 from School 4). Finally, individual participants meeting the inclusion criteria (aged 15-19, grades 9-12, willing to participate) were chosen by simple random sampling from class registers until the quota of 419 was reached. Three research assistants with public health backgrounds completed two days of training in study

procedures, ethical conduct, and interview techniques. They then obtained written informed consent and conducted private, face-to-face interviews with eligible students.

Research instrument

Data were collected using a structured questionnaire administered through face-to-face interviews. The instrument was adapted from several published studies and refined for the Nepali context via expert review (7, 21). It comprised four sections individual factors, environmental factors, social factors, and a semi-quantitative food-frequency component listing 40 commonly consumed junk-food and beverage items. Prior to field administration, the questionnaire was pre-tested with 30 participants to assess clarity and internal consistency; Cronbach's alpha values for each section exceeded the commonly accepted threshold of 0.70, indicating acceptable reliability.

Section 1: (Individual Factors) included questions on demographic and personal characteristics: age (categorized 15–19 years), gender (male/female), family size, and nutritional status (BMI-for-age Z score). Dietary-pattern questions on fast-food, and sugary-beverage, snacks, and sweets consumption employed frequency per week categories by mostly (more than 5 days a week), often (2 – 5 days a week), sometimes (less than 2 days a week) and never (7).

Section 2 (Environmental Factors) comprised items measuring the availability of junk-food outlets along the home-to-school route (categorized < 5 vs. ≥ 5 shops for fast-food, sugary-beverage, snack, and sweet vendors) (14). It also included self-reported exposure to junk-food advertising.

Section 3 (Social Factors) contained items about peer-influence. Peer influence items used 5-point Likert scales (strongly agree to strongly disagree).

The semi-food-frequency questionnaire (Section 4) listed 40 locally relevant junk-food and beverage items. Respondents reported consumption frequency (__times per day, __times per week, or __times per month) and portion size (small, medium, large), with standard portion sizes defined for 15–19-year-olds in consultation with a nutritionist.

Height and weight were measured using a digital scale (to the nearest 0.1 kg) and portable stadiometer (to the nearest 0.1 cm), with participants barefoot and without heavy accessories. Body-mass-index-for-age Z scores were calculated (kg/m^2) and interpreted via WHO Anthro-Plus (2007) growth references to classify nutritional status as underweight ($\text{BAZ} < -2$), normal weight ($-2 \leq \text{BAZ} \leq +1$), overweight ($\text{BAZ} > +1$), or obese ($\text{BAZ} > +2$) (15).

Data collection procedure

Data was collected after approval by the Mahidol Central Institutional Review Board, Mahidol University (Code: MU-CIRB 2024/250.0210, No. 78.0130/3429) in March to May 2025. Permission to conduct the study was obtained from each selected school prior to data collection. The questionnaires were administered to the students by trained research assistants through face-to-face interviews, and responses were recorded on paper forms during the interview sessions.

Data analysis

Data were analyzed using IBM SPSS Statistics version 21. Descriptive statistics summarized participant characteristics and consumption patterns. Semi-quantitative food-frequency data were classified into low, moderate, and high consumption using the 33rd and 67th percentiles of total monthly consumption frequency, a data-driven classification based on the sample's distribution. Environmental variables (e.g., outlet density) were dichotomized (< 5 vs. ≥ 5 shops); the cut-off was based on the distribution of observed outlet counts in the study area and aligns with thresholds used in prior studies to distinguish low- and high-exposure environments (14). Likert-scale items for peer influence are grouped using median cut-offs, Chi-square tests ($\alpha = 0.05$) identified bivariate associations, and variables with $p < 0.05$ were entered into an ordinal logistic regression to determine independent predictors of higher junk-food intake.

Ethical Consideration

The Ethical Committee of the Mahidol University Central Institutional Review Board (MU-CIRB) has approved the study (COA No.

2024/250.0210) and permission was granted by each participating school. Written informed consent was secured from all students (and parental/guardian assent for minors), with assurances of voluntary participation, confidentiality, and the right to withdraw at any time. All data were anonymized and stored securely to protect participant privacy.

RESULTS

Table 1 illustrates junk food consumption among 419 students, classified using cut-offs at the 33rd and 67th percentiles into low (≤ 198.7 times/month; 27.0%), moderate (198.8–228.8; 24.6%), and high (> 228.8 ; 48.4%) consumers.

The median consumption score was 2, corresponding to the moderate consumption category. Scores ranged from a minimum of 1 (low consumption) to a maximum of 3 (high consumption).

Table 1 also shows that among the 419 students, 27.2% were 15 years old, 48% were 16–17, and 24.8% were 18–19, with a near-equal gender split. Most lived in small (51.1%) or medium (44.2%) households, and 71.4% were of normal weight compare to 26.3% overweight; 2.4% obese. In dietary patterns, 70.4% consumed fast food, 62.5% drank sugary beverages, and 52.5% ate fried snacks 2 to 5 days per week, and 70.9% ate sweets/candies fewer than 2 days per week.

Table 1 Frequency and percentage of junk food consumption behavior and individual factors of respondents (n = 419)

Variables	Frequency (N)	Percentage (%)
Junk food consumption behavior (per month);		
Low (≤ 198.7)	113	27
Moderate (198.8–228.8)	103	24.6
High (> 228.8) (Median = 2, Min = 1, Max = 3)	203	48.4
Age		
15	114	27.2
16-17	201	48
18-19	104	24.8
Gender		
Female	207	49.4
Male	212	50.6
Family size		
Small (≤ 4 members)	214	51.1
Medium (5–6 members)	185	44.2
Large (≥ 7 members)	20	4.8
Nutritional status		
Normal weight	299	71.4
Overweight	110	26.3
Obese (Median = 2, Min = 2, Max = 4)	10	2.4
Dietary patterns;Fast food consumed		
Mostly (more than 5 days in a week)		
Often (2 to 5 days in a week)	70	16.7
Sometimes (less than 2 days in a week)	295	70.4
Never	52	12.4
Sugary beverage consumed		
Mostly (more than 5 days in a week)	2	0.5
Often (2 to 5 days in a week)	26	6.2
Sometimes (less than 2 days in a week)	262	62.5

Variables	Frequency (N)	Percentage (%)
Never	129	30.8
Fried snacks consumed	2	0.5
Mostly (more than 5 days in a week)		
Often (2 to 5 days in a week)	15	3.6
Sometimes (less than 2 days in a week)	220	52.5
Never	181	43.2
Sweets or candies consumed	3	0.7
Mostly (more than 5 days in a week)		
Often (2 to 5 days in a week)	5	1.2
Sometimes (less than 2 days in a week)	115	27.4
Never	297	70.9
	2	0.5

Table 2 shows availability of junk food outlets between home and school was high across all categories: 77.3% of students reported encountering five or more fast food shops versus 22.7% reporting fewer, 81.1% reported five or more sweet beverage outlets versus 18.9% fewer, 80% reported five or more snack shops versus 20% fewer, and 36.8% reported five or more

sweets shops versus 63.2% fewer. Exposure to junk food marketing was most frequently reported via billboards/posters (80.4%), social media (79.0%), and magazines/newspapers (68.3%). Peer influence was also notable, with 39.1% of students strongly agreeing and 52.3% agreeing that their peers influenced their junk food choices.

Table 2 Frequency and percentage of environmental and social factors of respondents (n = 419)

Variables	Frequency (N)	Percentage (%)
Availability of junk food between home and school:		
Fast food shops		
Less than 5 shops	95	22.7
5 or more than 5 shops	324	77.3
Sweet beverage shops		
Less than 5 shops	79	18.9
5 or more than 5 shops	340	81.1
Snacks shops		
Less than 5 shops	84	20
5 or more than 5 shops	335	80
Sweets Shops		
Less than 5 shops	265	63.2
5 or more than 5 shops	154	36.8
Exposure to junk food advertising		
Television	30	7.2
Social media	331	79
Billboards/Posters	337	80.4
Magazines/Newspapers	286	68.3
Peer Influence		

Variables	Frequency (N)	Percentage (%)
Influenced by my peers' choices when it comes to consuming junk food		
Strongly agree	164	39.1
Agree	219	52.3
Neutral	36	8.6

The chi-square test revealed several key individual determinants of high junk-food consumption. Age was significantly associated ($p = 0.018$), with mid-adolescents (16–17 years) showing the highest rate of high consumption (54.2%) compared to 36.8% of 15-year-olds and 50% of 18–19-year-olds. Nutritional status was

also related ($p = 0.025$): 59.1% of overweight and 60.0% of obese students were high consumers, versus 44.1% of their normal-weight peers. Finally, frequent fried-snack ($p = 0.006$) and sweets ($p = 0.006$) consumption were each significantly linked to higher junk-food intake (Table 3).

Table 3 Association between individual factors and junk food consumption behavior of respondents

Variables	Junk Food Consumption Behavior			P-value*
	Low n (%)	Moderate n (%)	High n (%)	
Gender				
Female (n = 207)	54 (26.1%)	55 (26.6%)	98 (47.3%)	0.644
Male (n = 212)	59 (27.8%)	48 (22.6%)	105 (49.5%)	
Age				
15 (n = 114)	43 (37.7%)	29 (25.4%)	42 (36.8%)	0.018*
16 to 17 (n = 201)	43 (21.4%)	49 (24.4%)	109 (54.2%)	
18 to 19 (n = 104)	27 (25.9%)	25 (24.03%)	52 (50%)	
Nutritional Status				
Normal (n = 299)	92 (30.7%)	75 (25.08%)	132 (44.1%)	0.025*
Overweight (n = 110)	18 (16.3%)	27 (24.5%)	65 (59.09%)	
Obese (n = 10)	3 (30%)	1 (10%)	6 (60%)	
Dietary Patterns				
Fried snacks;				
Low (n = 184)	57 (30.98%)	54 (29.3%)	73 (39.7%)	0.006*
High (n = 235)	56 (23.8%)	49 (20.8%)	130 (55.3%)	
Sweets;				
Low (n = 297)	92 (31%)	74 (24.9%)	131 (44.1%)	0.006*
High (n = 122)	21 (17.2%)	29 (23.8%)	72 (50.02%)	

* P-value by Chi-square Test

Chi-square analyses identified several environmental and social exposures linked to high junk-food consumption. Students passing fewer than five fast-food outlets on their route to school were much more likely to be high consumers (63.1% vs. 44.1%, $p = 0.004$), and a similar trend held for sweet-beverage shops (62% vs. 45.3%, $p = 0.014$). Greater exposure to social-

media marketing (49.8% vs. 43.2%, $p = 0.039$) and to billboards/posters (49.85% vs. 42.7%, $p = 0.02$) was also associated with higher intake. Finally, peer influence emerged as a powerful driver: 50.8% of students reporting peer pressure were high consumers versus only 21.2% of those without peer influence ($p = 0.001$) (Table 4).

Table 4 Association between environmental and social factors and junk food consumption behavior of respondents

Variables	Junk Food Consumption Behavior			P-value*
	Low n (%)	Moderate n (%)	High n (%)	
Food shops between home and school; Fast food shops				
Less than 5 shops (n = 95)				
5 or more than 5 shops (n = 324)	17 (17.9%)	18 (18.9%)	60 (63.1%)	0.004*
Sweet beverage shops				
Less than 5 shops (n = 79)				
5 or more than 5 shops (n = 340)	19 (24.05%)	11 (13.9%)	49 (62.02%)	0.014*
Exposure to marketing				
94 (27.6%)		92 (27.05%)	154 (45.3%)	
Social media				
Exposed (n = 331)				
Not exposed (n = 88)	80 (24.2%)	86 (26%)	165 (49.8%)	0.039*
Billboards/Posters				
Exposed (n = 337)	33 (37.5%)	17 (19.32%)	38 (43.2%)	
Not exposed (n = 82)	81 (24.03%)	88 (26.1%)	168(49.85%)	0.02*
Peer influence				
No influence (n = 33)	32 (39.02%)	15 (18.3%)	35 (42.7%)	
Influence (Yes) (n = 386)	17 (51.5%)	9 (27.3%)	7 (21.2%)	0.001*
	96 (24.9%)	94 (24.35%)	196 (50.8%)	

* P-value by Chi-square Test

Table 5 presents the results of the ordinal logistic regression analysis identifying key predictors of junk food consumption among secondary school students. Overweight/obese students were about 1.9 times more likely to consume junk food at higher levels than those with normal weight (95% CI: 1.26–2.87, p = 0.002). High intake of sweets and fried snacks was also associated with increased consumption, with adjusted odds of 1.9 (95% CI: 1.27–2.88, p = 0.002) and 1.7 (95% CI: 1.23–2.45, p = 0.004), respectively.

Students passing fewer than five fast food shops or sugary beverage shops on their school route had higher odds of junk food consumption (Adj. OR = 2.1, 95% CI: 1.34–3.32, p = 0.001; and Adj. OR = 1.72, 95% CI: 1.07–2.77, p = 0.027). Exposure to billboard/poster advertisements was linked to higher consumption (Adj. OR = 1.6, 95% CI: 1.03–2.51, p = 0.039). Peer influence showed the strongest effect, with students being 3.4 times more likely to consume junk food at higher levels (95% CI: 1.7–6.7, p < 0.001).

Table 5 Ordinal logistic regression

Variables	Adj.OR	95% C.I of OR		P-value*
		Lower	Upper	
Nutritional status (BAZ status)	Normal	1		
	Overweight/ Obese	1.91	1.26	2.87
Dietary patterns Sweets	Low	1		
	High	1.912	1.27	2.88

Fried snacks	Low	1			
	High	1.7	1.23	2.445	0.004*
Fast food shops	Less than 5 shops	2.11	1.34	3.32	0.001*
	5 or more than 5 shops	1			
Sugary beverage Shops	Less than 5 shops	1.72	1.07	2.77	0.027*
	5 or more than 5 shops	1			
Peer Influence	Influenced	3.4	1.724	6.71	< 0.001*
	No influenced	1			
Exposure to junk food marketing					
Social media	Exposed	1.53	0.99	2.37	0.056
	No exposed	1			
Billboards/posters	Exposed	1.605	1.03	2.51	0.039*
	No exposed	1			

Notes: n = 419, Adj. OR = Adjusted Odds Ratio, CI = Confidence Interval, *p ≤ 0.05

DISCUSSION

This study examined the food environment and related factors influencing junk food consumption among secondary school students in Biratnagar, Nepal. Nearly three-quarters of students reported moderate to high junk food intake, consistent with a previous study in Pokhara, Nepal (7). Overweight and obese students were significantly more likely to have high junk food consumption compared to those with normal weight (3, 6). Mid-adolescents (16–17 years) showed higher intake, aligning with evidence that junk food consumption peaks during this age (19). Frequent consumption of fried snacks and sweets was also significantly associated with higher intake, similar to findings from the Pokhara study (7).

Environmental and social factors had strong effects. Students passing fewer than five fast-food or sugary beverage outlets were more likely to consume junk food. The result aligns with previous studies highlighting that adolescents who live near school and walk to school have more chances to buy and consume junk food, while those using motorized transport make fewer spontaneous purchases despite

passing more outlets (18). Exposure to billboard/poster advertisements also showed a significant association with increased intake (16, 17). Peer influence was the strongest predictor, with students experiencing peer pressure being 3.4 times more likely to report high junk food consumption. The results align with another study of Nepal (20).

CONCLUSION

This study found that nearly half of Biratnagar secondary students are high junk-food consumers, with greater intake linked to overweight/obese status, and an “obesogenic” environment of dense fast-food, and sugary-drink vendors, dietary patterns (sweets and fried snacks), and billboard advertising exposure. Peer pressure emerged as the strongest predictor, underscoring the need for interventions that reshape social norms and environmental cues.

RECOMMENDATIONS

Policy measures should include zoning restrictions on fast-food outlets near schools and excise taxes on sugar-sweetened beverages.

School-based interventions, such as peer-led nutrition clubs, social-norms-driven behavior-change campaigns, subsidized healthy snacks, and on-school fruit vending, can improve access to nutritious options. Community and parental workshops on affordable, nutrient-dense meal preparation will reinforce these efforts and support sustained dietary change.

LIMITATIONS

It includes the cross-sectional design, which prevents causal inference, and reliance on self-reported dietary, environmental, and social measures, risking recall and social-desirability bias. Food-outlet exposure was based on student recall rather than objective counts, potentially misclassifying the environment. Results may not generalize beyond urban and semi-urban Biratnagar, and unmeasured factors (e.g., physical activity, cultural influences) could also affect consumption and nutritional status.

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FACTORS ASSOCIATED WITH POOR SELF-RATED HEALTH IN OLDER ADULTS RECEIVING OUTPATIENT NCD CARE IN HPA-AN DISTRICT, KAYIN STATE, MYANMAR

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ABSTRACT

Introduction: Population ageing is accelerating in low- and middle-income countries like Myanmar, where adults aged ≥ 60 are projected to exceed 20% by 2050. This shift increases the burden of noncommunicable diseases (NCDs), particularly in resource-limited settings. Older adults with NCDs often face comorbidities and socioeconomic challenges that affect their well-being. While self-rated health (SRH) is a known predictor of morbidity and mortality, its determinants in Myanmar's older NCD population remain unclear. This study examined factors associated with poor SRH among older outpatient attendees.

Methodology: In this cross-sectional study, 306 older adults aged ≥ 60 years with NCDs were enrolled from two purposively selected clinics in Hpa-an district, Kayin State, Myanmar. Multistage sampling targeted patients based on clinic volume and accessibility. Trained interviewers administered a structured questionnaire covering: (1) socio-demographics/economics, (2) health status, and (3) self-rated health. Data were analyzed using SPSS version 29.0.1.0 (171), with statistical significance set at $p < 0.05$. Prevalence estimates, Chi-square tests, and multivariate logistic regression (good health as reference) were analysed.

Results: Participants' mean age was 62.5 ± 2.5 years; 68.3% were female, 78.4% aged 60–64 years, and 57.5% had monomorbidity. Overall, 67.3% rated their health as poor. In bivariate analyses, good health was associated with younger age, male gender, higher education, informal employment, higher income, shorter disease duration, married status, no family financial support, and monomorbidity (all $p < 0.05$). In multivariable analysis, the following increased odds of poor self-rated health: age 65–69 versus 60–64 years (aOR 2.90; 95% CI 1.30–6.48), primary-school (aOR 3.16; 95% CI 1.26–7.91) or no formal education (aOR 6.57; 95% CI 1.80–23.94) versus university, partial (aOR 2.94; 95% CI 1.12–7.71) or full family support (aOR 3.20; 95% CI 1.31–7.79) versus none, and multimorbidity versus monomorbidity (aOR 2.21; 95% CI 1.22–4.00).

Conclusion: Poor self-rated health was found to be prevalent among older adults with NCDs in Hpa-an. Advanced age, lower education, family financial dependence, and multimorbidity are independent predictors. Incorporating routine self-rated health screening and targeted social and clinical interventions may improve outcomes in this vulnerable group.

Keywords: self-rated health, NCDs, older adults

INTRODUCTION

Population ageing has become a defined global trend. Since the early 21st century, global life expectancy at birth has increased from 66.8 years in 2000 to 71.4 years in 2020, contributing to a rising number and proportion of older adults worldwide (1). Individuals aged 65 and older represent the fastest-growing demographic, projected to increase from 9% to 16% by 2050—meaning one in six people globally will be 65 or

older (2). This shift is occurring most rapidly in low- and middle-income countries (LMICs), which are expected to house two-thirds of the world's older population by 2050 (3). Southeast Asian countries, including Myanmar, are undergoing similar demographic and epidemiological transitions. In Myanmar, the proportion of those aged ≥ 60 is projected to rise from 6.6% in 1990 to 22.2% by 2050 (4). According to the 2014 census, the share of adults

aged ≥ 60 is expected to grow from 9.1% in 2015 to over 20% by 2050, exceeding global averages (5).

As the demographic trend of the world is changing and the world population become older, new public health challenges of the 21st century have emerged. Chief among these is the growing burden of chronic non-communicable diseases (NCDs) in older populations. NCDs are now the leading cause of death globally, responsible for approximately 74% of all deaths (6). Out of all NCD deaths, more than 75% occur in middle and low-income countries (7). WHO also report that adults in low and lower-middle income countries are twice as likely to die from NCDs as adults in high-income countries. A striking proportion of these are premature: over half of NCD fatalities in South-East Asia occur before 70 years of age (8). In 2018, NCDs were responsible for 72% of all mortality in Myanmar (9). The prevalences of hypertension and diabetes among the older adults are also rising, 71% and 20% respectively (10, 11). The growing burden of NCDs in Myanmar's older population is of special concern: with more seniors living longer, managing chronic disease, and preventing complications in this group is a critical public health challenge.

Epidemiological data indicate that while life expectancy has risen, healthy life expectancy has not, meaning older adults often spend prolonged periods in poor health and require considerable care and support (3). Ensuring health systems adapt to this "silver tsunami" of ageing and NCDs is therefore a critical global health priority (3, 6). All countries face difficulties in developing "age-ready" health and social services to cope with the complex needs of an ageing society, underlining the importance of research into factors affecting older adults' health outcomes.

Self-rated health (SRH) – usually assessed by a single question like "How would you rate your health?" – has emerged in gerontology and public health as a simple but powerful summary measure of overall health status. An individual's SRH provides a holistic self-assessment of health and has proven to be a remarkably strong predictor of important outcomes, including the onset of illness, functional decline, and mortality (12). In fact,

numerous studies have shown that older adults who rate their health as "poor" face significantly higher risks of mortality in subsequent years compared to those with more positive self-ratings. Notably, this predictive power persists even after accounting for objective clinical indicators (such as diagnosed conditions or functional status), suggesting that SRH captures dimensions of health not fully reflected in standard medical assessments. In other words, seniors' subjective health ratings seem to "fill in the gaps" by integrating subtle health information (13).

Given Myanmar's ageing population and high NCD burden, understanding how older adults perceive their health – and what factors contribute to poor self-rated health – is of considerable importance. Routine clinical assessments in low-resource settings often overlook patients' subjective health experience. However, SRH is closely linked to future morbidity and mortality. There is currently a knowledge gap regarding SRH among older people with NCDs in Myanmar. While SRH has been extensively studied in high-income countries, far less is known about its determinants in Myanmar context. Older adults in Myanmar face unique socioeconomic and healthcare challenges that may influence their health perceptions. Access to chronic disease care in rural areas like Kayin State can be hindered by travel distance, conflict, and resource constraints. These contextual factors could all impact how an older NCD patient gauges his or her own health. Understanding the correlations of poor SRH in this group can provide insight into unmet needs and help identify vulnerable subgroups for intervention.

Therefore, we conducted the present study to investigate factors associated with poor self-rated health among older adults receiving outpatient NCD care in Hpa-an District, Kayin State, Myanmar. Specifically, the study sought to determine the prevalence of poor self-rated health in this population and to examine the associations between patients' self-rated health and various characteristics, including their sociodemographic profile and health status (e.g., number and duration of NCDs).

METHODOLOGY

This study utilized a cross-sectional design to investigate factors associated with poor self-rated health among older adults. Data collection was conducted in March 2025 in Hpa-an Township, Hpa-an District, Kayin State, Myanmar. Hpa-an Township, as the capital of Kayin State, was selected due to its considerable proportion of older adults, comprising approximately 10.4% of its total population (14). The sample size of 306 was estimated using Cochran's formula, assuming a 95% confidence level, 5% margin of error, and an expected prevalence of poor self-rated health of 29% (26). Two clinics were purposively selected for their high patient volumes, accessibility, and key role in providing specialized NCD care for older adults in Hpa-an Township. From 930 eligible older adults (≥ 60 years) attending NCD clinics, 306 were selected through systematic random sampling, using a sampling interval of 3 and a random start between 1 and 3. Inclusion criteria included individuals aged ≥ 60 years residing in Hpa-an Township who attended outpatient clinics for NCD treatment. Exclusion criteria included older adults diagnosed with cognitive impairment that precluded participation or those who declined consent.

Data was collected using a structured, self-developed questionnaire tailored specifically to the study objectives. The questionnaire comprised three main sections: (1) socio-demographic characteristics, (2) health status, and (3) self-rated health. Socio-demographic data included age, gender, residential area, educational attainment, current occupation, marital status, household composition, average monthly income, financial support status, and unhealthy lifestyle behaviors (current use of one or more of the following: smoking, alcohol consumption, and betel quid chewing). Health status questions addressed types of diagnosed chronic diseases, and duration since diagnosis.

The self-rated health section employed the Organization for Economic Co-operation and Development (OECD) measurement (15), which captured respondents' subjective health perceptions through a 5-point scale: "very good," "good," "moderate," "poor," and "very poor."

The questionnaire was initially developed in English, translated into Burmese by an experienced lecturer from the College of Public Health Sciences at Chulalongkorn University, and reviewed for linguistic accuracy and cultural relevance. Content validity was assessed by three public health experts, and reliability was tested through a pilot study to ensure consistency and clarity of the questionnaire.

Data collection was conducted by trained interviewers who administered face-to-face structured interviews. Interviewers received comprehensive training covering questionnaire administration, ethical considerations, and data management protocols to maintain data integrity and respondent confidentiality.

Descriptive statistics were computed for categorical variables and presented as frequencies and percentages. Inferential analysis involved two main steps. First, a bivariate analysis Chi-square was performed to identify associations between independent variables and self-rated health status, with a p-value threshold of < 0.2 (15). Variables meeting this criterion were subsequently included in a multiple logistic regression analysis to ascertain their independent associations with the dependent variable - self-rated health status. The dependent variable was dichotomized for logistic regression analyses: "very good" and "good" were categorized as "good health" (coded as 1), whereas "moderate," "poor," and "very poor" were categorized as "less than good health" (coded as 2). Variables with p-values below 0.05 in the multivariate logistic regression model were considered statistically significant and reported accordingly.

Ethical Considerations

Ethical approval for the study protocol was obtained from the Ethical Committee of Chulalongkorn University (COA 050/68), issued on February 20, 2025. All study participants provided informed consent prior to participation, and data confidentiality was strictly maintained throughout the study period.

RESULTS

Table 1 presents sociodemographic and clinical characteristics of the 306 older adults enrolled. Participants had a mean age of 62.48 ± 2.54 years, predominantly aged 60–64 years (78.4%), and were mostly female (68.3%). Education varied, with 32.4% completing primary school, 20.3% middle school, 9.8% high school, 22.5% university, and 14.7% having no

formal education. The majority were married (71.2%), with 63.1% earning less than 0.5 million kyat monthly.

Unhealthy behaviors were reported by 39.5%. Family financial support was full for 50.0%, partial for 11.8%, and absent for 38.2%. Disease duration since diagnosis was predominantly 1–5 years (51.6%), with 57.5% having monomorbidity and 42.5% multimorbidity.

Table 1 Socio-demographic and clinical characteristics

Socio-demographic and clinical characteristics	Total n = 306	
	Number	%
Age		
60 - 64	240	78.40%
65 - 69	66	21.60%
Mean ± SD	62.48±2.54	
Gender		
Male	97	31.70%
Female	209	68.30%
Education		
University	69	22.50%
High School	30	9.80%
Middle School	62	20.30%
Primary School	99	32.40%
No Education	45	14.70%
Marital Status		
Married	218	71.20%
Single	88	28.80%
Income		
No income	10	3.30%
Less than 0.5 million kyat	193	63.10%
More than 0.5 million kyat	103	33.70%
Unhealthy behavior*		
Absent	185	60.50%
Present	121	39.50%
Family Financial Support		
No support	117	38.20%
Partial support	36	11.80%
Family support	153	50.00%
Duration of the disease		

Socio-demographic and clinical characteristics	Total n = 306	
	Number	%
More than 10 years	34	11.10%
5 - 10 years	86	28.10%
1 - 5 years	158	51.60%
Less than one year	28	9.20%
Comorbidities		
monomorbidity	176	57.50%
multimorbidities	130	42.50%

Table 2 indicates that only 32.4% (n=99) of participants rated their health as "good," while 67.3% (n=206) rated it as "poor."

Table 2 prevalence of self-rated health among participants

Self-rated health	Total n = 306	
	Number	%
Good health	99	32.40%
Less than good health	206	67.30%

Table 3 highlights significant associations between self-rated health and participant characteristics. Younger age (60–64), male gender, higher education, informal

employment, higher income, shorter disease duration, married status, lack of family financial support, and monomorbidity were significantly had significantly poorer self-rated health.

Table 3 Significant associations between self-rated health and participant characteristics

Characteristics	Number (%)		p-value
	Good health (n= 99)	Poor health (n = 206)	
Age			
60 - 64	89(89.9)	151(73.3)	<.001
65 - 69	10(10.1)	55(26.7)	
Gender			
Male	39(39.4)	58(28.2)	0.048
Female	60(60.6)	148(71.8)	
Education			
University	34(34.3)	35(17.1)	<.001
High School	11(11.1)	19(9.3)	
Middle School	24(24.2)	38(18.5)	
Primary School	25(25.3)	73(35.6)	
No Education	5(5.1)	40(19.5)	
Occupation			

Characteristics	Number (%)		p-value
	Good health (n= 99)	Poor health (n = 206)	
Informal	53(53.5)	74(35.9)	<.001
Employed	16(16.2)	20(9.7)	
Dependent	30(30.3)	112(54.4)	
Income			
More than 0.5 million kyat	47(47.5)	56(27.2)	0.002
Less than 0.5 million kyat	50(50.5)	142(68.9)	
No income	2(2)	8(3.9)	
Duration of the disease			
More than 10 years	7(7.1)	27(13.1)	0.002
5 - 10 years	21(21.2)	64(31.1)	
1 - 5 years	54(54.5)	104(50.5)	
Less than one year	17(17.2)	11(5.3)	
Marital status			
Married	80(80.8)	138(67)	0.012
Single	19(19.2)	68(33)	
Family financial support			
No support	61(61.6)	56(27.2)	<.001
Partial support	8(8.1)	28(13.6)	
Family support	30(30.3)	122(59.2)	
Comorbidities			
Monomorbidity	70(70.7)	105(51)	0.001
Multimorbidities	29(29.3)	101(49)	
Unhealthy behavior			
No unhealthy behavior	54(54.5)	131(63.6)	0.13
Unhealthy behavior	45(45.5)	75(36.4)	

Unhealthy behavior – presence of one or more current use of cigarette smoking, drinking and betel chewing

In multivariable logistic regression (Table 4), older age (65–69 years; adjusted OR=2.61, 95% CI: 1.19–5.71), partial family support (adjusted OR=2.83, 95% CI: 1.09–7.39),

full family support (adjusted OR=2.94, 95% CI: 1.34–6.47), and multimorbidity (adjusted OR=2.22, 95% CI: 1.23–4.01) significantly increased odds of poor self-rated health.

Table 4 Multivariable logistic regression

	B	S.E.	p-value	Adjusted OR	95% C.I.for aOR	
					Lower	Upper
Age						
60 - 64				Reference		
65 - 69	1.064	0.410	0.010*	2.90	1.297	6.476
Education						
University				Reference		
High School	0.644	0.552	0.244	1.90	0.645	5.620

	B	S.E.	p-value	Adjusted OR	95% C.I.for aOR	
					Lower	Upper
Middle School	0.457	0.470	0.331	1.58	0.629	3.965
Primary School	1.149	0.469	0.014*	3.16	1.258	7.911
No Education	1.883	0.660	0.004*	6.57	1.803	23.937
Family financial support						
No family support				Reference		
Partial support	1.077	0.493	0.029*	2.94	1.117	7.708
Full support	1.162	0.455	0.011*	3.20	1.310	7.794
Comorbidities						
Monomorbidity				Reference		
Multimorbidities	0.792	0.304	0.009*	2.20	1.217	4.001
Presence of unhealthy behaviors						
No unhealthy behavior				Reference		
Unhealthy behavior	-0.605	0.320	0.059	0.55	0.292	1.022

* $p < 0.05$

DISCUSSION

In the present study, poor self-rated health was highly prevalent among older adults receiving outpatient NCD care in Hpa-an District. We found that 67.3% of participants rated their health as poor. By comparison, a study conducted in community in Malaysia reported lower rates of poor SRH in general older populations (32% in Malaysian elders) (16). This could be because participants in our study already had one or more NCDs and were receiving outpatient care.

Advancing age was a significant predictor of poorer SRH in our study. Participants in their late 60s were far more likely to report poor health than those in their early 60s. This is consistent with previous studies, both cross-sectional and longitudinal, in that, with each passing age, self-rated health declines (17, 18). As people age, they tend to accumulate chronic conditions, physical limitations, and frailty, all of which can degrade one's perceived health. In Myanmar, today's older adults have lived through decades of limited healthcare access and economic hardship, especially in rural areas. Many still face barriers to care (e.g., distance to clinics or cost of services). Such lifetime and current challenges could exacerbate age-related

health deterioration, making older patients in Myanmar more prone to feeling their health is poor. Overall, our finding reinforces that even among older adults, age matters – the oldest patients bear the greatest burden of poor SRH, likely reflecting cumulative health deficits over time.

Lower educational attainment was another significant predictor of poorer self-rated health (SRH) among older adults. Specifically, individuals with primary education or lower demonstrate significantly higher odds of reporting poor health when compared to those possessing a university-level education. Previous studies in the United States and India also showed that people with higher education attainment reported more “good health” compared to their counterparts (19, 20). Our finding aligns with existing literature that establishes a link between socioeconomic status and health perceptions, consistently indicating that individuals with less education tend to report poorer SRH. A possible explanation is that educated older adults may possess greater health knowledge, and the use of health services compared to their less educated counterparts

We found that older adults who depended on family for financial support were significantly more prone to poor SRH. In fact, those receiving partial or full support from their family had roughly three times higher odds of poor health rating compared to those not receiving any family financial support. This is consistent with another study in China where there was a significant negative association between the financial support provided by children and the physical health of older people. Specifically, increased financial support from children correlated with poorer physical health outcomes for older adults (21). In the context of Myanmar, these findings can be understood against the prevailing social and economic conditions affecting older adults. The absence of a universal social security in Myanmar means family support serves as the primary safety net, a cultural norm where adult children are expected to provide for their aged parents.

However, the necessity of such support often implies that an older individual lacks independent income or savings. Within our study area of Kayin State, where many families are subsistence farmers or informal workers, an older patient unable to contribute economically may experience feelings of being a burden. This, in turn, could negatively impact their subjective health rating.

Multimorbidity emerged as another significant predictor of poor self-rated health in this study. Older adults diagnosed with two or more chronic non-communicable diseases (NCDs), such as diabetes co-occurring with hypertension, were substantially more likely to report poor health compared to those with a single chronic condition. This finding aligns with prior research conducted in countries across various income levels. For instance, multiple studies from Japan, India, and Nepal have consistently reported that older adults with multimorbidity have lower odds of self-rated good health (20, 22, 23). This result is

unsurprising as each additional disease adds to the burden. Patients with multimorbidity often face more symptoms, medications, and functional limitations, which can worsen their overall health perception. In low-resource settings like Myanmar, limited access to care and high out-of-pocket costs for multiple medications pose significant challenges. In Kayin State, geographic remoteness and intermittent conflict further disrupt continuity of care. As a result, older adults may not receive adequate treatment, leading to persistent symptoms and health-related anxiety. These findings highlight multimorbidity as a key factor influencing poor self-rated health, consistent with evidence from other countries.

The findings of this study align with Andersen's Behavioral Model of Health Services Use (25), which explains health outcomes through predisposing, enabling, and need factors. Advancing age and low educational attainment serve as predisposing factors influencing health perceptions, while financial dependence reflects limited enabling resources that may hinder care access. Multimorbidity represents a need factor indicating greater health burden. In the Myanmar context, where structural barriers persist, these factors interact to shape poor self-rated health among older adults with NCDs.

RECOMMENDATIONS

Routine screening for self-rated health (SRH) should be incorporated into regular outpatient assessments for older adults in Myanmar, particularly within NCD care settings, as it provides a brief, valid, and powerful summary measure—predicting future morbidity and mortality often better than objective indicators (24). Healthcare providers should prioritize patients who are older, have lower educational attainment, depend on family financial support, or experience multimorbidity, given their increased risk for poor SRH. Health education targeted to less educated older adults and economic empowerment initiatives to reduce dependence on family support. Additionally,

expanding healthcare access and specialized care services in rural and conflict-affected areas, such as Kayin State, is critical to managing multimorbidity effectively. Policy interventions should focus on implementing a universal social security system to alleviate financial burdens and enhance autonomy among older populations.

LIMITATIONS

The findings of this study offer crucial insights for both healthcare providers and policymakers. For healthcare providers, these results underscore the practical value of incorporating Self-Rated Health (SRH) assessments into routine clinical practice. This integration can facilitate the early identification and targeted management of older adults at higher risk of experiencing poor health. Furthermore, healthcare policymakers can leverage these evidence-based insights to inform strategic decisions aimed at strengthening healthcare systems, mitigating health disparities, and ultimately improving the overall health outcomes for older populations within Myanmar.

However, the cross-sectional design limits causative inferences. Self-reporting of health status could introduce reporting bias, and the study's geographic limitation to Hpa-an District restricts generalizability to other regions. Additionally, the relatively small sample size may limit the statistical power to detect weaker associations. Future research should consider longitudinal designs and broader geographic sampling to validate these findings further.

CONCLUSION

Poor self-rated health is prevalent among older adults with NCDs receiving outpatient care in Hpa-an District, Kayin State, Myanmar. Significant predictors identified include advanced age, lower educational attainment, dependence on family financial support, and multimorbidity. Addressing these factors through targeted clinical, social, and

policy interventions can significantly enhance the health perceptions and outcomes of this vulnerable population. Further research, particularly longitudinal studies, is essential to deepen understanding and inform more effective health system responses.

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COMPARATIVE ANTIOXIDANT CAPACITY AND POLYPHENOLIC PROFILES OF BENJAKUL CAPSULES AND THEIR INDIVIDUAL HERBAL INGREDIENTS

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ABSTRACT

Background: Benjakul (BJK) is a traditional Thai herbal formulation comprising five herbs: fruits of *Piper retrofractum* Vahl. (PRV), rhizomes of *Zingiber officinale* Roscoe. (ZOR), roots of *Piper sarmentosum* Roxb. (PSR), roots of *Plumbago indica* L. (PIL), and stems of *Piper interruptum* Opiz. (PIO) valued for its therapeutic potential for the treatment of inflammatory disorders. Recent interest in its antioxidant properties has prompted scientific validation of its efficacy.

Objective: This study aimed to evaluate the antioxidant activity and phenolic and flavonoid content of BJK capsules and its individual herbal components extracted with 99% ethanol.

Methodology: Extracts of the five herbs and BJK capsules were prepared using 99% ethanol through ultrasound-assisted extraction. The antioxidant activity was assessed via 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, while total phenolic content (TPC) and total flavonoid content (TFC) were quantified.

Results: ZOR extract showed the highest antioxidant activity (TPC: 348.38±13.27 mg GAE/100g, TFC: 350.84±9.65 mg QE/100g, DPPH IC₅₀: 104.46±28.68 µg/mL). PIO and BJK capsule extracts presented (TPC: 156.85±7.53 and 145.37±6.18 mg GAE/100g; TFC: 151.23±3.08 and 135.27±6.85 mg QE/100g; IC₅₀: 3009.33±229.05 and 1229.00±161.58 µg/mL). PRV, PSR and PIL extracts had lower values, with TPC ranging from 67.40 to 130.35 mg GAE/100g, TFC from 62.38 to 143.68 mg QE/100g, and IC₅₀ from 1648.33 to 6162.00 µg/mL.

Conclusion: These findings confirm the potent antioxidant property of BJK and its constituent herbs, particularly ZOR extract, supporting their traditional use. Further studies are recommended to identify bioactive compounds and explore in vivo applications for pharmaceutical development.

Keywords: Antioxidant, Benjakul, DPPH, Free radicals, Herbal formulation, Traditional medicine

INTRODUCTION

Benjakul (BJK) is a Thai traditional medicine included in Thailand's National Essential Drug List.

It is traditionally used to promote general health and well-being, regulate bodily imbalances, and relieve flatulence (1). BJK is primarily administered orally, traditionally as decoctions prepared from dried powders or liquors formulated by traditional Thai medicine practitioners. In contemporary practice, it is also available in capsule form for convenient oral consumption. It is composed of five medical plants components used in equal proportions: fruits of *Piper retrofractum* Vahl. (PRV), rhizomes of *Zingiber officinale* Roscoe. (ZOR), roots of *Piper sarmentosum* Roxb. (PSR), roots of *Plumbago indica* L. (PIL), and stems of *Piper interruptum* Opiz. (PIO). These plant parts are typically dried, ground into fine powder, and thoroughly blended prior to use or formulation. PRV commonly known as "long pepper", contains numerous bioactive compounds, with piperine identified as its signature alkaloid through extensive phytochemical analysis (2). Its fruits are traditionally utilized for their analgesic and anti-inflammatory properties (3). ZOR commonly known as "ginger", contains numerous bioactive compounds, including 6-gingerol and 6-shogaol (4), and its underground rhizome is widely used for both culinary and medicinal purposes (5). PSR is a traditional medicinal and edible plant in Southeast Asian countries, is used in its entirety or as parts, either alone or combined with other herbs, in folk remedies to treat various ailments (6), with its roots traditionally chewed to relieve symptoms of cough, asthma, and odontalgia (7). PIL with plumbagin as its primary active compound, is a natural naphthoquinone exhibiting a wide range of pharmacological activities against various diseases, with current extraction protocols targeting its roots as the primary source of this bioactive molecule (8). PIO contains bioactive

compounds such as crotepoxide, eupomatene, and pipericallosine extracted from its stems, which have traditionally been used as a carminative, stomachic, and tonic (9).

Several studies have demonstrated that the ethanolic extract of BJK exhibits diverse pharmacological activities across multiple experimental models. In vitro assays have shown cytotoxic effects against human lung cancer cell lines, including COR-23 and NCI-HI 688 (10, 11). Anti-inflammatory and anti-allergic activities have also been reported in in vitro studies (12). Furthermore, a clinical trial confirmed that BJK extract was as effective as diclofenac in alleviating symptoms of knee osteoarthritis, without inducing renal or hepatic toxicity (13). However, its antioxidant capacity has yet to be systematically evaluated. The antioxidant property is among the most thoroughly investigated characteristics of compounds obtained from natural sources. Oxidative stress, triggered by excess reactive oxygen species (ROS), superoxide, hydroxyl radicals, hydrogen peroxide, which from metabolism or environmental exposure (14), damages biomolecules, causes cell death and inflammation, disrupts physiological functions, and contributes to inflammation and chronic diseases (15). Herb plants contain natural antioxidants, such as polyphenols and flavonoids, which mitigate the harmful effects of oxidative stress (16). Phenolic compounds, characterized by at least one aromatic ring with one or more hydroxyl groups, exert antioxidant effects by reacting with free radicals through free radical neutralization and metal ion binding (17). The antioxidant mechanism of flavonoids involves stabilizing free radicals by donating electrons through resonant hydroxyl groups (18). These compounds act as free radical scavengers, reducing oxidative stress and potentially serving as alternative therapies for various human diseases.

This study aims to systematically evaluate the antioxidant activity of BJK extracts using DPPH, TPC, and TFC assays, investigate the relationship between their phenolic and flavonoid content and antioxidant capacity. To the best of our knowledge, this is the first study to conduct a comparative analysis of BJK capsules and their individual herbal components in this context, providing theoretical support for the use of BJK as a natural antioxidant.

METHODOLOGY

Plant Materials and Chemicals

The five dried plant species comprising BJK shown in Figure 1, along with the BJK capsule, were identified and sourced from Chao Phraya

Abhaibhubejhr Hospital and the Thai Traditional Medicine Museum in Prachinburi Province, Thailand. All plant materials were authenticated by botanists at the hospital. The plant materials were dried by the supplier using a two-step method, consisting of initial air-drying under shade followed by oven-drying. Each plant was processed into fine particulates using a mechanical grinder and maintained under ambient temperature conditions prior to application. All commercially available chemicals and solvents were analytical grade, purchased from commercial companies and used without further purification. Quercetin hydrate and gallic acid were purchased from Sigma Aldrich, Darmstadt, Germany.



Figure 1 Benjakul components of five medicinal plant parts.

Maceration Extraction

Each plant sample (20 g) was extracted using 99% ethanol (100 mL) at a solid-to-liquid ratio of 1:5, the ethanol was replaced every 24 hours followed by 6 hours of shaking and the extraction was continued until the plant material no longer released visible color into the solvent, indicating exhaustive extraction. After extraction, the solution was filtered using one filter paper (Whatman, Cat No. 1001-125, diameter 125mm), and the filtrate was

concentrated using rotary evaporation under reduced pressure at 78.3 °C, corresponding to the boiling point of ethanol. The distilled extract was then collected in a crucible, dried on a heater at 60°C for 18 hours until the successive extraction was obtained. The dried extracts were stored at -20 °C in airtight containers until further analysis. The extraction procedure was modified with reference to previously published studies (19). Extraction yields were calculated as a percentage of the dried extract relative to the initial dry weight of the plant material using Equation (1).

$$\%Yield = \frac{\text{Weight of extract (g)}}{\text{Weight of dried plant material used (g)}} \times 100 \quad (1)$$

2.2 Diphenyl-1-Picrylhydrazyl Radical Scavenging Activity

A 96-well plate was configured by adding 20 μL of sample extract solutions (conc. 0.3125, 0.625, 1.25, 2.5, 5 mg/mL) followed by 180 μL of 120 μM DPPH reagent in methanol, as described in a previous study (20). The plate was incubated under dark conditions at 37°C for 30

minutes, after which absorbance at 517 nm was quantified using a microplate reader. Quercetin served as the positive control, while methanol solvent functioned as the negative control. All experiments were performed in triplicate. Radical scavenging activity was calculated using Equation (2).

$$\%Inhibition = \frac{\text{Absorbance control} - \text{Absorbance sample}}{\text{Absorbance control}} \times 100 \quad (2)$$

Total Phenolic Content Determination

Each extract sample (50 μL , 1 mg/mL) was sequentially added to individual wells of a 96-well plate. Following this, 50 μL of 10% Folin–Ciocâlteu reagent was added to each well. The mixture was incubated under dark ambient conditions at room temperature for 20 minutes, after which 50 μL of 7.5% sodium carbonate

solution was added. A second 20-minute incubation period ensued, followed by absorbance measurement at 756 nm using a microplate reader. Gallic acid served as the standard reference for TPC and results were expressed as mg GAE/100g dry weight of extract. All experiments were performed in quadruplicate.

Total Flavonoid Content Determination

The 96-well plate was prepared by sequentially introducing extract samples (50 μL , 1 mg/mL). Each well received 10 μL of 10% aluminum chloride solution, followed by the addition of 150 μL ethanol and 10 μL 1 M sodium acetate solution. The mixture was subjected to darkroom incubation at room

temperature for 40 minutes, after which absorbance at 415 nm was measured using a microplate reader. Quercetin was used as the standard compound for TFC and results were expressed as mg QE/100g dry weight of extract. All experiments were performed in quadruplicate.

Statistical Analysis

One-way analysis of variance (ANOVA) was used to compare differences among groups, followed by multiple comparisons using Tukey's post hoc test. IC_{50} values for DPPH radical

scavenging activity were determined by nonlinear regression analysis based on dose–response curves. All data were presented as mean \pm standard deviation (SD) and were analyzed and visualized using GraphPad Prism Version 9.4.1.

RESULTS

Extraction Analysis

Using 99% ethanol maceration, the extraction yields of the plant components in the BJK formula showed marked variation. PIL produced the highest extract yield (11.90%, 2.38

g), whereas PIO yielded the lowest (2.58%, 0.52 g). Moderate yields were observed for PRV at 10.02% (2.00 g) and ZOR at 8.60% (1.72 g). In contrast, PSR and the BJK capsule powder exhibited relatively lower yields of 4.02% (0.80 g) and 4.86% (0.97 g), respectively. These

differences may be attributed to variations in phytochemical polarity, the ethanol permeability of plant tissues, and the structural complexity of plant matrices. Detailed extraction data are presented in Figure 2.

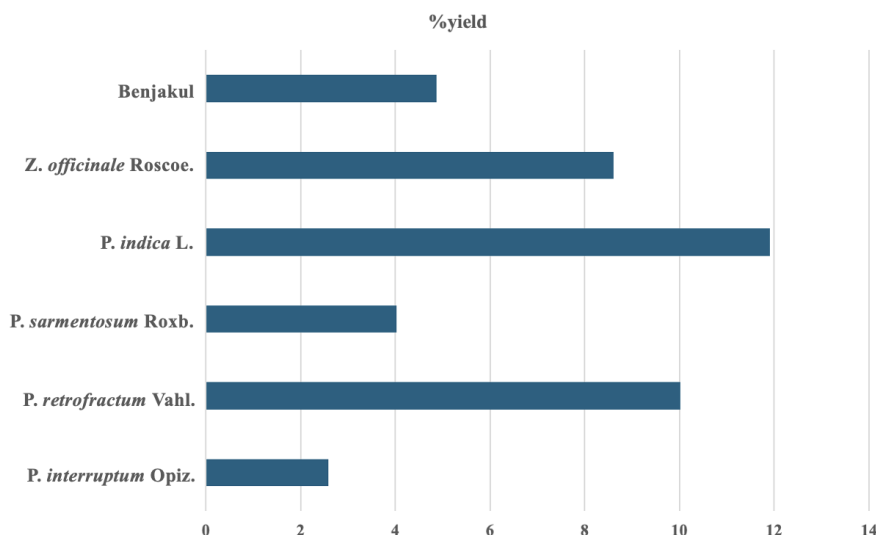


Figure 2 Extraction yields (% w/w) of BJK and its herbal components using 99% ethanol. (Values are based on dried sample weight)

Total Phenolic Content

The TPC expressed as mg GAE/100 g dry extract, varied significantly among the samples when compared with the BJK capsule extract (145.37±6.18 mg GAE/100 g). ZOR exhibited the highest TPC at 348.38±13.27 mg GAE/100 g, which was significantly higher than BJK capsule extract ($p < 0.0001$). PIO had a TPC of 156.85±7.53 mg GAE/100 g, which was slightly higher than BJK capsule extract but not statistically significant (ns). PRV showed a TPC of 130.35±6.83 mg GAE/100 g, which was significantly lower than BJK capsule extract

($p < 0.05$). PSR yielded 91.18±4.49 mg GAE/100 g, and PIL had the lowest TPC at 67.40±1.22 mg GAE/100 g, both of which were significantly lower than BJK capsule extract ($p < 0.0001$). These results indicate that ZOR substantially contributed to the overall phenolic content of the BJK formulation, while PSR and PIL contributed the least. Notably, only PIO exhibited a TPC level comparable to the Benjakul capsule, while all other ingredients showed either significantly higher or lower phenolic concentrations. The details were shown in Figure 3.

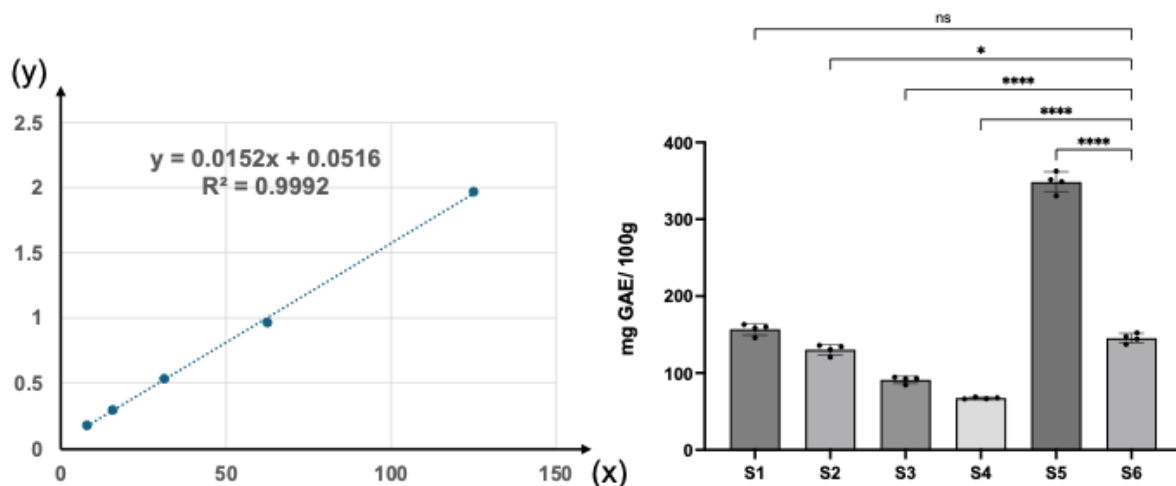


Figure 3 Total phenolic content analysis: linear regression and distribution of BJK and its composite. (Note: S1: *P. interruptum* Opiz.; S2: *P. retrofractum* Vahl.; S3: *P. sarmentosum* Roxb.; S4: *P. indica* L.; S5: *Z. officinale* Roscoe.; S6: Benjakul; **** $p < 0.0001$, * $p < 0.05$, ns = not significant)

Total Flavonoid Content

The TFC expressed as mg quercetin equivalent (QE)/100 g dry extract, showed statistically significant differences among the samples compared to the BJK capsule extract (135.27±6.85 mg QE/100 g). ZOR exhibited the highest TFC at 350.84±9.65 mg QE/100 g, significantly exceeding that of the BJK capsule extract ($p < 0.0001$). PIO had a TFC of 151.23±3.08 mg QE/100 g, slightly higher than BJK capsule extract, and the difference was statistically significant ($p < 0.01$). PRV showed a TFC of 143.68±6.66 mg QE/100 g, which was

not significantly different from BJK capsule extract (ns). PSR had a lower TFC of 76.68±1.03 mg QE/100 g, and PIL had the lowest TFC at 62.38±6.31 mg QE/100 g; both values were significantly lower than BJK capsule extract ($p < 0.0001$). These findings indicate that ZOR contributes substantially to the total flavonoid content of the formulation, while PIL and PSR provide relatively minor contributions. Interestingly, PIO also demonstrated higher flavonoid content than BJK capsule extract, further supporting its potential role in the formula's antioxidant profile. The details were shown in Figure 4.

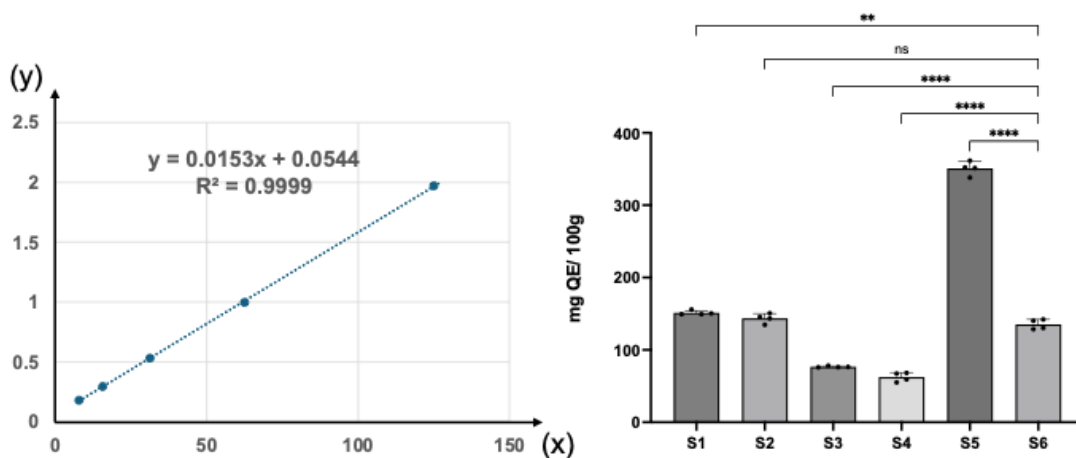


Figure 4 Total flavonoid content analysis: linear regression and distribution of BJK and its composite. (Note: S1: *P. interruptum* Opiz.; S2: *P. retrofractum* Vahl.; S3: *P. sarmentosum* Roxb.; S4: *P. indica* L.; S5: *Z. officinale* Roscoe.; S6: Benjakul; **** $p < 0.0001$, ** $p < 0.01$, ns = not significant)

2.2 Diphenyl-1-Picrylhydrazyl Radical Scavenging Activity

The DPPH assay results, expressed as IC₅₀ µg/mL, indicated the concentration of each sample required to inhibit 50% of DPPH free radicals, with lower values reflecting higher antioxidant activity. ZOR extract showed the lowest IC₅₀ at 104.46±28.68 µg/mL, demonstrating the strongest antioxidant activity,

followed by BJK capsule extract at 1229.00±161.58 µg/mL and PIL at 1648.33±210.78 µg/mL, both indicating potent free radical scavenging ability. PIO extract had an IC₅₀ of 3009.33±229.05 µg/mL, followed by PSR extract at 5607.00±565.06 µg/mL and PRV extract at 6162.00±953.39 µg/mL, suggesting moderate to lower antioxidant activity, with PRV extract being the least effective. The details were shown in Table 1.

Table 1 Antioxidant activity of BJK and its composite ethanol extracts determined by DPPH method.

Extract	DPPH (IC ₅₀ µg/mL)	Multiple comparisons
<i>P. interruptum</i> Opiz.	3009.33 ± 229.05	P=0.0026
<i>P. retrofractum</i> Vahl.	6162.00 ± 953.39	P<0.0001
<i>P. sarmentosum</i> Roxb.	5607.00 ± 565.06	P<0.0001
<i>P. indica</i> L.	1648.33 ± 210.78	P=0.7233
<i>Z. officinale</i> Roscoe.	104.46 ± 28.68	P=0.0500
Benjakul	1229.00 ± 161.58	/
Positive control (quercetin)	5.10 ± 0.48	/

Note: P-values indicate comparisons between each extract and Benjakul.

DISCUSSION

This study systematically evaluated the antioxidant properties of five medicinal plants in the Thai traditional medicinal formulation BJK and its composite capsule preparation using TPC, TFC, DPPH radical scavenging assays. The results revealed significant differences in antioxidant capacities among individual herbs and identified synergistic effects within the composite formulation, providing scientific evidence for its application in traditional medicine.

TPC and TFC assays were selected for their simplicity and standardization to quantify phenolic and flavonoid compounds, which are crucial in herbal formulations due to their antioxidant and anti-inflammatory properties. DPPH assay assessed free radical scavenging and electron transfer capabilities, respectively, complementarily characterizing antioxidant

potential (21). The results showed a clear parallel trend in TPC and TFC values across the samples. For instance, samples with higher TPC, such as ZOR (348.38±13.27 mg GAE/100g) and PIO (156.85±7.53 mg GAE/100g), also exhibited correspondingly high TFC (350.84±9.65 mg QE/100g and 151.23±3.08 mg QE/100g, respectively). This parallel pattern suggests that flavonoids constitute a significant portion of the total phenolic compounds in these extracts. ZOR extract exhibited superior activity across various antioxidant assays, with the highest TPC (348.38±13.27 mg GAE/100g), TFC (350.84±9.65 mg QE/100g), alongside the strongest DPPH radical scavenging capacity (IC₅₀: 104.46±28.68 µg/mL). This exceptional performance aligns with previous studies attributing ginger's efficacy to its rich phenolic content known for their outstanding free radical scavenging and metal ion reduction capabilities

(19). This direct alignment between ZOR's high phenolic content and its strong antioxidant activity strongly supports the established relationship between these phytochemicals and antioxidant potential. However, this relationship is not simple or absolute. PIO extract displayed notable DPPH scavenging activity (IC_{50} : $3009.33 \pm 229.05 \mu\text{g/mL}$), despite relatively moderate TPC and TFC values. This discrepancy suggests the presence of specific, highly effective free radical scavengers. Similarly, PIL extract despite lower phenolic content, showed strong DPPH activity (IC_{50} : $1648.33 \pm 210.78 \mu\text{g/mL}$). Previous literature indicates that specific compounds, such as unique flavonoid derivatives in PIO and naphthoquinone compounds in PIL, may exhibit potent free radical scavenging activities independent of their total phenolic content (22, 23). PRV extract exhibited TPC and TFC values comparable to BJK, but its antioxidant activity was lower (IC_{50} : $6162.00 \pm 953.39 \mu\text{g/mL}$), potentially indicating inefficient interaction of its phenolic structures with free radicals. This emphasizes that not all phenolic compounds equally contribute to antioxidant capacity, and structural specificity plays a crucial role in antioxidant efficiency (24). PSR extract showed lower TPC and TFC than other Piper species, with relatively weaker antioxidant activity (IC_{50} : $5607.00 \pm 565.06 \mu\text{g/mL}$). This lower activity may be linked to its reduced phenolic and flavonoid content. The BJK capsule formulation exhibited an intriguing antioxidant profile, with effects not simply equivalent to the sum of its components. Although its TPC ($145.37 \pm 6.18 \text{ mg GAE/100g}$) and TFC ($135.27 \pm 6.85 \text{ mg QE/100g}$) values were moderate compared to individual herbs, its DPPH scavenging activity (IC_{50} : $1229.00 \pm 161.58 \mu\text{g/mL}$) surpassed most single herb extracts, second only to ZOR and PIL extracts. This enhanced activity suggests potential synergistic interactions among the phytochemicals in the formulation. Overall, while there is a link

between phenolic and flavonoid contents and antioxidant capacity, chemical structures, the presence of non-phenolic compounds, and interactions among components significantly influenced the outcomes. BJK's high antioxidant activity likely stems from synergistic effects of diverse compounds in its multi-component formulation, enhancing free radical scavenging and electron transfer capabilities (25).

These findings have significant implications for BJK's application in Thai traditional medicine. The demonstrated antioxidant activity provides a scientific basis for its ethnopharmacological uses, particularly in conditions where oxidative stress plays a pathogenic role. The composite formulation's superior performance compared to most individual components validates the traditional wisdom of combining these specific herbs. Future studies should be employed by compound identification, cytotoxicity and in vivo validation.

LIMITATIONS

This study has several limitations include extraction solvent specificity, which may omit certain water-soluble antioxidants, the nonspecific nature of TPC and TFC assays, reliance solely on DPPH assay, and limited sample size restricting statistical correlation analyses. Future research should incorporate multiple antioxidant assays (ABTS, FRAP), advanced analytical techniques (LC-MS/MS, NMR), and larger sample sizes to validate findings and mechanistic insights comprehensively.

CONCLUSION

In conclusion, our study provides systematic evidence for the antioxidant potential of BJK and its constituent herbs. The findings not only validate traditional knowledge but also highlight phytochemical interactions worthy of further investigation. These results underscore the value of traditional herbal formulations as sources of bioactive compounds and emphasize

the importance of studying such holistic preparations to understand potential synergistic effects.

RECOMMENDATION

BJK's potent antioxidant activity provides scientific support for its traditional use in oxidative stress-related diseases. The superior performance of the composite formulation compared to most individual components validates the traditional wisdom of herbal combinations, highlighting the value of synergistic effects.

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