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College of Public Health Sciences
Chulalongkorn University

Mahidol University
ASEAN Institute
for Health Development

50th Anniversary of Institute for Population and Social Research, Mahidol University

The 12th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP)

July 12, 2021

The College of Public Health Sciences, Chulalongkorn University

Prof. Sathirakorn Pongpanich, Ph.D.
Chairperson, Executive Committee, 12th IGSCPP
Dean
The College of Public Health Sciences,Chulalongkorn University, Thailand
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Dear Colleagues:

On behalf of the College of Public Health Sciences, Chulalongkorn University and Scientific Committees of the 12th International Graduate Students Conference on Population and Public Health Sciences, I would like to welcome all of you to the College of Public Health Sciences. There will be a number of student presentations reflecting the broad diversity of public health issues. We hope you will take the advantage of this opportunity to participate in interesting discussions as well as to meet with new colleagues.

I would like to thank the conference co-chair Associate Prof. Dr. Aree Jampaklay, Director of Institute for Population and Social Research, Mahidol University and Asst. Prof. Dr. Phudit Tejativaddhana, MD, Director of ASEAN Institute of Health Development, Mahidol University as well as the members of the Organizing and Scientific Committees, colleagues and staff for their tireless efforts to organize this conference. I, as well, would also like to acknowledge significant support of Chulalongkorn University for this conference.

The success of the conference now rests upon your collective shoulders, in your presentations and participation. I encourage all of you to take in the experience as much as you can, to meet colleagues, to debate scientific perspectives, and of course, to take some time to enjoy the surroundings and Chulalongkorn University Campus.

Once again, welcome all of you to The 12th International Graduate Students Conference on Population and Public Health Sciences.

Associate Professor Dr.Aree Jampaklay
Co- Chairperson, Executive Committee, 12th IGSCPP
Director
Institute for Population and Social Research, Mahidol University, Thailand
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Dear Colleagues:

The International Graduate Students Conference on Population and Public Health Sciences (IGSCPP) has been held annually since 2010. Now in its 11th year, the conference continues to be a sustainable success because of the ongoing academic collaboration between three Institutes: The College of Public Health Sciences (CPHS), Chulalongkorn University, and the ASEAN Institute for Health Development (AIHD), and the Institute for Population and Social Research (IPSR), Mahidol University. The continued success of the conference proves that even faced with a considerable challenge, such as with COVID-19, nothing will prevent us from working together to make this conference happen.

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

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

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

Thank you.

Associate Professor Dr. Phudit Tejativaddhana
Co-Chairperson,Executive Committee, 12th IGSCPP
Director
ASEAN Institute for Health Development, MahidolUniversity,Thailand
www.aihd.mahidol.ac.th

Dear Colleagues:

On behalf of the organizing committee, I am honored to welcome you to the 12th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). This international conference is jointly organized by the College of Public Health Sciences, Chulalongkorn University, Institute for Social and Population Studies and ASEAN Institute for Health Development of Mahidol University. The collaboration between these three organizations has been strengthened for several years. I wish for further achievements, and hope for continued cooperation..

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

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

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

The 12th International Graduate Students Conference
on Population and Public Health Sciences (IGSCPP)
July 12, 2021
The College of Public Health Sciences, Chulalongkorn University

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Time	Program
8.30-8.45	**VDO Presentation &Welcome**
8.45-9.00	**Conference** **Welcome Report** **Welcome keynote:** *Professor Sathirakorn Pongpanich, Ph.D. Dean, College of Public Health Sciences, Chulalongkorn University* *Associate Professor Phudit Tejativaddhana, Ph.D., MD Director, ASEAN Institute of Health Development, Mahidol University* *Associate Professor Aree Jampaklay, Ph.D. Director, Institute for Population and Social Research, Mahidol University* **Conference Opening Keynote** *Professor Bundhit Eua-arporn, Ph.D. President of*
9.00-9.30	**Special Lecture:** COVID-19 and Its Impact on Mental Health *Andrea Bruni, MD, Psychiatrist* *Mental Health Technical Officer, WHO – Iraq (Baghdad) Chairperson & Co-chairperson:* *Assoc. Prof. Wattasit Siriwong, Ph.D. / Montakarn Chuemchit, Ph.D.*
9.30-9.40	**Short Break**
9.40-12.00	**Oral Presentation**
Room 1 (Host by CPHS)	**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
	Chairperson & Co-Chairperson *Wandee Sirichokchatchawan, Ph.D. / Asst. Prof. Dusita Phuenqsamran, Ph.D.* ***Outstanding awards committee:*** *Assoc. Prof. Cheerawit Rattanapan, Ph.D.*

Time	Program
Room 1 (Host by CPHS)	1) Variation of tuberculosis prevalence across geographical areas and tuberculosis diagnostic approaches (#01) *by Alvera Noviyani*
	2) Prevalence and factors associated with psychological aggression against the children in Myanmar (#02) *by Nyan Linn*
	3) Health Literacy and Determinants of Glycemic Control (HbA1C) among Older Adult and Elderly in Sub-urban Bangkok, Thailand (#03) *by Tiwaporn Junkhaw*
	4) Parental Support and Religiosity Factors on Adolescent Pre-Marital Sex Education in Red Light District, Yogyakarta Province, Indonesia (#04) *by Lafi Munira*
	5) Assessment of infection prevention and control measures against COVID-19 adopted by undergraduate students of Bangkok Metropolitan Region (#05) *by Su Myat Lin*
	6) Factors Associated with HIV Status Disclosure among Men Who Have Sex with Men in Bali, Indonesia (#06) *by Ngakan Putu Anom Harjana*
Room 2 (Host by IPSR)	**Track 1:** Population, Demography, Aging and Migration, Active Aging and Innovation **Track 3:** Primary Health Care, Global Health, Health Care Management, Health Promotion, Health Behaviours, Substance abuse, Addiction studies, Mental Health, District Health System, Health System Research, Universal Health Care Coverage, Social Health Protection and Health Security Management, Health Economic, Behavioural Economic, Health Policy and Administration **Track 6:** One Health, Zoonoses and Antimicrobial Resistance
	Chairperson & Co-Chairperson: *Asst. Prof. Malee Sunpuwan, Ph.D. / Tepanata Pumpaibool, Ph.D.* ***Committee:*** *Asst. Prof. Somsak Wongsawass*
	1) Unit cost analysis of Acute Respiratory Infection (ARI) clinic for COVID-19 screening at Bangbuathong Hospital, Nonthaburi, Thailand (#07) *by Tharit Mongkol*
	2) Prevalence of Depression and The Associated Factors among The Elderly in Some Communities of Thua Thien Hue Province (#08) *by Thi Mai Nguyen*
	3) Association between adverse childhood experiences and antenatal depressive symptoms in Northeast Thailand (#09) *by Yoshiko Abe*
	4) Association between Factors Related and Stress, Depression and Suicidal Risk among Health Care Personnel During Covid-19 Second Outbreak in Bangkok, Thailand (#10) *by Aphichaya Polrak*
	5) Impact of Covid-19 on Mental Health of Health Care Personnel from Government Hospitals in Yangon Region, Myanmar (#11) *by Za Mae Nin Sar Aung*

Time	Program
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	Chairperson & Co-Chairperson: *Asst. Prof. Aroonsri MongkolChati, Ph.D./ Asst. Prof. Nutta Taneepanichskul, Ph.D.* ***Committee:*** *Napaphat Satchanawakul, Ph.D.*
	1) Development of targeted nanoparticles specific to breast cancer-associated fibroblasts (#12) *by Suttikiat Deureh*
	2) Association between PM2.5 concentrations and hospitalization cases for Mental and Behavioral Disorders in Ho Chi Minh City, Vietnam from 2019 to 2020 (#13) *by Do Thi Hoai Thuong*
	3) Factors Contributing to Glycemic Control in Adults with Type 2 Diabetes Mellitus During COVID-19 Outbreaks in Jakarta, Indonesia (#14) *by Novi Sulistia Wati*
	4) Identifying the relationship between wastewater temperature and ambient air temperature Using Artificial Neural Network (#15) *by Mahdi Reyahi-Khoram*
12.00-13.30 (Host by CPHS)	**Poster Presentation (room 1)**
	Poster committees: Lecturer Dr. Dyah Anantalia Widyastari *Assoc. Prof. Ratana Somrongthong, Ph.D. / Nipunporn Voramongkol, M.D. MPH./* *Nuchanad Hounnaklang, Ph.D. / Onuma Zongram, Ph.D.*
	1) Quality control of Morus alba Linn. leaves with quantification of chlorogenic acid Contents (#01) *by Phimkun Aiyarakanchanakun*
	2) Association between internalized Homophobia and Perceived Discrimination in health care services among lesbians in Chengdu, China (#02) *by Linghong Liao*
	3) Utilization of Delivery Services and its Contributing Factors among Adolescent Mothers Indonesia: An Analysis of 2017 Indonesia Demographic and Health Survey (#03) *by Dewi Nuryana*
	4) A Cross Sectional Assessment of Knowledge, Attitude, and Practice towards Social Distancing during Coronavirus Disease 2019 pandemic among Undergraduate Students in Medical fields in Samarinda, Indonesia (#04) *by Siti Hadijah Aspan*
	5) Depression and sleep quality in the first trimester of pregnancy among Myanmar Migrant Workers in Samut Sakhon province, Thailand: A secondary data analysis (#05) *by Thuvachit Kriengtuntiwong*
	6) Determination of pain and activities of daily living among community-dwelling older adults with knee pain in suburban area of Bangkok, Thailand (#06) *by Pattaraporn Piwong*

Time	Program
12.00-13.30 (Host by CPHS)	7) The *in vitro* Cell Study of small interfering RNA Loaded Polymeric Nanoparticles for Reduction of *TYR* Gene Expressions in Melanogenesis (#07) *by Numpueng Ridchuayrod*
	8) Deoxyarbutin-Loaded Transethosomes Decrease Melanin Production in an In Vitro Model of Hyperpigmentation Disorder (#08) *by Primana Punnakitikashem*
	9) Study on Characteristics of Extracellular Vesicle-Derived from Various Sources of Mesenchymal Stem Cells (#09) *by Kanticha Dumpin*
	10) Prevalence of premenstrual syndrome (PMS) among university students (#10) *by Apiradee Wangkahart*
	11) Maternal behaviour influencing on diarrhoea among children aged under 2 years in Myanmar: A secondary data analysis (#11) *by Yair Naing Ooa*
	12) Prevalence of Maternal Near-Miss in Magway Regional Hospital, Magway, Myanmar (#12) *by Aye Myo Thet*
	Poster Presentation (room 2) *Poster committees: Kriangkrai Lerdthusnee, Ph.D. / Napaphan Viriyautsahakul, Ph.D. M.D. Assoc. Prof. Chaweewon Boonshuyar/ Pokkate Wongsasuluk, Ph.D / Nanta Auamkul, M.D, M.P.H*
	13) Underlying Factors Linked to Heavy Tobacco Smoking among the Chinese Floating Population (#13) *by Yanyan Zhu*
	14) Describe the Physical Activity of the Elderly in Some Communes and Wards of Thua Thien Hue Province (#14) *by Luong Thi Thu T*
	15) Evaluation of Antiretroviral Medication Adherence Counselling in Taunggyi, Southern Shan State, Myanma (#15) *by Nang Thiri Htwe*
	16) Heavy Metals Exposure from Cassava Farms Located in Abandoned Tin mines at Ong Phra Sub-District, Thailand (#16) *by Sirinart Pongyart*
	17) Maternal Knowledge, Attitude, and Practices on The Dietary Omega 3 and 6 consumption in children aged 1-2 years in Labuhanbatu Utara, Indonesia (#17) *by Sinar Yunita Purba*
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	20) Cognitive interviewing on person-centered maternity care at public health facilities in Cambodia (#20) *by Yuko Takahashi*

Time	Program
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	22) Air Quality Management in Higher Education Institutions: An Overview of Sustainability Assessment Methodologies (#22) *by Silalak Grove*
	23) The Effect of Early Childbearing on the Labor Force Participation Later in Life of Ever Married Women in Myanmar (#23) *by Mya Kay Khine*
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	Chairperson & Co-Chairperson: *Assoc. Prof. Kanchana Rungsihirunrat, Ph.D. / Assoc. Prof. Thunwadee Suksaroj, Ph.D* ***Committee:*** *Asst. Prof. Malee Sunpuwan, Ph.D.*
	7) Socioeconomic Inequity in Antenatal Care Service Utilization among Young Mothers in Myanmar (#16) *by Phyo Thiha Kyaw*
	8) Perception and Experiences of Sexual Harassment among LGBTQ students in Bangkok Thailand (#17) *By Jiratchaya Rungrote*
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	8) Assessment of Knowledge, Attitude and Usage on Personal Protective Equipment among Mechanical Maintenance Workers of a Power Generation Unit in Thailand (#29) *By Titiphorn Tankian*
15.30.00-16.00	**Wrap Up & Evaluation** ***Chairperson & Co-Chairperson:*** *Anchalee Prasansuklab, Ph.D. / Anuchit Phanumartwiwath, Ph.D.*
16.00-16.15	**Outstanding Award and Closing** *Professor Sathirakorn Pongpanich, Ph.D.* ***MC:*** *Anchalee Prasansuklab, Ph.D. / Anuchit Phanumartwiwath, Ph.D.*

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TRACK 6: ONE HEALTH, ZOONOSES AND ANTIMICROBIAL RESISTANCE

UNIT COST ANALYSIS OF ACUTE RESPIRATORY INFECTION (ARI) CLINIC FOR COVID-19 SCREENING AT BANGBUATHONG HOSPITAL, NONTHABURI, THAILAND

Tharit Mongkol and Sathirakorn Pongpanich*

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ABSTRACT

The COVID-19 outbreak has affected the services of all hospitals in Thailand, particularly making their financial position at risk of bankruptcy. Although managing the cost of health care services for COVID-19 effectively can help reduce that risk, but very little research has been done and analyzed on these issues. This study aimed to identify the operating cost, unit cost, and cost recovery of the Acute Respiratory Infection (ARI) clinic for COVID-19 screening at Bangbuathong Hospital. This research was a descriptive study by retrospective data collection from hospital records and database of costs of ARI clinic between March to May 2021, which was the period that covered before and during the third wave of COVID-19 outbreak in Thailand. Data were analyzed from the provider's perspective by considering only the accounting cost. The results showed a total of 1,955 cases in the ARI Clinic. Total operating cost was 1,065,628.50 Thailand baht, divided into labor cost (LC) 868,417.75 baht and material cost (MC) 197,210.75 baht. Each month had different costs. It was found that in March, with only a few patients, the lowest cost was 240,841.34 baht (LC 198,332.39 baht: MC 42,508.95 baht). As of May, which had the highest number of patients in the clinic, the cost was 462,641.64 baht (LC 380,789.94 baht: MC 81,851.70 baht). Unit cost was 545.08 baht per case. But considering each month, March's highest was 734.27 baht. Finally, cost recovery refers to the ratio of accrued revenue from the National Health Security Office (sample collection fee 100 baht per case), and the material cost was 0.71 (0.23, 0.83, and 0.85 per month, respectively). Summarizing, the cost and cost recovery of the ARI Clinic varies from month to month. Director and Chief Financial Officer (CFO) should consider adjusting resource management to be the most cost-effective.

Keywords: Unit cost analysis, COVID-19, ARI Clinic

INTRODUCTION

The outbreak of COVID-19, which infected nearly one hundred million people worldwide and about 2 million deaths in the past year(1), has affected health care financing around the world, including Thailand.(2) In 2020, Thai government approved an additional budget of 6,302 million baht (US$ 203.3 million) to tackle the COVID-19 outbreak, and an additional 1,020 million baht to the National Health Security Office (NHSO) to subsidize COVID-19-related services.(3) However, the outbreak cannot be controlled until mid-2021(4) which certainly put pressure on government's ability to fund public health care.(5) Meanwhile, hospitals also need to provide more health care services, especially screening for COVID-19 patients.(6) ARI Clinic has been set up in all hospitals to screen patients for COVID-19 appropriately and is helpful in preventing the spread of the virus to other patients and communities.(7) The model of this clinic, which has been in operation for more than a year, has consumed a large amount of hospital resources, from medical personnel to materials and equipment, but very few researches has been done and analyzed on the cost of ARI Clinic. Therefore, this research aims to identify the operating cost, unit cost and cost recovery of Acute Respiratory Infection (ARI) clinic for COVID-19 screening. The researcher chose Bangbuathong hospital in Nonthaburi province, where there has been continuous outbreak of COVID-19(8). The findings could be useful not only to improve appropriate resource utilization for COVID-19 screening at hospital, but also to develop and optimize reimbursement models from central organization.

METHODS

Study design

This research was a descriptive study by retrospective data collection. It was analyzed from the provider perspective by considering only the accounting cost. We studied the costs and cost recovery of ARI clinic at Bangbuathong hospital, Nonthaburi, Thailand between 1 March to 31 May 2021 (3 months), which was the period that covered before and during the 3rd wave of COVID-19 epidemic in Thailand.(9)

Sources of data & data collection

This research took 2 weeks to collect data. We collected data from various departments related to the ARI clinic in Microsoft Excel, details as follows.

Number of patients in ARI clinic

We used data recorded on the total number of patients in the ARI clinic as a case (or visit) unit, divided into 3 major groups: those with the common cold and low-risk which did not need to swab for COVID-19, those who were at high risk of COVID-19 and need to be swab and patients who must be swabbed before undergoing any procedures.

Labor Cost

We collected data on name of health workers, salaries, compensation for personnel working for service units of the Ministry of Public Health (No.11), extra money for special-emerging positions of public health workers (PTS), extra compensation for working in a service unit under the Ministry of Public Health without doing personal medicine and or working in a private hospital and contingent compensation for COVID-19 received during the research period from the financial and administrative department of hospital. We also collected data from individual working time record from ARI clinic. Each person is assigned daily hours of work in ARI clinic by specifying a percentage.

Material Cost

Materials used in ARI clinic were collected from requisition record from both central supply unit and pharmacy. For the prices of materials were based on medical supplies procurement plan for fiscal year 2020 (October 2019 – September 2020) of Bangbuathong Hospital.

Procedures

We followed the ARI clinic's costing procedure adapted from the recommendations of the Ministry of Public Health. (10) Firstly, we did system analysis which covers general information of ARI clinic, administrative structure, flow of services, and duties and operating guidelines of each staff member in the clinic in order to visualize how to use some information to calculate the cost.

Secondly, we calculated the total operating cost of ARI clinic based on the equation

"Total operating Cost (TDC) = Labor Cost (LC) + Material Cost (MC)"

Labor cost was calculated from the total incomes that the workers earn each month. For material cost, the researcher used the amount of medical materials and consumables used in the ARI clinic throughout the research period including disposable gloves, disposable masks, face shield, N 95, cover all kit, head cover, apron plastic, alcohol gel, swab kit, etc. multiplied by the purchase price of each material and presented as monthly costs and total costs for the duration of the study.

Then, **unit cost** was calculated by total operating cost of ARI clinic divided by total cases.

Lastly, we calculated **cost recovery**, the ratio of the revenue that should be received from NHSO to compare with the material cost of ARI clinic as follows:

"Cost recovery of ARI Clinic = Reimbursement from NHSO / Material cost"

For the reimbursement from NHSO, we used accrued revenue (revenue that has been earned by providing a service from NHSO, but for which no cash has been received) based on criteria and conditions for receiving expenses of COVID-19 for health care services (in Thailand by NHSO, fiscal year 2021).(11) For ARI clinic, compensation for screening of COVID-19 infections by RT-PCR method was received, which is sampling fee for laboratory examination, payable at the rate of 100 baht per service.

Statistical analysis

Descriptive statistics such as percentage and mean were used primarily to summarize and describe the findings. Data were processed by personal computer with Microsoft Excel 2016.

RESULTS

General finding

Acute Respiratory Infection (ARI) clinic, Bangbuathong hospital is one of the facilities to screen patients at risk for COVID-19 who come to the hospital.

It was activated for the first time as ordered by the Ministry of Health since the first wave of the coronavirus outbreak (around April 2020). This clinic is open only during office hours from 8:30 a.m. to 4:30 p.m.

ARI Clinic is under the responsibility of OPD (Nursing), which is supported by other units including Medical personnel from the medical organization, primary health care, and some personnel from operating room / labor room and Material & Equipment from the Central supply unit, Pharmacy, and General administration.

For the patient service process. First of all, all patients must pass preliminary screening by ARI clinic. The staff at the screening point inquired about the initial symptoms and measured body temperature. If it meets the specified risk criteria, patients must continue to be screened and examined at the ARI Clinic. If not, patients to be able to receive services from other departments in the hospital.

After the patient passed the screening criteria to enter the ARI Clinic, they have to wear a surgical mask, rub their hands with alcohol gel and maintain a distance of at least 1 meter from other patients. Screening nurse asked symptoms and exposure history of COVID-19 / measured body temperature, blood pressure, pulse rate, O2

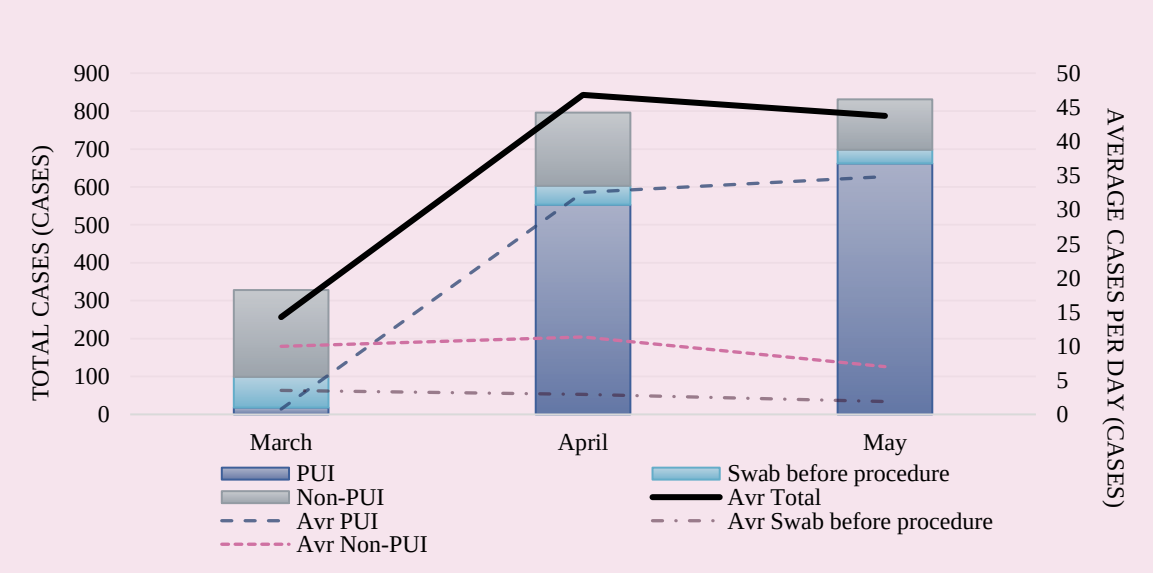
saturation and recorded in OPD card. After completing the history taking and physical examination process, patients are divided into 3 groups, Patient Under Investigation (PUI), Non-PUI and Swab before procedure.

For PUI, screening nurse notified Surveillance and Rapid Response Team (SRRT) for taking patients history according to the "Novelcorona-3 form" to request the SAR-CoV-2 code from the Disease Control Department, Nonthaburi Province. In case of severe symptoms, send the patient to Emergency Room. Subsequently, all patients in this group were required to undergo nasopharyngeal swab in which specimens were examined for the presence of SAR-CoV-2 by RT-PCR method (laboratory examination performed by central lab outside the hospital). After completing the swab, the patients were discharged to self-quarantine at home according to the guidelines of the Department of Disease Control to wait for the results of the COVID-19 test. Patients who had to be swab before procedure had similar procedures to the PUI, but were not discharged to self-quarantine at home. For Non-PUI, the doctor treated according to their causes or diseases. These patients were at low risk of COVID-19. Therefore, SAR-CoV-2 was not tested like other groups.

For the medical personnel, there were approximately 4-8 persons in the clinic, consisting of 2 doctors, one half-day in the morning and one half-day in the afternoon. Other health workers work full time in a clinic consisting of 1-4 nurses depending on the number of patients and 1-2 SRRT (public health officers). Each person wears 5 PPE kits: protective gown, surgical mask, face shield, head cover and gloves. In case of collecting SARS-CoV2 samples, personnel added leg cover, cover all and N95. Nasopharyngeal & throat swab had been collected, put both specimens in one VTM tube and sealed with parafilm.

From the study which was conducted during the period from March to May 2021 (3 months), the number of cases in the ARI Clinic over the three-month period was 1,955, an average of 34.94 cases per day.

When considering for each month. March recorded the lowest number of cases at 328, after which the number of patients increased dramatically, with April totaling 796 cases and the highest in May with 831 cases. The number of PUI also grew rapidly, from 18 cases in March to 553 and 662 cases in April and May respectively, while the non-PUI and Swab before procedure patients also tended to decline as shown in Figure 1.



*Avr = Average

Figure 1 Number of cases in ARI clinic

Operating cost

Labor cost

This cost depends on the number of medical personnel for each month. In March, there were 4-5 providers (2 doctors /1-2 nurses /1 SRRT), but April and May, with more patients, had 6-8 providers (2 doctors /3-4 nurses /1-2 SRRT).

Total labor cost was 868,417.75 baht. When considering monthly, it was found that Labor costs were rising. The highest month was May 380,789.94 baht, while March had the lowest labor cost. However, the monthly labor cost of doctors varied slightly as shown in Figure 2.

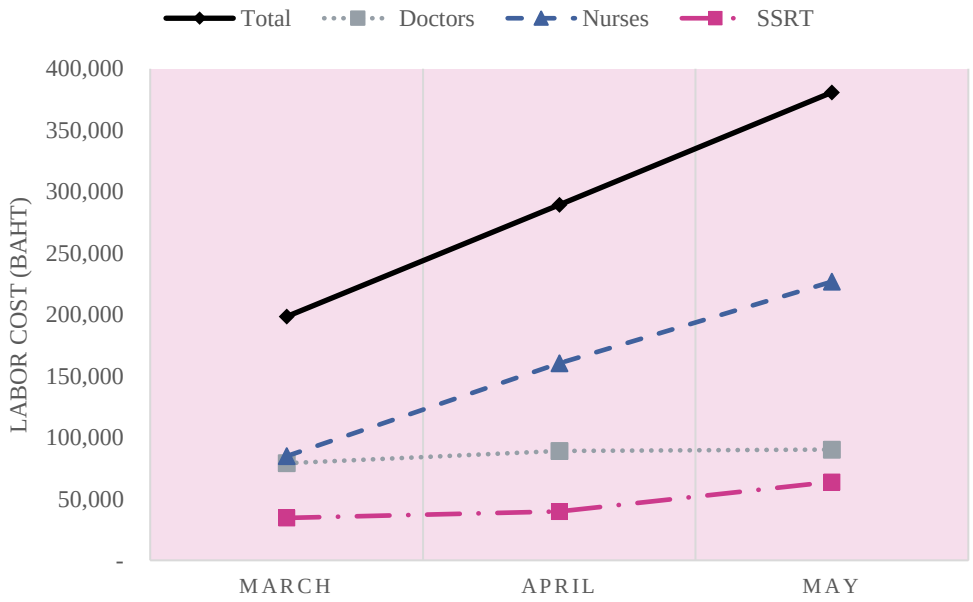


Figure 2 Labor cost of ARI clinic (Thai baht)

Material cost

Total material cost was 197,210.75 baht. The highest cost in May was 81,851.7 baht, followed by April 72,850.10 baht and March was the lowest cost at 42,508.95 baht. The cost of most materials such as disposable mask, N 95, face shield, head cover, cover all kit, protective gown and leg cover slightly differed from month to month as shown in Table 1.

Table 1 Lists of materials, unit price, amount used, and monthly material cost of ARI clinic (Thai baht)

Material lists	Price / unit	Month						Total cost
		March (23 days)		April (17 days)		May (18 days)		
		Unit used	Cost	Unit used	Cost	Unit used	Cost	
Disposable Glove *(1 box = 100 pieces)*	208.65 *(per box)*	3	625.95	12	2,503.8	14	2,921.1	6,050.85
Disposable mask *(1 box = 50 pieces)*	125 *(per box)*	4.5	562.5	3.5	437.5	4	500	1,500
N95	50 *(per piece)*	92	4,600	68	3,400	76	3,800	11,800
Face shield	45 *(per piece)*	92	4,140	68	3,060	76	3,420	10,620
Disposable head cover	1.3 *(per piece)*	92	120	68	88	76	99	306.8
Cover all kit	214	92	19,688	68	14,552	76	16,264	50,504
Protective gown	17.65 *(per piece)*	92	1,624	68	1,200	76	1,341	4,165.4
Leg cover	20 *(per piece)*	184	3,680	136	2,720	152	3,040	9,440
Alcohol gel *(1 bottle = 450 ml)*	27.82 *(per bottle)*	5	139	10	278	10	278	696
Swab kit *(VTM + sterile wooden swab)*	70	99	6,930	603	42,210	698	48,860	98,000
Parafilm	800 *(per piece)*	0.5	400	3	2,400	3.5	2,800	5,600
Total material cost		**42,508.95**		**72,850.10**		**81,851.70**		**197,210.75**

Operating cost

The operating cost derived from the sum of labor cost and material cost of ARI clinic for all three months was 1,065,628.50 baht.

May had the highest cost at 462,641.64 baht, while April had the lowest cost at 240,841.34 baht, as shown in Figure 3.

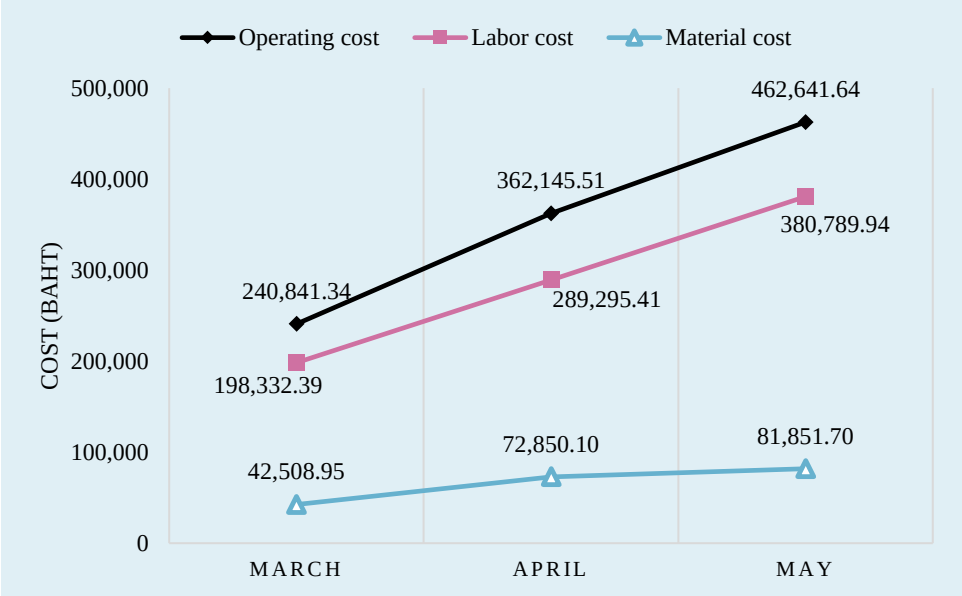


Figure 3 Operating cost of ARI clinic (Thai baht)

The total cost of services at ARI clinic per case was 545.08 baht, but when considering monthly, it was found that March had the highest cost per case at 734.27 baht, followed by May (556.73 baht) and April (454.96 baht).

Cost recovery

The reimbursement from NHSO varied from month to month depending on the number of cases in which COVID-19 screening specimens were collected (which mean PUI and Swab before procedure groups).

From total of 3 months, compensation was 140,000 baht (from 1400 cases). In May, the highest was 69,800 baht, followed by April at 60,300 baht, while March was the lowest at only 9,900 baht.

When calculated for cost recovery (divided by material cost), this 3-month total period was 0.71. If considering at each month, the highest May was 0.85, which was close to April (0.83), while March was only 0.23.

DISCUSSION

The unit cost analysis of Acute Respiratory Infection (ARI) clinic for COVID-19 screening at Bangbuathong Hospital, Nonthaburi was studied during the third wave of COVID-19 spreading period in Thailand, before the spreading was March, during the spreading was April and after 3rd wave in May. The three-month study thus provided the rough estimate of the cost data of hospitals in managing all three scenarios of COVID-19 screening at ARI clinic.

The data from the research shows that operating costs tend to increase with the number of patients in the ARI clinic and patient group. Especially for patients with PUI group, which is much higher in the last 2 months, this group of patients need to be screened for SARS-CoV2 and need more medical materials (e.g. disposable gloves, swab kit, parafilm and alcohol gel), thus increasing the cost as well.

Labor costs also tend to be in line with the number of patients. When the number of patients increases, it requires more personnel to provide services in the clinic, especially nurses who have to do history taking, screening, including swabs to collect specimens. Similarly, SRRT had to add personnel to investigate the disease in late April until May. However, the labor cost of doctors did not increase each month because the number of doctors in the clinic did not increase with the number of patients.

However, if considering the cost of labor for doctors, it was found to be quite high compared to the wages of nurses or SRRT. In addition to the reason that doctors receive more salary than other professions, Bangbuathong hospital provided specialized doctors such as obstetricians, surgeons, orthopedists etc. whose full-time jobs had been reduced due to the spreading of COVID-19 to help in ARI clinic as well.

As for the material cost, the amount of some materials used was not dependent on the number of patients but on the number of working days. No matter how many patients in the clinic, the staff still use the same amount of disposable mask, N95, face shield, cover all kit, protective gown and leg cover on a daily basis. In the case of nurses from other department to help work in the ARI clinic, they also brought a PPE kit from their own department. As a result, the material cost of ARI clinic for some materials did not change much in each month.

Taking into account the unit cost, the month with the fewest patients had the highest cost per case, as many of the medical supplies were not used by the number of patients but by the number of working days mentioned above. Moreover, March had the highest number of working days (23 days), making March's cost-per-case the highest.

Due to the reimbursement rate of ARI clinic from the NHSO, it can only be reimbursed for collecting specimens for COVID-19 testing, which is 100 baht per case. Therefore, reimbursable cases were in the both of PUI and Swab before procedures group, so March, which had fewer cases in these two groups than the other months, had the lowest cost recovery. In case of better control of the epidemic, the central authority should adjust the reimbursement rate in accordance with the cost used.

Finally, this research may have some limitations. First, although the study analyzed data over a three-month period covering the third wave of outbreaks. However, it may be a short time to see the details of each cost structure and constrain the learning of organizational adaptation, especially resource management, in the face of different epidemic scenes. Second, the data collection and costing of labor did not consider in more detail the position of individual health workers and Full time equivalent (FTE), which limits cost analysis. Third, the statistics used in this research were not able to tell the relationship, the degree of relationship between variables and did not consider confounding factors.

Lastly, this research was an analysis of accounting costs from service provider perspective only. It did not include economic costs (did not account for opportunity costs), and analyzed only operating costs, did not take into account the capital cost, so it can only provide preliminary cost data used in the ARI clinic.

CONCLUSION

During the three-month period that overlapped the third wave of the COVID-19 outbreak in Thailand, operating cost, unit cost and cost recovery of ARI clinic at Bangbuathong hospital was 1,065,628.50 baht, 545.08 baht per case and 0.71 consequently. When considering the monthly, may had the highest operating costs and cost recovery, while March had the highest unit costs.

RECOMMENDATION

The data obtained from this research can not only be used as the preliminary information for the director or CFO of the hospital to use in managing the resources of the ARI clinic in various scenarios, but also to develop and optimize reimbursement models from central organization (for example, it may be necessary to increase the payment channel for supporting equipment or PPE packages, etc.).

For future researches, in order to get a clearer and more detailed cost structure in various dimensions, longer data collection intervals should be taken into account. Other statistics should be used to tell the relationship of related variables. A full cost analysis, which includes capital cost, should also be considered, as well as taking into account the opportunity cost in the economic cost dimension.

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FACTORS ASSOCIATED WITH STRESS, DEPRESSION, AND SUICIDAL RISK AMONG HEALTH CARE PERSONNEL DURING THE COVID-19 SECOND OUTBREAK IN BANGKOK, THAILAND

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ABSTRACT

The situation with the COVID-19 pandemic has affected physical and mental health, and economic and social situations. One of the populations who are most directly affected by these effects is health care personnel. The aim of this study was to identify the prevalence of stress, depression, and suicidal risk and associated factors among health care personnel during the COVID-19 second outbreak in Bangkok, Thailand. This study was a cross-sectional study, which used secondary data from the "Mental Health Check-In" database from the Department of Mental Health, Thailand, collected from December 17, 2020, to February 23, 2021. A total of 1,078 health care personnel participated in this research. The prevalence of stress, depression, and suicidal risk was assessed by the Srithanya stress scale (ST-5), with nine questions of depression assessment (9Q), and eight questions (8Q) of suicidal risk assessment. Multivariable logistic regression analysis was performed to identify factors associated with stress, depression, and suicidal risk outcomes. The prevalence of stress, depression, and suicidal risk among health care personnel in this study was 10.1%, 12.8%, and 4.3%, respectively. In multivariate logistic regression analysis, stress was significantly associated with the home quarantine group, burnout, and resilience quotient factors (p-value <0.05). For depression, the business problem/failure group, low-income group, have members with physical/mental disability in family group, and burnout and resilience quotient factors showed statistically significant associations (p-value <0.05). And for suicidal risk, the low-income group, the business problem/failure group, burnout and resilience quotient factors showed statistically significant (p-value< 0.05). The main implication of this study reveals that burnout and resilience quotient factors are strongly associated with stress, depression, and suicide risk. Where burnout is a risk factor and resilience quotient is a protective factor, having policy or intervention that reduces burnout and increases resilience quotient can help reduce these mental health problems in health care personnel.

Keyword: Stress, depression, suicidal risk, health care personnel, COVID-19.

INTRODUCTION

In December 2019, an outbreak of a new virus was reported in Wuhan city, capital of Hubei province, China (1). This virus is coronavirus2 (SARS-CoV-2), later called 'COVID-19', which can cause severe respiratory disease. On March 11, 2020, the World Health Organization (WHO) announced that COVID-19 has been elevated to pandemic, the largest outbreak of respiratory and pulmonary disease since the outbreak of SARS in 2003. Within weeks after the outbreak the number of cases has also skyrocketed and until skyrocketed which was more than the previous SARS outbreak (2). All sectors of society are affected by this pandemic situation and whether situation and it is the economic sector the income of the private sector and retail stores fell (3). Health care personnel get stressed due to hoarding and lack of protective equipment and long working hours at hospital (4).

Especially health care personnel, inevitably they must work closely with the patient. Infection risk is highest (5) and various challenges in working to combat the spread of COVID-19 (4) whether it is working to take care of patients with serious infections. As the number of patients increases, each work day is multiplied by many times more. Workload that increases beyond their potential. There are also pressures from social expectations(6). Previous study has shown that about one-third of the medical professionals surveyed (38%) had anxiety conditions, one-quarter (24%) had depression. The association factors of stress among medical personnel were found to have a variety of factors, for example, in women, stress was found to be higher than that of males (7). Roles, duties and places of work mentioned above. And found that those working at the forefront are more stressful than other positions etc.(6). When mental health problems arise inevitably affects health, mental suffering and the working potential of health care personnel. If left ignored or not corrected can lead to chronic mental health problems causing depression and even suicidal (8).

This can be seen the effects on mental health especially stress on medical personnel is very important. Many factors depend on the context and resources of each country including situations and measures in response to the pandemic (9). But at this time in Thailand, studies on the psychological impact of healthcare professionals during the COVID-19 situation, there is still a limit. This study aims to identity the prevalence of stress, depression and suicidal risk. And investigate the association between factors related and stress, depression and suicidal risk among health care personnel during COVID-19 second outbreak in Bangkok, Thailand. This knowledge can be used to develop plans to improve the quality of living and service of health care personnel, providing assistance and care for personnel suffering from mental health problems. Guidelines can be implemented for promoting and preventing mental health problems at the policy level. Planning and response measures can be done for mental health in the event of pandemic crisis.

METHODS

This study was retrospective cross-sectional study, used the secondary data from 'mental health check-in' databases from the department of mental health, Thailand. The inclusion criteria for study population were health care personnel in Bangkok, Thailand who answered the 'mental health check-in' questionnaire during December 17, 2020, to February 23, 2021. All health care personnel in Bangkok, who answered the mental health check-in questionnaire completely all questions at that time were included in this study.

The demographic data, vulnerable group factors, burnout factor and resilience quotient were collected by 'mental health check-in' questionnaire. The burnout factor was measure by using burnout assessment form by the department of mental health, Thailand. There is 1 question to the past 1 week of burnout symptoms. The criteria for interpreting results into 2 groups as follows : 0-2 points was normal group, more than or equal 3 points was risk group (10). The resilience quotient was measure by using short form from RQ assessment form. The RQ assessment form was used to assess a person's abilities in 3 parts: 1. pressure resistance, 2. The aspect of having hope and 3. encouragement and the battle side overcomes obstacles. The criteria for interpreting results into 3 groups as follows : 3-14 points was low RQ group, 15-23 points was middle RQ group and 24-30 points was high RQ group (11)(12). The stress was measured by using the Srithanya stress scale (ST-5). ST-5 was the short version of stress questionnaire there are 5 items.

The criteria for interpreting results into 3 groups as follows: 0-4 points was no problem group, 5-7 points was might have a problem group and more than or equal 8 points was having problem group. The ST-5 has high internal reliability (cronbach alpha = 0.85) and highly correlate to Hospital anxiety depression scale (HAD) (pearson correlation = 0.61) (13). The depression was measured by using the 9 questions of depression assessment (9Q), The 9-question depression assessment form (9Q) was developed by Thoranin Kongsuk and colleagues as a tool to assess and classify the severity of depression with divided into 4 levels of severity of symptoms of depression as follow: <7 points was normal group, 7–12 points was mild depression group, 13- 18points was moderate depression group and more than or equal 19 points was severe depression group. The 9Q has a sensitivity of 68.75% and specificity 37.93% compared with the diagnosis of MDD (Major Depressive Disorder). The probability of depression was 11.41 times with the accuracy. To measure changes in depression at a relatively high level, it took less time to assess symptoms. The 9 question depression assessment (9Q), compared with the Hamilton Rating Scale for Depression (HRSD-17(, had a relative coefficient of 0.719) P-value <0.001(, a sensitivity of 85%, a specificity of 72 .%And Likelihood Ratio 3.04 (14). The suicidal risk was measured by using the 8 questions (8Q) of suicidal risk assessment. The department of mental health, was drawn 8Q from the part of the M.I.N.I, suicidal risk assessment part. Mini - International Neuropsychiatric Interview (M.I.N.I.), is a tool for interviewing structure for diagnosis psychiatric illness. With divided into 4 levels of severity of suicidal risk as follow: 0 point was no suicidal risk, 1-8 points was low suicidal risk, 9-16 points was moderate suicidal risk and more than or equal 17 was high suicidal risk. The M.I.N.I.-Thai version, current suicidal risk part has Cohen's Kappa >0.75, sensitivity >0.81, specificity >0.81, positive predictive value >0.81, negative predictive value >0.81 (15).

To analyze the characteristic of participants and the prevalence of stress, depression and suicidal risk, this study used descriptive statistic. And used multiple logistic regressions for determine the associations between related factors and stress, depression and suicidal risk. Ethical approval No. for this study was DMH.IRB.COA 019/2564.

RESULTS

Table 1 showed the demographic factors, vulnerable group factors, burnout factors and resilience quotient factors of the participants. There were 1,078 health care personnel participated in the study. Among 1,078 participants, female participants were 87.2% and male participants 12.8%. Most of the participants (42.9%) were in age group of 26 to 35 years and the least of participants (17.4%) were in age group under or equate 25 years. Participants who were vulnerable groups sorted from most was low income/dept 24.9% and the least was those who had patient with bed ridden in family 1.8%. The burnout factors, there were 153 participants (14.2%) were in risk group. For resilience quotient factors, most of participants (60.6%) had high level of resilience quotient, moderate level and low level of resilience quotient were 35.3% and 4.1%, respectively.

Table 1 Number and percentage of participants by demographic, vulnerable group, burnout factors and resilience quotient factors (n=1,078)

Demographic factors	Number	Percent
Age		
<=25	188	(17.4)
26-35	426	(42.9)
36-45	202	(18.7)
>=46	226	(21.0)
Mean (SD)	35 (10.26)	
Range (minimal-maximal)	49 (18-67)	
Gender		
Male	138	(12.8)
Female	940	(87.2)

Vulnerable groups		
Patient with COVID-19		
No	1,040	(96.5)
Yes	38	(3.5)
Home quarantine		
No	1,018	(94.4)
Yes	60	(5.6)
Have chronic underlying diseases		
No	1,033	(95.8)
Yes	45	(4.2)
The business has problems/failure		
No	1,057	(98.1)
Yes	21	(1.9)
Low income/debt		
No	810	(75.1)
Yes	268	(24.9)
Have elderly/newborn in family		
No	852	(79.0)
Yes	226	(21.0)
Have patient with bed ridden in family		
No	1,059	(98.2)
Yes	19	(1.8)
Have member with physical/mental disability in family		
No	1,058	(98.1)
Yes	20	(1.9)
Burnout		
Normal (0-2)	952	(85.8)
Risk group (=>3)	153	(14.2)
Resilience quotient		
Low (3-14)	44	(4.1)
Moderate (15-23)	381	(35.3)
High (24-30)	653	(60.6)

The Prevalence of stress, depression and suicidal risk among health care personnel in Bangkok, Thailand were showed in table 2. The most common stress levels were mild level (66.1%), followed by moderate (23.7%) and severe level (10.1%) respectively. Of the ST5 assessment, if participants scored greater than or equal to 8, they were at risk for stress. That is, this study had a 10.1% stress prevalence. On the part of depression from the 9Q assessment, the most common in this study was normal group (87.2%), followed by mild (10.3%), moderate (1.8%), and severe level (0.7%), respectively. The total prevalence of depression in this study was 12.8%. The suicide risk from the 8Q assessment, the most common was no risk group (95.7%), followed by low risk (3.4%), moderate risk (0.5%), and severe risk (0.4%), respectively. The total prevalence of suicidal risk in this study was 4.3%.

Table 2 Prevalence of stress, depression and suicidal risk among health care personnel during COVID-19 second outbreak in Bangkok, Thailand. (n=1,078)

Severity	Number	Percent	Prevalence (%)
Stress (ST5)			
Mild (score 0-4)	713	66.1	10.1
Moderate (score 5-7)	256	23.7	
Severe (score =>8)	109	10.1	
Depression (9Q)			
Normal (score 0-6)	940	87.2	12.8
Mild (score 7-12)	111	10.3	
Moderate (score 13-18)	19	1.8	
Severe (score =>19)	8	0.7	
Suicidal risk (8Q)			
No risk (score 0)	1,032	95.7	4.3
Low risk (score 1-8)	37	3.4	
Moderate risk (score 9-16)	5	0.5	
Severe risk (score =>17)	4	0.4	

Multivariate analysis was used to describe association between related factors and stress, depression and suicidal risk. All significant different variables associated with stress, depression and suicidal risk in bivariate logistic regression analysis with a p-value of less than 0.2 were considered in a multivariable logistic regression.

Table 3 showed that stress was significantly associated with participants who with home quarantine were more likely to have stress by 3.453 times than those who were not. [Adjusted OR=3.453, 95%CI (1.20 - 9.95)]. Participants who were risk group of burnout were more likely to have stress by 25.173 times than those who were normal group [Adjusted OR=25.173 95% CI (14.18 - 44.70)]. There was significant association between participants who had high resilience quotient group and moderate resilience quotient group and stress. When compared to those who had low resilience quotient group, participants who had high resilience quotient group and moderate resilience quotient group had less stress 0.021 time and 0.134 time than those who had low resilience quotient, respectively [Adjusted OR=0.021, 95%CI (0.01 - 0.06) and Adjusted OR=0.134, 95%CI (0.05 - 0.33)].

Table 3 Multivariable logistic regression analysis between related factors and stress (n=1,078)

Variable	Adjusted OR	95% C.I.		P-value
		Lower	Upper	
Vulnerable groups				
Home quarantine				
No	Ref.			
Yes	3.453	1.20	-9.95	0.022
The business has problems/failure				
No	Ref.			
Yes	2.927	0.69	-12.42	0.145
Low income/debt				
No	Ref.			
Yes	1.483	0.68	-3.24	0.322

Variable	Adjusted OR	95% C.I.		P-value
		Lower	Upper	
Burnout				
Normal (0-2)	Ref.			
Risk group (=>3)	25.173	14.18	-44.70	<0.001
Resilience quotient				
Low (3-14)	Ref.			<0.001
Moderate (15-23)	0.134	0.05	-0.33	<0.001
High (24-30)	0.021	0.01	-0.06	<0.001

Table 4 showed participants those who with business problems/failure, low income/debt and had member with physical/mental disability in family were more likely to have depression by 4.620, 4.620and 7.774 times than those who were not. [Adjusted OR=4.620, 95%CI (1.50 - 14.27), Adjusted OR=4.620, 95%CI (1.26 - 4.44) and Adjusted OR=7.774, 95%CI (2.33 - 25.89), respectively]. Participants who were risk group of burnout were more likely to have depression by 13.072 times than those who were normal group [Adjusted OR=13.072 95%CI (7.89 - 21.65)]. There was significant association between participants who had high resilience quotient group and moderate resilience quotient group and depression. When compared to those who had low resilience quotient group, participants who had high resilience quotient group and moderate resilience quotient group had less depression 0.026 time and 0.118 time than those who had low resilience quotient, respectively [Adjusted OR=0.026, 95%CI (0.01 - 0.07) and Adjusted OR=0.118, 95%CI (0.05 - 0.29)].

Table 4 Multivariable logistic regression analysis between related factors and depression (n=1,078)

Variable	Adjusted OR	95% C.I.		P-value
		Lower	Upper	
Vulnerable groups				
Home quarantine				
No	Ref.			
Yes	1.191	0.47	-3.03	0.714
Have chronic underlying diseases				
No	Ref.			
Yes	2.299	0.85	-6.24	0.103
The business has problems/failure				
No	Ref.			
Yes	4.620	1.50	-14.27	0.008
Low income/debt				
No	Ref.			
Yes	2.366	1.26	-4.44	0.007
Have member with physical/mental disability in family				
No	Ref.			
Yes	7.774	2.33	-25.89	0.001
Burnout				
Normal (0-2)	Ref.			
Risk group (=>3)	13.072	7.89	-21.65	<0.001
Resilience quotient				
Low (3-14)	Ref.			
Moderate (15-23)	0.118	0.05	-0.29	<0.001
High (24-30)	0.026	0.01	-0.07	<0.001

Table 5 showed participants those who with business problems/failure and low income/dept were more likely to have suicidal risk by 8.090 and 2.565 times than those who were not. [Adjusted OR=8.090, 95%CI (2.07 - 31.55) and Adjusted OR=2.565, 95%CI (1.01 - 6.52), respectively]. Participants who were risk group of burnout were more likely to have suicidal risk by 6.735 times than those who were normal group [Adjusted OR=6.735 95%CI (3.13 - 14.50)]. There was significant association between participants who had high resilience quotient group and moderate resilience quotient group and suicidal risk. When compared to those who had low resilience quotient group, participants who had high resilience quotient group and moderate resilience quotient group had less suicidal risk 0.039 time and 0.617 time than those who had low resilience quotient, respectively [Adjusted OR=0.039, 95%CI (0.07 - 0.38) and Adjusted OR=0.617, 95%CI (0.01 - 0.13)].

Table 5 Multivariable logistic regression analysis between related factors and suicidal risk (n=1,078)

Variable	Adjusted OR	95% C.I.		P-value
		Lower	Upper	
Vulnerable groups				
Home quarantine				
No	Ref.			
Yes	1.534	0.43	-5.41	0.506
The business has problems/failure				
No	Ref.			
Yes	8.090	2.07	-31.55	0.003
Low income/debt				
No	Ref.			
Yes	2.565	1.01	-6.52	0.048
Have member with physical/mental disability in family				
No	Ref.			
Yes	4.907	0.95	-25.45	0.058
Burnout				
Normal (0-2)	Ref.			
Risk group (=>3)	6.735	3.13	-14.50	<0.001
Resilience quotient				
Low (3-14)	Ref.			
Moderate (15-23)	0.167	0.07	-0.38	<0.001
High (24-30)	0.039	0.01	-0.13	<0.001

DISCUSSION

The results of this study found that there was a prevalence of stress, depression and suicide risk among health care personnel were 10.1%, 12.8%, and 4.3%, respectively. Compared to the study of mental health impacts among health care personnel in other countries as a study of medical personnel in China (n=34) during 22-29 February 2020. The study found that moderate level of perceived stress (PSS) 38% and depressed (PHQ-9) 24% (16) Alternatively, another study of health care personnel in China (n=1257), conducted January 29, 2020, to February 3, 2020, found a considerable proportion of participants reported symptoms of depression 50.4% and distress 71.5% (6). It can be seen that the prevalence of this study was much lower than the previous study from China. This may be because the pandemic situation was different severity. The strictness of lockdown measures are also different including other area-specific contexts are different those can cause different psychological effects. When compared this study with other studies in Thailand, it was found in studies among health care personnel had relevant results, although the studies were conducted at different times. Such as the study of stress and

depression among medical personnel at Surin Hospital. Surin Province, Thailand (n=179) during 12 March 2020 to 23 April 2020. They collected data every 2 week for 3 times, the study found that the prevalence of stress (ST5>8) during the first, second, and third visit were 14.07%, 7.29%, and 8.64%, and the prevalence of depression (9Q) was 69.83%, 26.04 and 9.88 percent (17).

In this study, there was association between vulnerable group, burnout and resilience quotient and stress, depression and suicidal risk. According to home quarantine group was restricted activity, can't go out or meet the people and still unable to went to work or can't take care of the family members, that can be cause of stress more than another people. For economy part that are directly affected no less than health and with a significantly lower income level or business failure making people more anxious and are more likely to have mental health disorders (9). Stress, depression and suicide are problems to mental health. In this study, health care personnel with low income/dept and had business problem/failure showed significant association with depression and suicidal risk compared to those who were not. The COVID-19 can cause severe symptoms in people with underlying illnesses or health problems. It is normal for someone who has a family member who is in poor health or have to take medication on a regular basis, there will be stress from fear that those members will have a serious illness. The health care personnel, who working closely with patients had higher the chance of bringing the infection back to their houses. The workload had increased greatly and less time, less time to take care of their family members. All the reasons as above show that why the health care personnel who had member with disability in family, were more likely to have depression than those who had not.

CONCLUSIONS

Covid-19 pandemic situation is a major crisis in today's world. Dealing with and changing into the new normal is a challenge. All sectors are affected directly or indirectly. In this study, there was association between vulnerable group, burnout and resilience quotient and stress, depression and suicidal risk. According to vulnerable group, this study showed that stress was significantly associated with participants with home quarantine. Depression was significantly associated with participants who had business problems/failure, low income group and who had member with physical/mental disability in family. For suicidal risk was significantly associated with participants who had business problems/failure and low income group. The burn out and resilience quotient were association with all of stress, depression and suicidal risk. That showed implication of this study reveals that in addition to internal factors such as

In the time of the COVID-19 outbreak, as the number of patient rises very fast, the health care personnel have to do more and more work, longer hours, or even the pressure of dealing with something that hasn't happened before (4)or even lack of resource (18). These things when faced for a long time can cause a feeling of discouragement can be bored. Especially in the fight against the unknown the end of pandemic, it can cause burnouts in healthcare workers. Burnout is a chronic emotional response to the work done in the form of emotional weakness or lack of fun to work which leads to exhaustion in the workplace. Leading to many emotional and physical problems, such as insomnia, lack of concentration, and boredom. In this study, during the second outbreak of the COVID-19,

the long-running battle against the pandemic have led to burnouts. In this study, health care personnel who were risk group of burnout were more likely to have stress, depression and suicidal risk than those who were normal group.

When compared to those who had low resilience quotient group, participants who had high resilience quotient group and moderate resilience quotient group had less stress, depression and suicidal risk than those who had low resilience quotient. Which is consistent with the study of capability well-being (OxCAP-MH) that found capability well-being was significantly strongly/moderately associated with all other outcome measures, the strongest correlation being with depression, but of opposite directions. Because resilient quotient is the ability to return to the original state. Psychological flexibility is the ability of people to return to normal by bouncing back from the ups and downs of life. Flexible person tends to choose to be optimistic about life. Optimistic attitude is one of the hopeful expectations for a positive outcome (19).

burnout and resilience quotient that were important to mental health, the external factors such as family, well-being and economy were also important, that can affect mental health as well.

RECOMMENDATION

For the next study, there should be a more comprehensive factors involved. Because many factors can be impact on mental health in crisis, especially the COVID-19 crisis. And long-term follow-up studies are needed to study as well.

For policy makers, the development and implementation of the effective intervention to reduces burnout and increases resilience quotient can help reduced these mental health problems in health care personnel.

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IMPACT OF COVID-19 ON THE MENTAL HEALTH OF HEALTH CARE PERSONNEL FROM GOVERNMENT HOSPITALS IN YANGON REGION, MYANMAR

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ABSTRACT

A dramatic rise in COVID-19 transmission and death rates profoundly hit Myanmar during the second wave, especially in the Yangon epicenter. The burden of managing COVID-19 has led health care personnel (HCP) into both physical and mental exhaustion. This study intended to determine the mental health impact among HCP during the COVID-19 pandemic. A cross-sectional, online-based self-administered questionnaire was used to gather data from HCP in the Yangon Region who were directly participating in COVID-19 management during June 2021. Depression, anxiety, and stress were measured using the Depression, Anxiety, and Stress Scale-21 (DASS-21). Predictive factors were analyzed using bivariate and multivariate binary logistics regression. Of the 406 participants, 75% were nurses, 18% were doctors, and 6.7% were laboratory technicians. The participants who exhibited moderately to extremely severe depression, anxiety, and stress symptoms were 15.5%, 17.9%, and 8.9%, respectively. The stigma experienced by HCP was significantly associated with higher odds of exhibiting severe symptoms of depression (Adjusted odds ratio (AOR): 2.34, 95%CI: 1.13-4.87) and anxiety (AOR: 2.14, 95% CI: 1.08-3.45). The experience of losing a loved one during the pandemic was significantly associated with HCP developing depression (AOR: 3.71, 95%CI: 1.53-8.99) and stress (AOR: 2.55, 95% CI: 1.02-6.39). HCP who tested COVID-19 positive was also significantly more likely to suffer from depression (AOR: 2.45, 95%CI: 1.03-5.82) and anxiety (AOR: 2.77, 95% CI: 1.17 – 6.57). Furthermore, HCP with the presence of children in their family were found less likely to exhibit anxiety (AOR: 0.40, 95% CI: 0.17 - 0.90), while insufficiency of government support was found significantly associated with higher odds of exhibiting anxiety (AOR: 2.49, 95% CI: 1.22 – 5.08). The findings revealed a significant proportion of depression, anxiety, and stress symptoms were prevalent among HCP during the COVID-19 pandemic. The mental health of HCP should garner immediate attention by raising awareness of the stigma against HCP, providing both physical and psychosocial needs, and ensuring a family support system.

Keywords: Depression, Anxiety, Stress, COVID-19, Health care personnel

INTRODUCTION

The new coronavirus disease (COVID-19), was discovered in China, Wuhan City in the late of 2019 and spread to other countries, driving the WHO to announce it as a global health emergency (1). Dramatic arise in transmission and morbidity rates resulted in an increased demand on health system and health care workers. Myanmar has experienced a dramatic rise in transmission rate and death rate during the second wave especially in epicenter Yangon with the mortality rate have tripled and positive cases have risen by more than 700% during August and September 2020 (2). Hospitals are facing an overloaded work and are being beyond their inpatient capacity. Consequently, this situation has led health care workers under tremendous mental distress due to the work burden, fear of being contracted of virus, lack of standardized protocol and specific drugs, and some social issue as well (3).

Frontline health care workers who directly participate to diagnosis, treatment and care of patients were at risk of developing emotional stress and other mental health symptoms (4). Moreover, COVID-19 related factors such as ever- rising number of COVID-19 positive and suspected cases, extended working hours, inadequate personal protective equipment (PPE) and other supplies, lack of standardized treatment and shortage of medicines and overwhelming thoughts of possible risk of transmission may all trigger the mental burden of health care personnel. In the initial phase of pandemic in Myanmar, due to poor health infrastructure and not being well prepared, medical workers had encountered a shortage of masks and other protective equipment (5).

Furthermore, studies depicted that health workers who had predisposing factors of having a history of taking treatment for mental illness had more chance of showing sleeplessness, anxiety, depression compared with those who did not have such history (6). It was also stated that the deaths of loved ones also contribute to physical and mental health issues due to the loss incurred (7). Consequently, theories testified that around 10% of bereaved persons are vulnerable to complicated grief after the death of family members and 30% fall in the moderate mental health risks (8).

Mental wellbeing has a significant impact on daily performance of people especially health workers during facing this critical situation. The COVID-19 impact on mental health have been well reported in many countries among variety of population groups including health professionals (6). However, in Myanmar, there is no evidence regarding the impact of the COVID-19 pandemic on mental health of health professionals.

Assessing mental status and mental health needs of HCP during emergencies will help the management to respond and reduce adverse mental outcomes of health care professionals. This study intended to estimate mental health impact among health care personnel treating patients during COVID-19 pandemic and result of this study was aimed to be useful for policy makers in planning appropriate interventions and the protection of mental health status of health care personnel during pandemic or future crisis of similar nature.

MATERIAL AND METHOD

Study design and eligible criteria

This study was a cross-sectional online questionnaire- based study using snow ball sampling method conducted on health care personnel from Yangon region who were government staff doctors, nurses and laboratory technicians. These health care personnel have directly participated in screening, diagnosing and treatment of COVID-19 confirmed and suspected patients during June 2021.

Sample Size Estimation

The sample size required for estimating prevalence of mental health outcomes was calculated using Cochran's formula (9). The calculation assumed a desired precision (sampling error) of 5 % to get larger sample size with a 95% confidence interval (CI). The anticipated proportion of depression among health care

personnel was 50.4% (4). Thus, sample size of health care professionals was 423 after addition of 10% non-response rate.

Study Procedure

The online questionnaires were designed on Google form and distributed on multiple social platforms including Facebook, Messenger, Telegram and also by email. After obtaining permission from online (Facebook, Messenger, Telegram) groups' admin, the study link was posted and circulated in the health care professionals' groups and shared the link individually by Messenger and email.

Participant screening question was employed in order to limit advertently responses from someone who did not involve in COVID-19 management process. Questionnaires was sent to specific potential participants and were encouraged to answer within two weeks. The data were kept anonymous and confidential. The questionnaires, Google form was comprised of five sections. The first section was screening question followed by questionnaires regarding sociodemographic characteristics, predisposing factors and work-related characteristics were in the second, third and fourth section respectively. Depression, Anxiety, and Stress Scale-21 (DASS-21) Myanmar version was administered in the last section. In order to avoid risk of un-response to important questions, mandatory response action was applied.

For the assessment of mental outcomes, DASS-21 with the use of subscales assessing for depression, anxiety and stress. Each subscale contains seven items, and is scored using 4-point Likert scale ranging from 0 (did not apply me at all) to 3 (much or mostly applied to me).

The validated Myanmar version of the DASS-21 was used for this study. The Myanmar version of DASS-21 has been shown to be a good psychometric screening tool with good validity and reliability. The result of this instrument test result demonstrated that Cronbach's alpha for the total score of the DASS-21 questionnaires calculated as 0.94. Cronbach's alpha for the depression, anxiety and stress calculated as 0.80, 0.86 and 0.83 respectively.

Statistical analysis

This study was analyzed in two major steps using Statistical Package for Social Sciences (SPSS) version 22.0 software.
Independent variables were summarized using descriptive statistics. Prevalence of moderate to extremely severe depression, anxiety and stress were described by percentage.

The hypothesized factors to each of study outcomes (depression, anxiety and stress) were subjected to univariate binary logistic regression. Those with p-value < 0.2 in the univariate analysis were included in the multivariate logistic regression model. Statistical significance was considered at p-value < 0.05.

Ethics statement

Ethical approval was obtained from the Ethics Review Committee for Research Involving Human Research Subjects, Health Science Group, Chulalongkorn University in Thailand (COA No. 141/2021). Participant information and voluntary process was explained, and whoever desire to accept consent were participated.

RESULTS

Sociodemographic characteristics of participants

A total of 406 health care personnel from COVID-19 treatment centers and hospitals in Yangon region participated in this study. Out of the 406 participants, 306 (75.3%) nurses, 73 (18.0 %) doctors and 27 (6.7%) laboratory technicians, in which the majority (82.0 %) were female health care personnel. The median and interquartile range of participants' age was 29 and 8 years, respectively. The majority of the participants (75.6%) were single, 51% were from nuclear family type, and 33.7% had children in their family (Table 1).

Table 1 Sociodemographic characteristics of the participants (n=406)

Characteristics	Number	Percent
Age (years)		
20-29	211	52.0
30-39	169	41.6
≥40	26	6.4
Median (IQR)= 29 (8) / Q1-Q3 = 26-34		
Education		
Diploma	148	36.5
Bachelor	188	46.3
Master	61	15.0
Ph.D.	9	2.2
Marital Status		
Single	307	75.6
Married	91	22.4
Separated/Widow/Widower	8	2.0
Family Type		
Living Alone	109	26.8
Nuclear	207	51.0
Extended/Joint	90	22.2
Accommodation		
Home	187	46.1
Rented-house	39	9.6
Staff-house	180	44.3
Presence of chronic disease	14	3.4
Presence of under 14 -year-old children in family	137	33.7
Presence of elderly (over 60 years of age) in family	193	47.5
Presence of family member with chronic medical condition	182	44.8

IQR- Interquartile Range, Q1 – First quartile, Q3- Third quartile

Predisposing factors and work-related characteristics

The percentage of the participants who had history of receiving treatment for mental health condition and who experienced loss of their loved one during COVID-19 pandemic were 2.0 % and 10.1 %, respectively (Table-2).

Of the total respondents, 73.0% were frontline health care workers and half of the study participants (51.2%) had to work between 9 - 24 hours in a shift during pandemic. Nearly three-quarter (73.8%) of health care personnel assumed that PPE were sufficiently supplied in work and a quarter of the respondents (27.1%), have faced stigmatization. Nearly two third (63.5%) of HCP had tested of COVID-19 and among who got tested, 14.7% had been tested positive (Table-2).

Table 2 Predisposing factors and work-related characteristics of participants (n= 406)

Characteristics	Number	Percent
History of receiving treatment for mental health condition	8	2.0
Experienced loss of your loved one	4	10.1
Work Role		
Front-line	297	73.2
Second-line	109	26.8
Years of government service		
≤ 5 years	155	38.2
>5 years	251	61.8
Median (IQR) = 7 (5) Q1-Q3 = 4-9		
Perception on availability of PPE at work		
Sufficiently Supplied	303	74.6
Insufficiently Supplied	103	25.4
Experienced of stigma	110	27.1
Being threatened	19	17.2
Being accused of a carrier of virus.	62	56.4
Being asked to leave rented hostel	6	5.4
Discrimination by others	23	21.0
Working hours		
1-8 hours	198	48.8
9-24 hours	208	51.2
Median (IQR) = 10 (4) Q1-Q3 = 8-12		
Perception on government financial supports during COVID-19		
Sufficiently Supplied	117	43.6
Insufficiently Supplied	229	56.4
Received training regarding COVID-19 management	183	45.1
Have tested COVID-19	258	63.5

IQR- Interquartile Range, Q_1 – First quartile, Q_3- Third quartile

Prevalence of Depression, Anxiety and Stress among health care personnel

The distribution of degree of depression, anxiety and stress across entire sample is shown in Table 3.

Table 3 Different degree of Depression, Anxiety and Stress (n=406)

Severity Level	Depression	Anxiety	Stress
	Number (%)	Number (%)	Number (%)
Normal	282 (69.5)	266 (65.5)	320 (78.8)
Mild	61 (15.0)	67 (16.5)	50 (12.3)
Moderate	43 (10.6)	43 (10.6)	25 (6.2)
Severe	13 (3.2)	15 (3.7)	6 (1.5)
Extremely severe	7 (1.7)	15 (3.7)	5 (1.2)

The prevalence of depression, anxiety and stress is shown in Table 4 by grouping the range "normal and mild" as "No presenting of symptoms" and, the range from "moderate to extremely severe" into "presenting of symptoms and require further consultation". Among the study participants, 15.5%, 17.9% and 8.9% of health care personnel have been found require further consultation for depression, anxiety and stress.

Table 4 Prevalence of moderate to extremely severe level of depression, anxiety and stress

Mental Outcomes	Moderate to Extremely Severe (Require further consultation)	Percent
Depression	63	15.5%
Anxiety	73	17.9%
Stress	36	8.9%

Factors associated with Depression, Anxiety and Stress among health care personnel

Those with significance of $p < 0.2$ in the bivariate analysis of each hypothesized predictors (sociodemographic factors, predisposing factors and work-related characteristics) of depression, anxiety and stress were included in the multivariable logistic regression model.

The health care personnel who experienced loss of loved one during pandemic was significantly associated with higher odds of exhibiting the symptoms of depression (AOR: 3.71, 95% CI: 1.53 - 8.99, p = 0.004) and stress (AOR: 2.55, 95% CI: 1.02 – 6.39, p=0.046). Stigma experienced among health care workers was significantly associated with higher likelihood of developing severe depression (AOR: 2.34, 95% CI: 1.13 - 4.87, p= 0.023) and anxiety (AOR: 2.14 95% CI: 1.08-3.45, p=0.030).

Moreover, respondents who tested COVID-19 positive was also found significantly associated with higher odds of experiencing high-level depression. (AOR: 2.45, 95% CI: 1.03 - 5.82, p=0.042) and anxiety (AOR: 2.77, 95% CI: 1.17 – 6.57, p = 0.021). Dissatisfaction on government financial support during COVID-19 pandemic was significantly associated with higher chance of exhibiting symptoms of anxiety (AOR:2.49, 95% CI: 1.22 – 5.08, p=0.012). Lastly, health care personnel who have children in their family were less likely to be suffering from anxiety than those who did not have children (AOR: 0.40, 95% CI: 0.17 - 0.90, p=0.028) (Table 5).

Table 5 Multivariable logistics regression of predictors and mental outcomes

Predictors	Depression			Anxiety			Stress		
	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Sociodemographic characteristics									
Age_20-29 years (Other age ref)	1.51	0.59 - 3.85	0.387	2.30	0.91 - 5.78	0.077	0.83	0.30- 2.26	0.721
Family Type_ Nuclear (Alone/Extended ref)	1.69	0.60 - 4.76	0.320	-	-	-	-	-	-
Family Type _Extended (Alone/Nuclear ref)	1.34	0.37- 4.84	0.656	-	-	-	-	-	-
Accommodation _ Home (Staff/Rented House ref)	2.14	0.90 - 5.08	0.085	-	-	-	-	-	-
Participant with chronic disease _ Yes (No ref)	2.17	0.30- 15.56	0.440	-	-	-	-	-	-
Presence of family member with chronic medical condition_ Yes (No ref)	0.74	0.35 - 1.60	0.450	-	-	-	-	-	-
Sex _ Male (Female Ref)	-	-	-	1.90	0.74 - 4.93	0.185	-	-	-
Education _ Diploma (Bachelor +Postgrad Ref)	-	-	-	1.05	0.49 - 2.23	0.911	-	-	-
Marital Status _ Married (Single Ref)	-	-	-	1.67	0.63 - 4.45	0.307	-	-	-
Presence of Children _ Yes (No Ref)	-	-	-	0.40	0.17 - 0.90	0.028*	-	-	-
Presence of elderly Yes (No Ref)	-	-	-				1.52	0.72 - 3.22	0.272
Predisposing Factor									
Experienced of loss of loved one _ Yes (No ref)	3.71	1.53 - 8.99	0.004*	2.40	0.97 - 5.92	0.058	2.55	1.02 – 6.39	0.046*
Work-related Characteristics									
Years of working services _≤5yrs (> 5 yrs ref)	1.46	0.59 - 3.65	0.413	0.89	0.37 -3.45	0.790	1.86	0.72 – 4.83	0.202
Experienced of stigma _Yes (No ref)	2.34	1.13 - 4.87	0.023*	2.14	1.08 -3.45	0.030*	2.00	0.96– 4.18	0.063
COVID-19 test result _ Positive (Negative ref)	2.45	1.03 - 5.82	0.042*	2.77	1.17 – 6.57	0.021*	-	-	-
Perception on Government support _ Insufficient (Sufficient Ref)	-	-	-	2.49	1.22 – 5.08	0.012*	1.68	0.77 – 3.64	0.193
Working- hours _ 9-24 hours (1-8 hours Ref)	-	-	-	1.08	0.53 - 2.20	0.835	2.05	0.93 - 4.53	0.077
Work- role _ front-line (Second line Ref)	-	-	-	1.45	0.60 - 3.45	0.408	2.12	0.77– 5.80	0.145

* = Statistically significant at p-value < 0.05, (-) = Variables did not analyze for particular outcome.From the output of binary logistic regression, predictive variables of each outcome (Depression, Anxiety, and Stress) with p value less than 0.2 were adjusted in multivariate analysis.

DISCUSSION

The result revealed that the prevalence of depression, anxiety and stress among health care personnel (HCP) were 15.5%, 17.9% and 8.9% respectively. In contrast, the prevalence of depression, anxiety and stress in this study is relatively lower than the earlier studies in Wuhan, China and Saudi and Egypt where 50.4%, 44.6% and 71.5 % and 29.6%, 27.0% and 19.3 % of HCP reported to suffer high level of depression, anxiety and stress, respectively (10, 11). One possible reason could be that even without a pandemic, HCP from Myanmar have been working under a great burden of workload with shortage of human resources, limited material supply under fragile health system (3). Doctors and nurses from Myanmar have already been exposed and getting stressed, anxious and depressed from unfavorable work environment according to previous studies of pre pandemic situation (12, 13). Long term exposed to such stressful job environment would produce the paradoxically result of lower negative mental outcomes among Myanmar medical staffs in comparison with those from high income countries with well- structured health system. However, it would be difficult to claim that the prevalence among of mental outcomes in this study is higher or lower than the other countries because of high heterogeneity among sociodemographic characteristics, country background and the used of measurements and cut-offs used for psychometric instrument.

In this study age, sex, education level, marital status, type of family, living with elderly, having family member with chronic medical condition have no significant effect on any mental health outcomes which is consistent with the study from Nepal (6). Nevertheless, it is undeniable that despite the evidence for this association being limited, in reality, still health care workers may have somewhat anxiety about spreading the infection to their children, families and especially those who are elderly or have chronic medical condition.

Remarkably, the result of this study displays that the respondents who are living with children in their family are 63.0 % less likely to develop anxiety symptoms. The possible explanation would be that bonding between family members and connectedness would support maintaining the emotional resilience which prevent HCP from being lonely and helps them to be mentally healthy. Moreover, in the previous studies that has proven that living away from family were most likely to feel lonely and which itself was a significant risk factor for negative mental outcomes (10,14-16).

This study showed experienced of loss of loved one during pandemic showed significantly higher chance of developing depression and anxiety. Population-based studies from United States revealed that unexpected loss of a loved one was the most frequently reported potentially traumatic condition that trigger mental health consequences (17). Regardless of profession, loss or death of loved one can propel anyone into devastating emotional condition. Hence, for health care personnel who keep working amid of infection and stressful work atmosphere, this factor would have become a significant risk factor for experiencing severe depression and anxiety.

This study observed that most (74.6%) of the HCP reported being satisfied with PPE supply in their work, however, the COVID-19 positive rate is still accounting for 14.7%, out of 63.5 % of total tests among HCP. The data reveals a higher prevalence of positive cases than Spanish study conducted on similar population (18). Moreover, it is found that being COVID-19 tested positive is significantly associated with highly chance of suffering depression and anxiety. In consistent with this, it has identified that COVID-19 positive health care staff were at increased risk of anxiety due to fear of spreading the virus to their families and relatives especially people at risk (19). In this scenario, it is necessary to take consideration of others causes for virus transmission like prolong exposure with COVID-19 patients (work shift), working services years and competency on professional skill regarding COVID-19 management practice including donning and doffing of PPE, intensive care practice, proper method of disinfection and so on.

Moreover, the COVID-19 pandemic has had a profound impact on not only the global economy but also individual family's financial situation (20).Subsequently, this study shows that

dissatisfaction on government financial support during COVID-19 pandemic was found significantly associated with exhibiting anxiety symptoms among health care staff. One systematic meta-analysis has reported that studies conducted in China, Italy, Turkey Spain and Iran have shown mutual finding that socioeconomic situation is one of the risk factors of heavier psychological burden (15, 21).

This study's finding demonstrates that experienced of stigma significantly affected both depression and anxiety. In support of evidence from other countries, where health workers facing stigma during COVID-19 were found to have more burnout, fatigue and adverse mental condition (6, 22). In time of struggling with new challenges in work, being stigmatized by the public may drive them to enhance the adverse psychological effects.

Unlike other studies, some particular variables that are mostly found significant association in other studies including sex (female), work-role, working-hours, presence of underlying medical condition and mental health problem, presence of elderly, and marital status are not found association in this study. Several reasons might have behind. However, to the best of researcher's knowledge, one of the possible reasons would be that by the time of data collection, Myanmar civilian including health care personnel might be equally suffering detrimental effects of military coup both physically and mentally across the country.

Since this study use of judgmental sampling as snowball method and collect data from only an outbreak region, generalizability of the study may be weak. Due to the political violence, consequently, the closure of the hospitals and COVID-19 centers, intermittent accessibility of internet, and lack of health care staff in hospitals (as HCP are being threaten of detaining), this situation may contribute to selection bias in this study. Importantly, as this study was conducted during the atrocious political crisis in Myanmar, this situation might have affected or confounded on the study result, therefore future study is suggested to conduct to validate this finding.

CONCLUSION

The study finding revealed a significant proportion of depression, anxiety and stress symptoms, which were prevalent among HCP during COVID-19 pandemic. Experienced of stigma, being COVID-19 tested positive, experienced of loss of beloved one and inadequate government support were at risk of developing negative mental outcomes. In conclusion, mental wellbeing of HCP should be taken immediate attention by raising awareness of stigma against HCP, providing both physical and psychosocial needs, and ensuring family support system for those HCP who have been working in such a prolong stressful pandemic situation.

RECOMMENDATION

- Government should take the initiatives on reduction of stigma among health care staff working in COVID-19 management, through the mobilization of mass media and community engagement strategy.
- Online- based psychosocial support and counseling through telephone including fast track referral pathways to those requiring psychological care should be initiated for HCP.
- Government should arrange strong support system including both financial support and additional support measure such as free transport, accommodation, child care facilities, etc.,

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GENDER INEQUALITY IN UNPAID WORK AND FEMALE LABOR FORCE PARTICIPATION IN MYANMAR

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ABSTRACT

Myanmar has undertaken significant economic and social changes, but the challenges related to traditional customs and ideas remain. In Myanmar, the labor force participation rates of males and females are still disproportionate. The traditional belief that household chores and reproductive burdens should be solely the responsibility of women has not yet become obsolete. This disproportionate distribution affects women's ability to explore their lives outside the homes. Therefore, the female burden on unpaid work could lead to their lower capacity to participate in the labor market. This study aimed to explore the influence of gender inequality in unpaid work in the labor market outcomes among working age women 15 to 64 years old in Myanmar. The sample of this study is 194,830 working age women 15 to 64 years old. This study used the 2019 Myanmar Inter-Censal Survey data. The binary logistic regression was used to examine the relationship between unpaid work factors and female labor market outcomes in Myanmar. Results showed that three measures of unpaid-work responsibility which comprised of being married (AOR=0.69), having children (AOR=0.79), and number of household members (AOR = 0.93) was negatively related to the odds of participating in the labor market of women controlling for age, education, household wealth, and residential areas. However, some members can help bear the household chores and make it possible for women to work outside the home. The findings showed that women who live in the house with other women and elders were 1.14 and 1.22 times more likely to participate in the labor market. Similarly, among the employed women, those who lived in the house with other women were more likely to work full-time. On the other hand, married women (AOR=1.09), those with children (AOR =1.13), women who lived with more members in the household (AOR=1.00), and women who lived with elders (AOR=1.03) were more likely to have part-time jobs. Unpaid work presents as a creation of well-being. However, the disproportional burden of housework and child-rearing that hinder women from performing well in the labor market could deplete female well-being. This study suggests that unpaid factors are associated with lower female labor market outcomes in Myanmar. Interventions that can effectively transform unpaid work for gender equality are required.

Keywords: Female Labor Force Participation, Unpaid Work, Gender Inequality, Myanmar

INTRODUCTION

Gender inequality in labor force participation that affects not only the lives of individuals but also the lower economic development of a country. Gender inequality in unpaid work is a fundamental important factor related to gender gap in labor force participation (1). The higher unequal distribution of unpaid works between men and women resulted the increasing of gender gaps in labor force participation. According to gender stereotypes, the role of women is defined as the key caregivers and for the men as the breadwinners deeply rooted in most of the Southeast Asian and other regions (2). As a result, women faced the burdens for the responsibility of high sharing unpaid work within their families like caring for children and elder people, and other household tasks (3). These unequal distributions of unpaid work within the household negatively affect women's ability to devote their life outside their homes. There is also discrimination in time allocation among male and female, that means men have to work for salary outside the home and women work household chores within the home. Therefore, women have unequal access to the labor market (4).

Although, the spread of globalization has given the opportunities for women to participate in the labor market, their time spent on unpaid work will not be reduced and they will encounter the double burden of labor (5). Therefore, finding a balance between paid and unpaid work is a struggle for women to create a position in the labor market while they have the responsibilities for housework. Household responsibilities are also linked to the women's employment quality with unequal amount of time to spend on the unpaid work and that may increase the probability of engaging in part-time jobs or in vulnerable employment (1).

Although there are tremendous development in reducing gender gaps in labor force participation, challenges have still remained. At the global level, female labor force participation in 2019 is 47.7 per cent and the male is 74.4. There are 27 per cent different between male and female (2). There are also high regional differences in the gender gap in the accessibility for employment. Female labor force participation also varies largely throughout the countries and also affecting differences in economic development, social norms, level of education, accessibility of childcare, fertility, and other services (6).

According to International Labor Organization (2019), Myanmar is the highest gender gap country in labor force participation at the regional level with 30 per cent. Myanmar's gender inequality ranking is 147 out of 189 countries in 2019 (7). and it is a high rank. Although Myanmar has been undertaken the significant economic and social changes such as reforming and updating country's labor related legislation, expanding country's economy, creating economic opportunities for all segments of the population, the challenges related to traditional customs and ideas are still remained and the participation of women in the public spheres is also restricted (8). In Myanmar, labor force participation rate is still disproportionate between male and female. According to traditional norms, males are breadwinners and household leaders, while females are caretakers of family members and household works are traditionally described as the duties of women. These traditional believes are also rooted in the labor market which excludes women out from many good work-life opportunities. According to the 2014 Myanmar Population and Housing Census, Myanmar's population is dominated by women and sex ratio is 93 (9). The female population at the working age 15-64 is 52 per cent and the male is at 48 per cent. But labor force participation rate for that age group is 86 percent for man higher than 51 percent of women (10).

In Myanmar, the study related to the prevalence of the domestic household burden is conducted in 2018 and covers only five cities in urban areas (8). There are no other surveys to cover for both urban and rural and the national level. Therefore, this study will fill the gap and provide information on unpaid works and female labor force participation in the country. This study will contribute the knowledge of how unpaid work affects the female labor force participation in Myanmar and how it is important to implement the practical system and to provide changes for attitude to overcome this barrier for the women.

METHODS

A quantitative study was conducted by using the secondary data from the 2019 Myanmar Inter-censal survey (ICS) in order to achieve the research objective. This survey was conducted by the Department of Population, Ministry of Labor, Immigration, and Population and covered only conventional households. This survey used a stratified two-stage sample design to select the sample. The sample enumeration areas (EAs) for 2019 ICS, 4316 EAs were selected from the 2014 Census frame and 4,028 were listed. But 3,960 EAs were enumerated and the rests were not covered because of security concerns. The response rate for this survey was achieved by 95% among sampled households (11).

The sample of this study was 194,830 women at working age 15-64 live in urban and rural areas and 15 states and regions in Myanmar. The sample is included all women whether they are working or not at working age 15 to 64 years old and all styles of the marital status of women (single, married, widowed, divorced, and separated) were included.

STATA version 15.1 was used to analyze the data. Univariate, bivariate and multivariate analysis were employed in this study. For the multivariate analysis, binary logistic regression was applied to examine whether there is a significant association between the dependent and independent variables.

This study analyzed two dependent variables. Firstly, female labor force participation (model I) is measured by in labor force if a woman who is working, or not working but seeking for job and by not in labor force if a woman who is not working and not seeking for jobs. The second dependent variable is employment (model II) and measured by full-time and part-time jobs based on the working hours per week. In this study, the predictor variables were individual factors, household factors, geographical factors and unpaid work factors. For the model goodness of fit, this study used Alkaike information criterion (AIC) and Bayesian information criterion (BIC). This study was already got the approval from an Institutional Review Board, Institute for Population and Social Research (IPSR-IRB) and protocol number is IPSR-IRB-2021-135.

RESULTS

Table 1 illustrates the descriptive statistics of the dependent variables used in this study. The sample of this study occupied 194,830 women at working aged 15 to 64 years old. Among these samples, 110,943 (56.9%) were in labor force, while 83,887 (43.1%) were not in labor force. And for the employment, the sample was 108,815, and 60,232 (55.3 %) were working in full-time job and 48,583 (44.7%) were employing in part-time job.

Table 1 Descriptive Statistics for Dependent Variables

Female Labor Force Participation	Number	Percent
In Labor Force	110,943	56.94
Not In Labor Force	83,887	43.06
Total	**194,830**	**100**
Employment		
Full time job	60,232	55.35
Part time job	48,583	44.65
Total	**108,815**	**100**

Table 2 showed the descriptive statistics results for independent variables. For the sample of labour force, the youngest age group 15-19 has the highest proportion (11.9%). Third-fifth of the women is married (60.5%), and one-third is single (30.2%), and widowed/ divorced/ separated (9.3%).

Among the sampled women, 38.6 per cent is completed the primary education and followed by high school and above level completed with 28.1 per cent. In this study, 10 per cent of female are household heads. Regarding to household wealth status, the women live in the poorest quintile have the lowest percentage with 15.9 per cent and the highest proportion of 23.6 per cent live in the richest quintile. In Myanmar, almost 70 per cent of the women aged 15 to 64 years old lives in rural area. By the geographical areas, the highest proportion with 37.4 per cent lives in the middle area and follow by mountainous area with 23.4 per cent. For the number of household members, four to six household members has 54.3 per cent as the highest proportion. The data informed that 29.6 per cent of the households has the children under 5 years old and 23.2 per cent has elder people aged 65 years and above. Two to three female household members were involved by 54.2 per cent as the highest proportion.

For the female employment, the results of descriptive statistics informed that 53.4 per cent have four to six female members in a household. About 27.2 per cent of the household have the children under 5 years old and 24.8 per cent have the elder people aged 65 years and above. For the number of females in the household, 52.5 per cent of the households had two to three females and 37.5 per cent had at least one female.

Table 2 Descriptive Statistics for Independent Variables

Variables	Labor Force Sample		Employment Sample	
	Number	%	Number	%
Individual Factors				
Age groups				
15-19	23,104	11.86	7,204	6.62
20-24	20,642	10.59	11,187	10.28
25-29	20,125	10.33	12,454	11.45
30-34	21,104	10.83	13,277	12.20
35-39	21,275	10.92	13,773	12.66
40-44	20,600	10.57	13,658	12.55
45-49	19,877	10.20	12,731	11.70
50-54	18,902	9.70	11,167	10.26
55-59	15,957	8.19	8,176	7.51
60-64	13,244	6.80	5,188	4.77
Marital Status				
Single/Never married	58,903	30.23	32,263	29.65
Married	117,883	60.51	65,813	60.48
Widowed/ Divorced/Separated	18,044	9.26	10,739	9.87
Education				
No school or less than primary level	24,041	12.34	13,519	12.42
Primary level	75,276	38.64	44,673	41.05
Middle level	39,146	20.09	21,111	19.40
High school and above level	54,834	28.14	28,637	26.32
Others	1,533	0.79	875	0.80
Household Factors				
Female headed of household				
Yes	19,534	10.03	12,105	11.12
No	175,296	89.97	96,710	88.88

Variables	Labor Force Sample		Employment Sample	
	Number	%	Number	%
Wealth quintile				
Lowest Quintile	30,996	15.91	17,567	16.14
Second Quintile	35,467	18.20	20,100	18.47
Third Quintile	40,570	20.82	22,828	20.98
Fourth Quintile	41,777	21.44	22,855	21.00
Highest Quintile	46,020	23.62	25,465	23.40
Geographical Factors				
Area of resident				
Urban	58,860	30.21	30,078	27.64
Rural	135,970	69.79	78,737	72.36
Geographical area				
Mountainous area	45,547	23.38	25,974	23.87
Coastal area	39,085	20.06	18,636	17.13
Middle area	72,934	37.43	45,339	41.67
Lower area	37,264	19.13	18,866	17.34
Unpaid Work Factors				
Number of household members				
One to three members	50,877	26.11	30,729	28.24
Four to six members	105,865	54.34	58,094	53.39
Seven to eight members	30,873	15.85	16,309	14.99
Ten and above member	7,215	3.70	3,683	3.38
Having children in the household				
Yes	57,650	29.59	29,601	27.20
No	137,180	70.41	79,214	72.80
Having elder people in the household				
Yes	45,117	23.16	26,956	24.77
No	149,713	76.84	81,859	75.23
Number of female in the household				
At least one female	69,720	35.79	40,785	37.48
Two to three females	105,497	54.15	57,160	52.53
Above three females	19,613	10.07	10,870	9.99

Binary Logistic Regression Analysis

The results informed that the labor force participation model had Chi-square value less than 0.001 and indicated that the model was suitable to predict. The logistic regression analysis for model I showed that every age group was statistically significant at p<0.001 and more likely to be in labor force compared with referenced age group 15-19. Among the age groups, 40-44 age group was the highest probability in labor force. For the marital status, married women and widowed/ separated/ divorced women were 0.69 and 0.80 times less likely to participate in labor force compared with single or never- married women. This variable is also significant at p<0.001. The regression results for the educational level illustrated that the women completed primary and secondary education level were 1.13 and 1.06 times more likely to participate in labor force

compared with a women who had not completed education. These two educational levels are significantly associated with labor force at p<0.001 but high school and above level are not significant.

The results of household headed women were statistically significant at p<0.001 and 1.32 times more likely to enter in labor market than other women. For the wealth status, the results showed that the third and fourth wealth quintiles were significant at p<0.05 and p<0.01 respectively and less likely to participate in labor force compared with the lowest quintile.

The regression results for the area of resident is also significant at p<0.001 and the women who live in rural areas were 1.34 times more likely to participate in labor market than women in urban area. For the geographical areas, coastal and lower areas were 0.60 and around 0.71 times less likely to participate in labor force but middle area is 1.05 times more likely to participate in labor market than the mountainous area. The geographical area was also significantly associated at p<0.001 with female labor force participation.

The regression results for the unpaid work factors can be significantly seen in the table 3. The unpaid work factors were statistically significant at p<0.001 and associated with the female labor force participation. The results showed that if one household member increases in the household, the probability of female labor force participation decreases at 0.93 times. The women live in the household with the children under 5 years old were 0.79 times less likely to participate in labor market than the women live in the household without children. And the women live in the household with elder people were 1.22 times more likely to participate in labor market compared with the women living in the household with no elder people. Similarly, one more woman has in the household, the probability of women to enter in labor market increased 1.14 times.

Table 3 Model I - Binary Logistic Regression for Female Labor Force Participation

Variables	Adjust OR	95% CI	
		Lower	Upper
Age (Ref: 15-19)			
20-24	3.17***	3.04	3.30
25-29	4.90***	4.68	5.12
30-34	5.29***	5.05	5.53
35-39	5.57***	5.32	5.84
40-44	5.60***	5.34	5.87
45-49	4.79***	4.56	5.02
50-54	3.71***	3.53	3.89
55-59	2.59***	2.47	2.73
60-64	1.46***	1.39	1.55
Marital Status (Ref: Single)			
Married	0.69***	0.67	0.71
Widowed/ Divorced/Separated	0.80***	0.77	0.84
Education (Ref:No school or less than primary level)			
Primary	1.13***	1.09	1.16
Middle	1.06**	1.02	1.10
High school and above level	0.97	0.93	1.00

Variables	Adjust OR	95% CI	
		Lower	Upper
Others	1.18**	1.06	1.32
Female headed household (Ref: No)			
Yes	1.32***	1.26	1.38
Wealth quintile (Ref: Lowest Quintile)			
Second Quintile	0.98	0.95	1.01
Third Quintile	0.96*	0.93	0.99
Fourth Quintile	0.96**	0.92	0.99
Highest Quintile	0.98	0.95	1.01
Area of resident (Ref: Urban)			
Rural	1.34***	1.31	1.37
Geographical area (Ref: Mountainous area)			
Coastal area	0.60***	0.58	0.61
Middle area	1.05***	1.02	1.08
Lower area	0.71***	0.69	0.73
Number of household members	0.93***	0.93	0.94
Having children in household (Ref: No)			
Yes	0.79***	0.77	0.81
Having elder people in the household (Ref:No)			
Yes	1.22***	1.19	1.25
Number of female in the household	1.14***	1.12	1.15

Note: Statistically significant at p< 0.001***, p< 0.01**, p< 0.05*
Number of observations =194,830, Pseudo R^2 = 0.0654, Sig = 0.0000

For female employment (model II), the Chi-square values were mostly less than 0.001, having children and wealth quintile were at p<0.05 and area of resident was not significant. In table 4, the binary logistic regression was also used and the dependent variable in this regression was whether the woman works in part-time jobs or full-time jobs (full-time jobs =0 or part-time jobs = 1).

It can be clearly seen that most of the age groups were significant except 20-24 age group and are more likely to participate in the part-time jobs than referenced age group 15-19. Highest quintile, geographical areas namely, coastal, middle and lower areas, and number of females in the household were statistically significant at p<0.05 and p<0.001 respectively and more likely to be associated with full-time jobs compared with lowest quintile, mountainous area, fewer female in the household with odd ratios of 0.94, 0.81, 0.88, 0.81, and 0.96 respectively. Married, high school and above educational level, female headed household, living in rural area, having children in household and having elder people in household were statistically significant at p<0.05 and p<0.001 and more likely to work in part-time jobs than single, not completed any educational level, not household head, living in urban area, without children under 5 years old, and without elder people in the household, with odd ratios of 1.09, 1.49, 1.13, 1.10, 1.13, and 1.03 respectively. One of the unpaid work factors, number of household members is not significantly associated with employment.

Table 4 Model II - Binary Logistic Regression for Female Employment

Variables	Adjust OR	95% CI	
		Lower	Upper
Age (Ref: 15-19)			
20-24	1.05	0.99	1.12
25-29	1.18***	1.11	1.25
30-34	1.16***	1.09	1.24
35-39	1.20***	1.12	1.27
40-44	1.27***	1.19	1.35
45-49	1.34***	1.26	1.43
50-54	1.51***	1.41	1.61
55-59	1.68***	1.57	1.81
60-64	1.97***	1.81	2.13
Marital Status (Ref: Single)			
Married	1.09***	1.05	1.12
Widowed/ Divorced/Separated	0.98	0.93	1.03
Education (Ref:No school or less than primary level)			
Primary level	1.04	1.00	1.08
Middle	1.03	0.98	1.08
High school and above level	1.49***	1.42	1.57
Others	0.92	0.80	1.06
Female headed of household (Ref: No)			
Yes	1.13***	1.08	1.19
Wealth quintile (Ref: Lowest Quintile)			
Second Quintile	1.00	0.96	1.05
Third Quintile	1.02	0.97	1.06
Fourth Quintile	1.01	0.97	1.06
Highest Quintile	0.94*	0.90	0.99
Area of resident (Ref: Urban)			
Rural	1.10***	1.06	1.13
Geographical area (Ref: Mountainous area)			
Coastal area	0.81***	0.78	0.84
Middle area	0.88***	0.85	0.91
Lower area	0.81***	0.78	0.84
Number of household members	1.00	1.00	1.01
Variables	Adjust OR	95% CI	
Age (Ref: 15-19)			
Having children in household (Ref: No)			
Yes	1.13***	1.10	1.17
Having elder people in the household (Ref:No)			
Yes	1.03*	1.00	1.07
Number of females in the household	0.96***	0.94	0.97

Note: Statistically significant at p< 0.001***, p< 0.01**, p< 0.05*

Number of observation= 108,815, Pseudo R2 = 0.0095, Prob > chi2 = 0.000

DISCUSSION

The results clearly stated that unpaid work factors were significantly associated with female labor force participation in Myanmar. The key findings of the study showed that number of household members and having children in the household was negatively associated and less likely to participate in labor market. The house works were culturally and unequally assigned to the women in a household. If one household member increase, the burden of household tasks and the workloads of the women in a household are also increased. This situation will also decrease the probability of female participation in labor force. The result also showed that the present of children under 5 years old in a household affected the women's labor force participation because young children need more time to care and attention and the child care services were not well developed in Myanmar. The results were similar to the previous results of other studies (6, 12-14). On the other hand, elder people and number of female in a household were positively related to female labor force participation. If there are elder people in a household, the women can get the assistance form them for household tasks including child caring and the present of more women in a household can also share the household works with each other and it can lead the higher probability of women to enter in labor market. These findings were sustained to previous findings of studies in other contexts (15, 16).

According to the findings, children, elder people and number of females in the household were also statistically significant with female employment. The present of children under 5 years old and elder people 65 years and above were more likely to participate in part-time jobs. The household work including caring for child are culturally responsible for women, even if they work for paid job, they have to continue for family responsibilities and this becomes obvious reason why women predominate in part-time jobs. The results are also similar to the findings of other studies as (17, 18). In the analysis of female labor force, the elder people can help the women to participate in labor force but the result for employment showed that having elder people in household may affect the women's employment time and lead more likely to choice the part-time jobs. The findings of the study showed that unpaid work factors especially number of household menbers and having children under 5 years old in a household are the important factors that affect lower female labor force participation, while having children under five years old and elder people with 65 years and above in a household are the main important factors impact on the employed women to invest in the part-time jobs.

According to patriarchy society in Myanmar, men believed that they are inborn superiority over women and women are assumed as belonging to subordinate position. And Myanmar women have to stay inside the home to do domestic works and to devote for all their family members, while men are accepted to be breadwinners and the leaders of the household (19). Therefore such kind of unequal distruibution of household works derived from existing social and cultural norms in Myanmar reflect that the women had less opportunity to make independent decision and also less chance to enter in labor force because of their household burdens. Therefore, this study highlights the importance of gender equity in unpaid works and its implications on women's labor market outcomes in Myanmar.

For the individual factors, age groups impacts on female labor force and employment. Most of the age groups were significant and more likely to participation in labor force but more likely to work in part time jobs. The experience and knowledge were also to be the positive relationship between age and labor force participation. For example, the people who were getting older have more experienc and more knowledge than the younger people but they can investigate their time for work in part-time jobs. The results were in line with the previous studies (20, 21). Married and widowed/divorced/ separated/ women were less likely to participate in labor force than single women and married women can be involved in part-time jobs. In Myanmar society, when women get married, the household works were traditionally assigned to women and there was also clear discrimination of the roles of women and men especially father and mother in a family. Therefore, women had more responsibilities for household works and had less chance to participate in labor force than single

women. Most of the studies supported the negative association between married women and female labor force participation (6, 22). For education, the women completed primary and secondary levels were more likely to participate in labor force and the high school and above level were more likely to employ in part time jobs.

For the household factors, female headed household was statistically significant with labor force participation and employment. The female headed households were more likely to participate in labor force but they can use their time for part-time jobs. It can be assumed that if the women who are household heads, they need to work for their family to support financial assistance. They participate in labor force because of their household need but if they do not have more female members in their households, they can just participate in part-time job. This results is supported by other finding of the studies (23).

For the wealth status, third and fourth quintiles are statistically significant and less likely to participate in labor force and highest quintile was associated with employment but more likely to work full-time jobs. Traditionally men are bread winners in the household and if the household is wealthier, the women do not need to work outside home. Therefore, this can be known that most women in Myanmar work due to the necessary for financial support of their family and not based on the choice. The results are similar to other studies where the wealth status of the household increases, the probability of female labor force participation increases (16, 24).

For geographical factors, areas of resident and geographical area statistically significant with female labor force participation and employment. Living in rural area is more likely to participate in labor market than urban area but less likely to participate in full-time jobs. Generally, rural areas are less developed than in urban areas and rural women may get lesser earns than urban area and this may force rural women to participate more in labor force and working in the farmland is as the general environment for the rural women in Myanmar. This is also similar with other studies with rural women were more likely to participate in labor force than women live in urban areas (20).

The women in middle areas are more likely to participate in labor force than other areas because the middle area is better for transportation and also has agricultural and industrial zones in this area. It is also included one of major economic centers, Mandalay and also Nay Pyi Taw is the neo capital city of Myanmar and most of the businesses moved to this area and job opportunities are also increased in the middle area. For the employment, the coastal, middle and lower areas are more likely to work in full time jobs than mountainous area. The common reason of enhancement for participation in part time jobs in mountainous area is because of higher fertility rate in this area according to the 2014 census results and most ethnicities with different traditional customs and culture live in this area. The results were consistant with the findings of other studies (18).

CONCLUSION

Female labor force participation and employment is very important for the advancement of women's lives and socio-economic development of a country because it encourages efficiency and equity. Therefore, most developed and developing countries need to focus on the female labor force participation and try to get higher participation of women in labor force. According to findings, number of household members and having children in the household were negatively associated with female labor force participation. For the employment, the present of children under 5 years old and elder people 65 years and above were more likely to participate in part-time jobs.Unpaid work performs as a creation of well-being. However, disproportional burden of housework and child rearing that hinder women to perform well in the labor market could deplete female well-being. This study suggests that unpaid work factors are associated with lower female labor market outcomes in Myanmar. Therefore, the effective transformations are required to perform for tackling the unequal distribution of unpaid works among men and women as the cause of gender inequality.

RECOMMENDATIONS

Interventions that can effectively transform unpaid work for gender equality are required. Therefore, at the individual and community levels, it needs to pay awareness related to gender inequality and especially for women to know their women rights to tackle the rooted gender norms and stereotypes in the distribution of care and household work between men and women for the effectively change the attitudes of the unpaid work. And at the policy level, the government should regulate the policy for equal pay, equal work for both men and women and should be made the flexible work schedules to assist the women to find out the work and life balance. And the public services including child and elderly care are also needed to be developed for the better work life balance and for the enhancement of female labor market outcomes in Myanmar.

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RETIREMENT PREPARATION AMONG FORMAL WORKERS AT NEAR RETIREMENT AGE: A CROSS-SECTIONAL STUDY IN THE PUBLIC SECTOR OF THAILAND

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ABSTRACT

In the past few decades, the extending life expectancy has raised concern over retirement issues worldwide, including Thailand. While insufficient preparation for retirement has been known to link with negative impacts on retirees' physical and mental health, there is still little research done on retirement preparation and planning among Thai elderly. Thus, the present study aims to determine the level of retirement preparation among formal workers in the public sector at near retirement age. This study was conducted from May to June 2021 with 226 participants aged 55-59 years old via a 45-minute self-administered questionnaire. Participants were selected using systematic random sampling. A self-administered questionnaire was distributed to assess sociodemographic characteristics, health status, and retirement preparation. All data were analyzed by descriptive statistics such as frequency, percentage, mean and standard deviation. The results showed that the formal workers in a public sector near retirement age are divided into 40.3% female and 59.7% male. Most participants had senior high school education and a couple's marital status. Many of the participants lived with their children, in the accommodation together with 3-4 family members. The monthly income of participants is between 15,001 to 25,000 Thai baht, and more than 90.3% of the participants received employee welfare benefits. Overall, the participants were not preparing for retirement very well. Less than half (47.3%) have the preparation for retirement at a moderate level. Although 23.5% of participants reported that they have a high level, more than a quarter (29.2%) fall far short of retirement preparation. Thus, implying that their perception towards retirement planning and preparedness is likely to be negative rather than positive, which should be further examined. The outcome of this study could be utilized to discover the factors influencing the retirement preparation behaviors of this population.

Keywords: Retirement Preparation, Formal workers, Near retirement age, public sector

INTRODUCTION

Over the past decade, the world population structure in both developed and developing countries is rapidly changing due to the steadily declining fertility and mortality rates. It affects the overall structure of populations and leads to changes in age structure in all areas of the world. The most obvious example is the rapid growth of the old age population in the last three or four decades. In 2017 there were 962 million people aged 60 or over, increasing 152% over the 383 million older people globally in 1980. The number of older people is expected to double again by 2050, when it is projected to reach nearly 2.1 billion (1). Thailand is experiencing unparalleled growth of its older population in number and proportion. This growth has been faster than most developed countries and the second-fastest in South-East Asia, next to Singapore (2).

At present, Thais have an increased average life expectancy at birth of 76 years (73 years for males and 81 years for females) (3). These figures tell us that Thai people who will pass into retirement age will face a longer life expectancy. It means that typical Thai people will have a longer time to spend in their retirement life without extending the retirement age. In addition, this increase in average life expectancy will put significant pressure on the financing of the state's social security system in the coming years. Furthermore, retirement may also influence mortality. One of the empirical studies that estimate the causal effect of retirement on mortality in Austria found that retirement causes an increase in the probability of dying before the age of 67 among blue-collar men but not among blue-collar women. The excess mortality in males was concentrated among heart disease, a disease associated with excessive alcohol consumption and vehicle trauma (4). In turn, a previous study from Canada reported that in the age group 55 and over, retirement improves the psychological well-being of both males and females (5). In Switzerland, retirement provides relief from people with at-risk jobs. Obviously, retirement can have both positive and negative effects for retirees (6). People who have prepared for retired life well will make transitioning easier (7) and leaving them with a substantial enough fund to fulfill their retirement life (8). In addition, retirement preparation is positively related to the level of retirement satisfaction among retirees after retirement as well (9). Thus, having retirement preparation is extremely important to healthy aging and achieve happiness in retirees after retirement.

While preparing for retirement is crucial, many countries have been found that most people still lack retirement preparation and also have limited financial resources. For example, according to a report from The United States (U.S.) Government Accountability Office on retirement security (2019), in 2016, about 48 percent of U.S. households headed by someone aged 55 and over had no retirement savings or a defined benefit plan to draw on in retirement (10). In addition, although Singaporean's pension system is quite robust compared to other Asian markets. The results of the survey of Singaporeans aged 30 and over from "Spotlight on Retirement: Singapore" found that a massive 80 percent of the respondents across Singapore anticipate a gap in retirement funds when they turn age 60, and only 20 percent expect to have enough funds that they need to lead a comfortable retired life (11).

In Thailand, based on evidence from a survey in retirement planning by Dhanaporn Chittinandana (2017) found that 41 percent of Thai workers have not planned or started saving for retirement (12). In addition, there are many workers who work in the formal sector who will soon transition from work to retirement years (13). According to data from Office of the Civil Service Commission (OCSC) (2018) of Thailand (14), during the past 10 years from 2008-2017 in Thailand, there were approximately 391,040 retired government officials (39,104 average yearly). And tended to increase over the past few years. In the years 2015-2017, there were 45,678 retirees, 43,597 and 40,022 retirees respectively (14).

Although there are some research studies on retirement preparation done in Thailand. For instance, the study on economic preparation for retirement of population aged 50–59 years old (15) and Health Preparation for Retirement among Community Hospitals Registered Nurses in Khon

Kaen Province, Thailand (16). The result of those studies is scarce and focuses only on one domain that can affect retirement preparation, so it is important to find out another domain that can be used to reliably identify the retirement preparation of these populations Moreover, the scarce study exists on retirement preparation among the formal workers at near retirement age population. Thus, while insufficient preparation for retirement has been known to link with negative impacts on both physical and mental health of retirees, the purpose of this study is to promote the successful retirement preparation of this population. And it is necessary to understand what the current level of their retirement preparation is. The present study aims to determine the level of retirement preparation among formal workers at near retirement age in a public sector and the outcome of this study could be utilized to find out for the factors influencing the retirement preparation behaviors of this population.

Design and Methods

Location

This was a cross-sectional study conducted in a public sector in the central region, Thailand, between April to May 2021 via 45-minute self-administered questionnaire with 226 participants aged 55 - 59 years old. Central region Criterion sampling involves the identification of a particular criterion of importance: This study selects the Central Region of Thailand, excluding Bangkok, to undertake because, based on the 2020 National Statistical Office (NGO)'s Labor Survey, the central region is the top 3 regions with a large number of formal workers aged 55-59 (17).

Sample

Participants were formal workers (civil servant, government employee and temporary employee) who are currently working in the public sector. The sample size was calculated based on Yamane's formula (18) and each participant who fits the criteria was selected by using systematic random sampling. The calculation from a total population of 426 current workers who aged 55 – 59 years old in a public sector, we recruited 226 formal workers with the following inclusion criteria, both men and women and willing to participate in the research. The exclusion criteria were formal workers who have worked less than 2 years and those who are currently going through severe conditions/diseases, with substantial risk for mortality. In this study, we had to exclude formal workers who have worked less than 2 years and who are currently in serious health conditions, or at high risk of death because both work period and severe health conditions were considered as confounders that could affect the outcomes of this study. The workers who work less than 2 years might not receive pension or other retirement benefits as common. The workers who are in severe health conditions have low quality of life and poor health status, which were included in our sample.

The number of sample size is;

$$n = \frac{426}{1 + 426 * (0.05)2}$$

$$= \frac{426}{2.065}$$

$$= 206.29$$

* 426 = Number of current workers who aged 55 – 59 years old in a public sector

The result of 206 subjects is used to predict the number of persons who refuse to participate in this research. Thus, the sample was increased by 10% of 206 subjects (20 people) and the total sample size of participants is 226 people.

Measurement Tools

After obtaining permissions from a public sector, the researchers collected data by self-administered questionnaire with 47 main questions for sociodemographic characteristics and health status the following variables assessed using a rating scale.

Sociodemographic characteristics, there were 2 open-ended and 15 closed-ended questions includes demographic and socioeconomic characteristics, i.e., age, gender, educational, marital status, number of children, family members, living status, financial, health status.

Retirement preparation, 30 items, modified from previous study by Chatjongkon Tunlayanisaka

(2009), measuring the retirement preparation scale: physiological and psychology, economic, lifestyle, household, participation in society (19). The internal consistency reliability for Retirement preparation was 0.939. The interquartile range (IQR) was employed to categorize the levels of retirement preparation in this study.

The study was approved by the Ethical Committee of Chulalongkorn University (108/2564).

Data analysis

The type of data on this study was collected by researchers directly from primary sources through a self-administered questionnaire, and it was distributed to assess sociodemographic characteristics, health status and retirement preparation. Age, gender, educational, marital status, number of children, family members, living status, financial, health status were analyzed as individual characteristics. Employee welfare benefits at work were measured with a variable indicating whether their employer contributed to their retirement welfare benefits or not. The part of retirement preparation consists of five domains: physiological and psychological, economic, lifestyle, household and participation in society. There were 30 questionnaires with a 3-rating scale, ranging from lowest (1-point) to highest (3-point) as measured by how much the participants thought about their retirement preparation. Since the retirement preparation questionnaire was no cut-off point for the level of retirement preparation, the researchers then classified it into three retirement preparation levels by using the interquartile range (IQR). The score less than or equal to Q1 was categorized as a low level of retirement preparation, the score between quartiles 3 to quartiles 1 as a moderate level of retirement preparation and the score greater than Q3 will be categorized as a high level of retirement preparation. All data were analyzed by descriptive statistics such as frequency, percentage, mean and standard deviation using SPSS software version 22.

RESULTS

Table 1 depicts the descriptive characteristics of the sample, showing that among the total of 226 formal workers at near retirement age in a public sector are divided into 40.3 percent female and 59.7 percent male. The average age was 57.3 years old (SD =1.368). Most participants had a senior high school education (40.7 percent) and a couple's marital status (72.1 percent). Many of them lived in their own accommodation (74.3 percent) with 3-4 family members (64.6 percent). For the financial status, the most monthly income of participants ranged from 15,001-25,000 baht (50.1 percent), followed by 25,001-35,000 baht (26.1 percent) and 10,001-15,000 baht (14.2 percent). In terms of perception of income, approximately half of participants had a balanced expense with their income, while 38.5 percent of participants had more expenses than their current income, and more than 90.3 percent of them received employee retirement benefits supporting their post-retirement life. According to the health status, 43.8 percent of participants had at least one chronic disease (hypertension, diabetes, asthma), participants with good health (without illness history) were 29.6 percent and short-term illness (muscle pain, insomnia) were 26.5 percent. Moreover, 18.1 percent had alcohol consumption and 13.1 had cigarette smoking habits during the past year.

Table 1 Descriptive Characteristics of Sociodemographic characteristics

Characteristics		Number	Percent
Gender	Male	135	59.7
	Female	91	40.3
Age	55	27	11.9
	56	46	20.4
	57	46	20.4
	58	47	20.8
	59	60	26.5
Marital status	Single	24	10.6
	Couple	163	72.1
	Separated	11	4.9
	Widowed	14	6.2
	Divorced	14	6.2
Number of Children	None	31	13.7
	1-2	183	81
	3 or more	12	5.3
Family member	1-2	35	15.5
	3-4	146	64.6
	5-6	43	19
	7 or more	2	0.9
Educational level	Primary /elementary school	40	17.7
	Junior high school	27	11.9
	Senior high school	92	40.7
	Bachelor's degrees and Higher	67	29.6
Personal income	Less than 10,000 THB	11	4.9
	10,001 THB - 15,000 THB	32	14.2
	15,001 THB -25,000 THB	114	50.4
	25,001 THB -35,000 THB	59	26.1
	More than 35,000 THB	10	4.4
Perception of income	Income more than expenses	19	8.4
	Balanced expenses with income	120	53.1
	Expenses more than income	87	38.5
House ownership	Yes	168	74.3
	No	58	25.7
Health status (during the past year)	Good (no illness)	67	29.6
	Fair (presence of short-term illness)	60	26.5
	Poor (presence of chronic diseases)	99	43.8
Presence of Chronic diseases	None	127	56.2
	1 disease	65	28.8
	2 diseases	25	11.1
	3 or more	9	4.0
Smoking	Yes	31	13.7
	No	195	86.3
Alcohol consumption	Yes	41	18.1
	No	185	81.9
Employee retirement benefits	Yes	204	90.3
	No	22	9.7

Table 2 showed the median of retirement preparation in each domain: physiological and psychological, economic, lifestyle, household, participation in society and overall. Based on the normality test, the results of the Kolmogorov-Smirnov test were less than 0.05 in the five domains and overall, the data significantly deviated from a normal distribution. According to the result, each of these sources was classified into three retirement preparation levels by using the interquartile range (IQR). An overall retirement preparation was measured with a 3 rating scale, ranging from lowest (1-point) to highest (3-point) as measured by how much the participants thought about their retirement preparation. The range of total score is 34 – 90 points. The median score was 60 (IQR = 12.0). The researcher divided the retirement preparation level into 3 levels by using quartile to categorize the score. The score above quartiles 3 (>67.0) as high retirement preparation, the score between quartiles 3 to quartiles 1 as moderate retirement preparation and the rest (≤ 55) as low retirement preparation. For physiology and psychology, the range of total score is 12 – 30 points then divided the score above quartiles 3 (>24.0) as high preparation, the score between quartiles 3 to quartiles 1 as moderate and the rest (≤ 19) as low preparation. According to economics, the range of total score is 5 – 15 points divided the score above quartiles 3 (>12.0) as high preparation, the score between quartiles 3 to quartiles 1 as moderate and the rest (≤ 9) as low preparation. For households, the researcher has divided the score above quartiles 3 (>13.0) as high preparation, the score between quartiles 3 to quartiles 1 as moderate and the rest (≤ 10) as low preparation. For lifestyle and society, the range of total score is 5 – 15 points divided the score above quartiles 3 (>10.0) as high preparation, the score between quartiles 3 to quartiles 1 as moderate and the rest (≤ 7) as low preparation

Table 2 The Median and Interquartile range (IQR) of retirement preparation (n=226)

Retirement preparation domains	Minimum	Maximum	Median	IQR	Q_1	Q_3
Physiology and psychology	12	30	21	5.0	19.0	24.0
Economic	5	15	10	3.0	9.0	12.0
Lifestyle	5	15	9	3.0	7.0	10.0
Household	5	15	10	3.0	10.0	13.0
Society	5	15	10	3.0	7.0	10.0
Overall	34	90	60	12.0	55.0	67.0

Table 3 showed the level of retirement preparation in five domains and compared an overall. The level of retirement preparation in each domain was classified into three levels. According to the result, overall retirement preparation participants were not preparing for retirement very well. Less than half (47.3 percent) have the preparation for retirement at a moderate level. Although 23.5 percent of 226 participants reported that they have a high level of retirement preparation, more than a quarter (29.2 percent) of participants fall far short of retirement preparation.

For physiological-psychology and economic domains, approximately half of the participants had a moderate level of preparation (50.0 percent and 53.5 percent) and the low level of preparation were 29.2 percent and 31.4 percent, respectively. According to the lifestyle, most of the participants (44.7 percent) had a moderate level of preparation and the low level of preparation were 40.7 percent. For households, more than half of the participants (52.7 percent) had a low level of preparation and a moderate level of preparation were 24.3 percent. For society, most of the participants (46.9 percent) had moderate preparation and the low of preparation were 31 percent.

Table 3 Distribution of the Level of Retirement preparation among formal workers in near retirement age (n=226)

Retirement preparation domains	Level of retirement preparation					
	Low		Moderate		High	
	Number	Percent	Number	Percent	Number	Percent
Physiological and psychology	66	29.2	113	50.0	47	20.8
Economic	71	31.4	121	53.5	34	15.0
Lifestyle	92	40.7	101	44.7	33	14.6
Household	119	52.7	55	24.3	52	23.0
Society	70	31.0	106	46.9	50	22.1
Overall	66	29.2	107	47.3	53	23.5

DISCUSSION

Preparation for retirement is a multidimensional construct and it also can have effects on physical and mental health differ from person to person, depending on attitude toward retiring and the preparation (20-21). This study aims to determine the level of retirement preparation among formal workers at near retirement age in a public sector. The finding of this study found that a large proportion of the participants were in moderate level of retirement preparation with 47.3 percent, followed by high level and low of preparation before retirement, there were 29.2 percent and 23.5 percent, respectively. Thus, implying that their preparation for retirement was more likely to have a negative than positive. Other studies have shown the findings are very different. In the study of Nipaporn Kerdmalai (2017) among 359 Teachers who are still formal workers in Ayutthaya province, Thailand was in a high of retirement preparation. However, there is a consistent in terms population were gave importance to economic and physiological and psychology (22). The difference in the level of retirement preparation measured in our study may be due to the data, the characteristics of the participants such as age, job position or monthly income, perception of income and the difference of individual perception or access to a retirement plan from the public sector. Thus, there is still needed to carry out further analysis to describe the association and relationship as this study used only descriptive statistics. The research also finds that among sociodemographic characteristics, the educational level of participants was mostly bachelor's degrees and followed by senior high school, and the monthly income of participants ranged from 15,001 to 25,000 baht, and approximately half of participants had a balanced expense with their income. However, for the household, an approximately 53 percent of participants had a low level of retirement preparation. Contrary to previous studies of Chanjira Vibluecher (2019) found that among 120 staff in private-run hospital in the Nonthaburi Province, aged above 45 years old, the level of the household retirement preparation was at a high (23). This may be due to the insufficient monthly income of participants or a lack of understanding of the household preparation before retirement such as how to make a home for older people friendly or still do not see the importance of housing preparation after retirement. Therefore, the household preparation was at a low level.

LIMITATIONS

The researcher acknowledges main limitations in this study. Firstly, the sample size only conducts by near retirement age. The population does not include every age group who are working in the public sector. Second, this study only focused on the 55-59 age group and does not contain another age in the public sector, which may have different association factors that relate to the retirement preparation. This will need to be further discussed and described in the discussion session of this research. Lastly, the sample size is drawn from the population of one public sector in the Central Region and did not cover another region in Thailand. Therefore, a bigger sample size comprising different regions of Thailand would be

more convincing and comprehensive for prediction for the whole Kingdom of Thailand.

CONCLUSION AND RECOMMENDATION

In conclusion, the overall level of retirement preparation among formal workers at near retirement age in a public sector is moderate level of retirement preparation followed by low level of retirement preparation and proportion of high level of retirement preparation before retirement became dramatically low among formal workers. Thus, to improve the perception towards retirement planning and preparation for increasing the level of retirement preparation, the factors influencing the retirement preparation of this population should be noticed and promote knowledge in retirement preparation throughout the lifespan until the worker retires. Furthermore, understanding the level of retirement preparation is also useful for the other public sector to review how workers plan retirement preparation and consider how to encourage workers for further retirement preparation before retirement. Moreover, future studies are recommended to examine the reason behind retirement preparation whether aging or not aging people are preparing for their retirement in advance with appropriate retirement planning, including their expectation of government programs and perception of employee retirement benefits.

There should be a study of factors in each domain in the preparation before retirement, for example, the household in this research result has a low level of retirement preparation. The next research study should be a qualitative research study on retirement preparation, to gain insight into reasons for complications and obstacles in preparation for retirement among formal workers in order to be useful to another public sector.

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MATERNAL KNOWLEDGE, ATTITUDE, AND PRACTICES ON THE DIETARY OMEGA 3 AND 6 CONSUMPTIONS IN CHILDREN AGED 1-2 YEARS OLD IN LABUHANBATU UTARA REGENCY, INDONESIA

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ABSTRACT

The objectives of this study were to explore maternal, household, and children characteristics, and to determine the level of maternal knowledge, attitude, and practices on the dietary omega 3 and 6 consumption in children aged 1-2 years in Labuhanbatu Utara Regency, Indonesia. This study was a cross-sectional study using face-to-face interviews with a structured questionnaire conducted among mothers of children aged 1-2 years during February 2021 to April 2021. A multi-stage sampling was employed, and the participants were drawn from villages in eight subdistricts of Labura. A total of 428 mothers were participated in this study. Data were reported in frequency, percentage, mean and standard deviation. More than one third of mothers who participated in this study were aged 25 years old, and were a private company employee. 54.4% of the mothers in this study graduated from higher education, and 52.1% were Islam. Most of them stayed in urban area. Almost a half of them (45.6%) were Batak. More than half participants (65.2%) were in a nuclear family. Almost 90% had monthly household income higher than district minimum wage. Most of participants (84.8%) had only one child aged 1 to 2 years old. More than half of mothers had children with normal body weight, and more than one third were tall. 59.8% of the children were boys. Almost half of participants (41.8%) had good level of knowledge on dietary omega 3 and 6 consumption in children aged 1-2 years old. Nonetheless, only 7.2% had good level of attitude, and 2.3% had good level of practice on dietary omega 3 and 6 consumption for 1-2 years old children.

Keywords: Maternal knowledge, attitude, practices, omega 3 and 6, Indonesia

INTRODUCTION

Indonesia is one of the countries with low quality human resources. One of the parameters of quality human resources is the creativity of each individual. Problem solving is one of the cognitive performances from brain functioning creativity (1). Omega 3 and 6 are essential fatty acids that play an important role in the development of the quality of the human brain. Omega 3 and 6 have n-3 and 6 carbon chains in their lipid molecular branches (2). Omega 3 fatty acids molecules into docosahexaenoic acid then particularly divided into eicosapentaenoic acid and alpha-linoleic acid (3). Their nutrient functions were important for the development of nerve cells in the brain and retina (4). Intelligence and creativity can also be stimulated if Omega 3 and 6 are met (5). Previous studies suggested that there was a critical timing of intervention regarding the nutrition and diet to produce a long-term effect, which emphasized the importance of supplementation throughout the first 24 months (6). Studies revealed that the effect of a longer duration of more than two years dietary supplementation in early childhood may have led to greater benefits cognitive intelligence functioning in late adolescence, and impaired brain performance and diseases were related to the imbalance dietary intake of fatty acids. Moreover, the period of milestone optimum brain development was in the first 5 years age of children's life, particularly in 1-2 years life of children (7).

In the effort to fulfil Omega 3 and 6 in children under aged 1-2 years, the most responsible person to the period are mothers. The mother should have knowledge about Omega 3 and 6 so that she realized that Omega 3 and 6 were very important for the development of her children's brain cells, so that the adequacy of Omega 3 and 6 in children can be fulfilled. Knowledge also influenced the attitude of giving Omega 3 and 6 to children (8). Factors that influence the mother's knowledge, attitude, and practice are general characteristic education, such as occupation, age, socio-economic, and mother's experience (9). However, limited information specifically examined the attitude and practice of mothers in administration sufficiency Omega 3 and 6 to the children under aged 1-2 years in Indonesia. Therefore, the objectives of this study were to explore maternal, household, and children characteristics, and to determine maternal knowledge, attitude, and practices on the dietary omega 3 and 6 consumption in children aged 1-2 years old in Labuhanbatu Utara, Indonesia.

METHODOLOGY

The cross-sectional study was employed and conducted during February 2021 to April 2021. The data were collected through face-to-face interviews using a structured questionnaire among women who had children aged 1-2 years in the house. A multi-stage sampling was employed, and the villages were drawn from eight subdistricts of Labuhanbatu Utara, where all women in the chosen villages were invited to participate. Face-to-face interview was conducted using a structured questionnaire consisted of six sub-sections as follows (1) maternal characteristics, (2) household characteristics, (3) children characteristics, (4) maternal knowledge towards dietary omega 3 and 6 consumption in children aged 1-2 years old, (5) maternal attitude towards dietary omega 3 and 6 consumption in children aged 1-2 years old, and (6) maternal practices on dietary omega 3 and 6 consumption in children aged 1-2 years old. The questionnaire was validated for content validity by three experts in the field with the Item Objective Congruence (IOC) equal to 0.7 or more. The reliability of the questionnaire was ensured by performing a pre-test carried out by the principal research among 20 participants in a nearby village with Cronbach's alpha of 0.750. Eight research assistants from Public Health Care Centre Staff in the villages were trained to help conducting the interview. The results were reported as frequency, percentage, mean and standard deviation. Level of knowledge were classified using Bloom's cut off points into poor knowledge (score< 60%), moderate knowledge (score = 60-80%), and good knowledge (score> 80%). Level of attitude and practice were classified into three levels from the mean and standard deviation as poor (score ≤ mean - standard deviation), fair (mean - standard deviation < score < mean + standard deviation), and good (score ≥ mean + standard deviation). The study was ethically approved from Research Ethics Review Committee for Research involving Human Research Participants, Chulalongkorn University (COA. No. 103/2021).

RESULTS

This study enrolled 428 mothers aged between 19 to 38 years old with most of them aged 25 years old and below (Table 1). More than half of the mothers (52.1%) were Islam, and married (82%). 54.4% of them graduated from higher education, and more than one third were occupied as private company employee. Majority of the mothers were in urban area (62.6%). In addition, almost half of the mothers were batak (45.6%). For the household characteristics shown in Table 1, Most of the mothers were nuclear family, and had only one child aged between 1 to 2 years old. 88.8% of the mothers had monthly household income higher than district minimum wage ≥ IDR 2,869,292, which approximately equal to 202.16 USD.

Table 1 Maternal and household characteristics of the participants (n=428)

Characteristics	Frequency	Percent (%)
Age		
≤25	145	33.9
26 - 30	135	31.5
31 – 35	98	22.9
≥36	50	11.7
Mean ± SD (min-max)	28.4 ± 4.9 (19-38)	
Religion		
Moslem	223	52.1
Protestant	102	23.8
Advent	45	10.5
Pentecostal	33	7.7
Others (Buddhism, Hindu, Catholic)	25	5.8
Marital status		
Married	351	82.0
Divorced/Widowed	77	18.0
Education level		
Middle High School	34	7.9
Senior high school	161	37.6
Higher education	233	54.4
Occupation		
Civil servant	85	19.9
Private company employee	165	38.6
Entrepreneur	65	15.2
Housewife	113	26.4
Place of Resident		
Urban Area	268	62.6
Rural Area	160	37.4
Ethnicity		
Malay	108	25.2
Javanese	125	29.2
Batak	195	45.6
Family Arrangement		
Nuclear family	279	65.2
Extended family	149	34.8
Monthly household income		
≤2.869 mill IDR per month	48	11.2
≥2.870 mill IDR per month	380	88.8
Cut-off according to district minimum salary rate		

Table 2 presents children characteristics. Majority of the children had normal weight, and were tall according to World Health Organization. Almost 60% of the children were boys. Interestingly, almost a half of them were fed with formula milk only during the past 3 months. Only five children were reported as having food allergy by the mothers.

Table 2 Children Characteristics (n=428)

Characteristics	Frequency	Percent (%)
Body weight in kilograms		
Thin (-3 SD till <-2 SD)	0	22.7
Normal (-2 SD till 2 SD)	372	86.9
Overweight (>2 SD)	56	13.1
Mean ± SD (min-max)	10.9 ± 1.1 (8.2-13.9)	
Height in centimeters		
Short (-3 SD till <-2 SD)	100	23.4
Average (-2 SD till 2 SD)	162	37.9
Tall (>2 SD)	166	38.8
Mean ± SD (min-max)	81.0 ± 4.3 (72.0 – 88.9)	
Sex of child subjected to this study		
Boys	266	62.1
Girls	162	37.9
Current breastfeeding status		
Breastmilk only	59	13.8
Breastmilk by cup with formula milk	137	32.0
Formula milk only	210	49.1
UHT milk only	22	5.1
Food Allergy (n = 428)		
Yes	5	1.2
No	423	98.8

Among 428 mothers participated in this study, almost half of them (41.8%) had good knowledge on dietary omega 3 and 6 for children aged 1-2 years as shown in Table 3. However, only 7.2% of the mothers had good attitude, while majority of them (66.8%) showed fair attitude towards dietary omega 3 and 6 consumption on children aged 1-2 years (Table 3). Moreover, only 10 mothers (2.3%) had good practice on dietary omega 3 and 6 consumption for children aged 1-2 years, whereas 36.9% had poor practice. Lastly, majority of them (60.7%) had fair practice on dietary omega 3 and 6 consumption for children aged 1-2 years.

Table 3 Level of maternal knowledge, attitude, and practices on dietary omega 3 and 6 consumption to the children aged 1-2 years (n=428)

Level	Frequencies	Percentage (%)
Knowledge		
Poor	153	35.7
Moderate	96	22.4
Good	179	41.8
Mean ± SD (min-max)	15.9± 8.9 (1-26)	
Attitude		
Poor	141	32.9
Fair	256	59.8
Good	31	7.2
Mean ± SD (min-max)	62.5 ± 10.5 (25-84)	
Practices		
Poor	158	36.9
Fair	260	60.7
Good	10	2.3
Mean ± SD (min-max)	252.7 ± 32.6 (161-334)	

DISCUSSION

Maternal, household, and children characteristics along with level of knowledge, attitude, and practices towards dietary omega 3 and 6 on children aged 1-2 years old were assessed in this study. The study population was mothers with children aged one to two years in Labuhanbatu Batu Utara Regency, Indonesia.

From 428 mothers who participated in this study, majority of them were Moslem, which was one of the main religions in Indonesia (10). Similar finding was reported in the study conducted in Jakarta, Indonesia (11). More than 80% of the participated mothers were married. This finding supports that woman in Indonesia should be engaged in marriage status (12). More than half of the mothers graduated with higher education, which could be the result from rapid increase in growth development in education and economic at Labuhanbatu Utara regency in the last decade (13). The participated mothers were mostly lived in the urban area, which might strongly influence the dietary habit and food intake of both mother and child due to availability of grocery and convenience stores, and food outlets (14-16).

This study found that the mothers with fair and poor knowledge on dietary omega 3 and 6 consumption in children aged 1-2 years old were more than half of the total participants. Moreover, very small fractions of participated mothers had good attitude and practices on dietary omega 3 and 6 consumption in children aged 1-2 years old. These findings were consistent with other studies that stated that nutrition-related knowledge was a fundamental factor for obtaining a good practice towards a healthy diet. In addition, previous studies also showed that attitudes on diet, food choices, and dietary quality could be influenced by good nutrition knowledge and could later provide a beneficial effect against obesity among children and young adolescents (17-18). Moreover, Parental knowledge and attitude toward nutrition played a fundamental role in their children's knowledge on food and diet (19-20).

The study was conducted at only in one regency of Indonesia; therefore, the results could not be a representative of the whole country. Since face-to-face interview was conducted, it could lead to a bias which might overestimated the results in this study.

CONCLUSION

There were limited studies on level of maternal knowledge, attitude, and practices on dietary omega 3 and 6 consumption in children aged 1-2

years old in Indonesia. Therefore, this study examined and found that while majority of participated mothers in Labuhanbatu Batu Utara Regency, Indonesia had good level of knowledge, most of them either had fair or poor level of attitude and practices on dietary omega 3 and 6 consumption in children aged 1-2 years old.

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UNDERLYING FACTORS LINKED TO HEAVY TOBACCO SMOKING AMONG THE CHINESE FLOATING POPULATION

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ABSTRACT

Prevalence of tobacco smoking and heavy tobacco consumption among the Chinese floating population are higher than the general population. There is a paucity of data regarding the underlying factors influencing heavy tobacco consumption among this floating population. This study aims to investigate which factors influence heavy tobacco smoking and which subcategories of the Chinese floating population are more at risk of developing heavy tobacco consumption. The descriptive statistical analysis explored smoking patterns and summarized the variables related to tobacco smoking based on the China Labor-force Dynamics Survey 2016 (CLDS). Multinomial logistic regression determined the association between heavy tobacco smoking behavior and related factors: gender, age, education, occupation, income, exposure to secondhand smoke per week (almost every day, 3+ days, 1-2 day(s), less than 1 day, never), work-related stress (every day, several times a week, several times a month, several times a year, never), work satisfaction (very much, somewhat, neutral, not much, not at all), and unhappiness (all the time, frequently, sometimes, rarely, never). Data analysis suggests that gender, age, education, occupation, income, exposure to secondhand smoke, and unhappiness variables influenced heavy tobacco usage among the Chinese floating population. The multinomial logistic regression results indicate that the individuals the most at-risk of being heavy smokers were males (OR: 864.639, 95% CI: 117.821-6345.250); with junior and senior high school education (OR: 2.711, 95% CI: 1.315-5.591) or below (OR: 2.568, 95% CI: 1.465-4.501); managers of organizations and enterprises (OR: 9.718, 95% CI: 1.537-61.458); exposed to secondhand smoke almost every day (OR: 3.977, 95% CI: 2.711-5.835); and frequently unhappy (OR: 3.694, 95% CI: 1.206-11.314). These specific socio-demographic, social environment and psychological factors must be considered when developing tobacco control interventions among the Chinese floating population to target its most at-risk members. Further research needs to accurately investigate the impact of psychological factors using appropriate measurement tools.

Keywords: Chinese floating population, tobacco, heavy smoking, tobacco risk factors

INTRODUCTION

The "Healthy China Initiative (2019-2030)" aims to decrease tobacco smoking rate to 20% by 2030, which constitutes a considerable challenge as the smoking rate has only fallen by 1.5% (from 28.1% by 2010 to 26.6% by 2018) in the past decade (1,7). According to the literature, the prevalence of tobacco smoking among the Chinese floating population is equal to 36.5% and more than half of them are heavy smokers (2,3). Tobacco heavy smokers refer to people who smoke 20 cigarettes and above per day.3 Previous studies indicated that heavy tobacco smoking is closely related to health hazards, such as cancers, cardiovascular diseases, and respiratory diseases (4,5,6). However, the Chinese floating population presents special characteristics and is difficult to reach in terms of public health policies. These two specificities of the Chinese floating population increase the likelihood of tobacco smoking (6,8,9)

In order to achieve the target set up by the "Healthy China Initiative (2019-2030)", it is imperative to prevent tobacco smoking among the Chinese floating population. However, tobacco smoking behavior among the Chinese floating population is understudied, especially regarding heavy tobacco smoking behavior. Therefore, this study aims to explore the factors influencing the heavy smoking behavior and identify potential sub-groups among the Chinese floating population affected by heavy smoking in order to provide evidences to further reduce the smoking behavior among this population.

METHODS

This study used secondary data named China Labor-force Dynamics Survey of the year 2016 (CLDS 2016) which was the nationwide survey. There were 20,186 subjects in CLDS 2016, which incorporated 2,659 Chinese nationals belonging to the floating population. The floating population were divided by household registration (hukou). If the working place of a person is not in the same county-level city where the individual hukou is located that means this person belongs to the floating population. After discarding the missing and unqualified data, 1,783 subjects out of 2,659 remained finally in this study. This study was considered to exempt from ethical review by the Committee for Research Ethics (Social Sciences) in Mahidol University.

This study employed descriptive statistical analysis to explore the smoking pattern of the study sample and summarize the variables. Multinomial logistic regression was used to identify the main factors influencing heavy tobacco use and which sub-groups of the Chinese floating population were more-at risk of developing heavy smoking behavior. When odds ratios were more than 1, the association was positive. Likewise, when odds ratios were less than 1, the association was negative. All statistical analyses in this study were conducted by using IMB SPSS version 20.0.

The dependent variable was measured as categorical variable with four levels based on the number of cigarettes smoked per day. The independent variables were categorized into three groups: 1) socio-demography characteristics: gender; age; education level; occupation; and income; 2) social environment factor: exposure to secondhand smoking environment; and, 3) psychological factors: stress-level (How often did you feel stressful at work in the past year?); work satisfaction (Are you satisfied with your current job?); and unhappiness (Did you feel unhappy in the past year?). Table 1 provides more details regarding the values of each variable.

Table 1 Variable descriptions

Variables	The categories of each variable
Dependent variable	
Number of cigarettes smoked per day	Non-smokers (0 cigarette smoked per day); Light smokers (1-9 cigarettes smoked per day); Moderate smokers (10-19 cigarettes smoked per day); Heavy smokers (20 and above smoked per day)
Independent variables	
Gender	Male; Female
Age	15-24; 25-34; 35-44; 45-54; 55-64
Education level	Primary school and below; Junior and senior high school; Junior college and above
Occupation	Managers of organizations and enterprises; Professional and technical personnel; Manufacturing and construction personnel; Social services personnel; Agricultural production personnel; Clerical support and related workers
Income level	Q1: 0-20,000; Q2: 20,001-36,000; Q3: 36,001-60,000; Q4: 60,001-1,000,000
Exposure to secondhand smoking environment	Almost every day; Average 3 days and above per week; Average 1-2 days per week; Average less than 1day per week; Never
Work-related stress	Every day; Several times a week; Several times a month; Several times a year; Never
Work satisfaction	Very much satisfied; Somewhat satisfied; Neutral; Not much satisfied; Not at all satisfied
Unhappiness	All the time; Frequently; Sometimes; Rarely; Never

RESULTS

There were 20,186 subjects in CLDS 2016, which incorporated 2,659 Chinese nationals belonging to the floating population. After discarding the missing and unqualified data, 1,783 subjects (from the Chinese floating population) remained. The sample characteristics are described in Table 2.

The descriptive statistics of this study indicated that 30.5% of the study sample were cigarette smokers, and 69.5% were non-smokers. Among tobacco smokers, 19.7% were light smokers, 24.5% were moderate smokers, and 55.8% were heavy smokers. For gender, only 1.9% of female floating population were smokers, while 56.5% of males were smokers. Importantly, 32.4% of them were heavy smokers. Concerning age, the results indicated that the proportion of smokers was positively related to age and the proportion of heavy smokers also increased with age (from 15-24: 7.7% to 55-64: 31.8%).

Regarding education level, the proportion of heavy smokers in the highest education level was much lower than other education levels (8.2% lower than 18.0% and 20.5%). Regarding occupation, the Chinese floating population who engaged in managers of organizations and enterprises were more likely to smoke cigarettes (51.6%), and presented the highest proportion of heavy smokers (29.0%) compared to other occupations. For income, the results indicated that the proportions of heavy smokers in the first and second quartile income groups were equal to 15.1% and 14.4% respectively, while this proportion raised to 23.4% in the Q4 income level (60,001-1,000,000 Yuan). In other words, the Chinese floating population with higher income had a higher likelihood to be tobacco smokers, notably to be heavy smokers. Concerning the frequency of exposure to secondhand smoking, those who were less frequently exposed to secondhand smoking were more likely to be non-smokers. The percent of non-smokers who exposed to second-hand smoking almost every day was 54.9% while the proportion of non-smokers who never expose to second-hand smoking was 81.0%. Additionally, the proportion of heavy smokers among the floating population who were exposed to secondhand smoking almost every day was equal to 27.5%, which was higher than other categories (more than and equal to 3 days per week: 12.3%, 1-2 day(s) per week: 6.2%, less than 1 day per week:14.0%, and never: 9.9%). In comparison to light and moderate smokers, heavy smokers represented a higher proportion among every stress level, which were 20.3%, 17.0%, 14.8%, 14.9%, and 19.0% respectively. Moreover, the highest percentage of heavy smokers (20.3%) was found among people with the highest level of perceived stress ("stress every day"). Work satisfaction does not seem to influence the level of daily consumption: there was no statistical difference between the five smoking consumption categories, the proportion of heavy smokers presented 16.0%, 16.6%, 17.7%, 17.5%, and 14.3% respectively. The proportion of heavy smokers who felt unhappy sometimes was 17.8%, which was similar to the group of “frequently unhappy” and “never unhappy”.

Table 2 The variables and tobacco smoking patterns of the Chinese floating population (percent %)

Variables	Overall (n=1,783)	The number of cigarettes smoked per day			
		Non-smokers (69.5%, n=1,240)	Light smokers (6.0%, n=107)	Moderate smokers (7.5%, n=133)	Heavy smokers (17.0%, n=303)
Gender					
Male	52.3	43.5	10.2	13.9	32.4
Female	47.7	98.1	1.4	0.4	0.1
Age					
15-24	9.4	75.6	8.9	7.7	7.7
25-34	31.9	72.1	7.9	7.7	12.3
35-44	27.7	71.4	4.1	7.9	16.6

Variables	Overall (n=1,783)	The number of cigarettes smoked per day			
		Non-smokers (69.5%, n=1,240)	Light smokers (6.0%, n=107)	Moderate smokers (7.5%, n=133)	Heavy smokers (17.0%, n=303)
45-54	23.8	67.7	4.0	5.4	22.9
55-64	7.2	49.6	7.8	10.9	31.8
Education level					
Primary school and below	18.1	73.6	3.4	5.0	18.0
Junior and senior high school	57.2	63.9	6.9	8.7	20.5
Junior college and above	24.7	79.6	5.9	6.3	8.2
Occupation					
Managers of organizations and enterprises	1.7	48.4	3.2	19.4	29.0
Professional and technical personnel	11.6	84.0	4.9	4.9	6.3
Clerical support and related workers	3.0	85.2	7.4	3.7	3.7
Social services personnel	49.1	69.4	5.7	7.3	17.6
Agricultural production personnel	7.7	68.6	3.6	8.8	19.0
Manufacturing and construction personnel	26.9	63.5	7.7	8.1	20.7
Income					
Q1: 0-20,000	27.4	75.9	4.5	4.5	15.1
Q2: 20,001-36,000	25.7	74.1	6.1	5.4	14.4
Q3: 36,001-60,000	26.8	66.2	6.1	11.1	16.6
Q4:60,001-1,000,000	20.1	59.5	7.8	9.2	23.5
Exposure to secondhand smoking environment					
Almost every day	39.3	54.9	7.6	10.0	27.5
>=3 days per week	4.5	61.7	13.6	12.3	12.3
1-2 days per week	6.3	81.2	6.2	6.2	6.2
<1day per week	6.8	76.0	4.1	5.8	14.0
Never	43.1	81.0	4.0	5.1	9.9
Work-related stress					
Every day	14.1	62.5	7.6	9.6	20.3
Several times a week	12.2	69.3	7.3	6.4	17.0
Several times a month	19.7	72.7	5.7	6.8	14.8
Several times a year	27.1	71.8	6.2	7.0	14.9
Never	26.9	68.7	4.6	7.7	19.0
Work satisfaction					
Very much satisfied	5.9	68.9	3.8	11.3	16.0
Somewhat satisfied	50.4	70.0	5.7	7.7	16.6
Neutral	36.1	68.8	7.1	6.4	17.7
Not much satisfied	6.4	69.3	4.4	8.8	17.5
Not at all satisfied	1.2	76.2	4.8	4.8	14.3
Unhappiness					
All the time	0.4	85.7	0.0	0.0	14.3
Frequently	4.2	66.7	6.7	9.3	17.3
Sometimes	22.4	68.9	6.8	6.5	17.8
Rarely	23.6	71.9	5.5	7.9	14.8
Never	49.5	68.8	5.9	7.6	17.7

Results of multinomial logistic regression analysis are presented in Table 3. The possibility of being heavy smokers in male floating population was prominently high (OR: 864.639, 95% CI: 117.821-6345.250) compared to the female floating population. For age, the results indicated that the people who belonged to the 15–44 age group category were less likely to be heavy smokers (OR: 0.190, 95% CI: 0.070-0.520; OR: 0.275, 95% CI: 0.134-0.564; OR: 0.362, 95% CI: 0.183-0.714) than those within the 55–64 years old category. For education, members of the Chinese floating population with junior and senior high school education level and below were 2 times (OR: 2.711, 95% CI: 1.315-5.591; OR: 2.568, 95% CI: 1.465-4.501) more likely to be heavy smokers compared to members of the floating population with higher education level (i.e., junior college and above). Concerning occupation, the floating population who worked on managerial positions were more likely to smoke cigarettes heavily (OR: 9.718, 95% CI: 1.537-61.458) compared to other professions. Concerning the impact of the income level, the floating population who got a lower yearly income(i.e., 20,001-36,000 Yuan) were less likely to smoke heavily (OR: 0.541, 95% CI: 0.327-0.893) compared to people who had the highest level of yearly income (i.e., 60,001-1,000,000 Yuan). Furthermore, those who were exposed to secondhand smoking environment almost every day were 4 times (OR: 3.977, 95% CI: 2.711-5.835) more likely to be heavy smokers compared to those who were never exposed to secondhand smoke. For unhappiness, the members of the floating population who felt unhappy frequently were 3.694 times (95% CI: 1.206-11.314) more likely to exhibit heavy smoking behavior compared to those who never felt unhappy.

Table 3 The multinomial logistic regression on light, moderate smokers and heavy smokers versus non-smokers among the Chinese floating population

Variable	Light smokers			Moderate smokers			Heavy smokers		
	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Gender									
Male (vs. Female)	16.689	(8.632, 32.265)	<0.001***	98.897	(30.252, 323.303)	0.000***	864.639	(117.821, 6345.250)	<0.001***
Age									
15-24	0.576	(0.189, 1.754)	0.332	0.563	(0.183, 1.734)	0.317	0.190	(0.070, 0.520)	0.001***
25-34	0.538	(0.271, 1.335)	0.181	0.551	(0.2228, 1.328)	0.184	0.275	(0.134, 0.564)	<0.001***
35-44	0.287	(0.113, 0.728)	0.009***	0.598	(0.255, 1.400)	0.236	0.362	(0.183, 0.714)	0.003***
45-54	0.309	(0.121, 0.790)	0.014**	0.411	(0.172, 0.983)	0.046**	0.575	(0.295, 1.117)	0.102
55-64	1.000			1.000			1.000		
Education level									
Primary school and below	1.143	(0.433, 3.017)	0.787	1.519	(0.614, 3.753)	0.365	2.711	(1.315, 5.591)	0.007***
Junior and senior high school	1.514	(0.789, 2.906)	0.213	1.821	(0.961, 3.449)	0.066*	2.568	(1.465, 4.501)	0.001***
Junior college and above				1.000			1.000		
Occupation									
Managers of organizations and enterprises	0.709	(0.066, 7.659)	0.777	7.611	(1.167, 49.634)	0.034**	9.718	(1.537, 61.458)	0.016**
Professional and technical personnel	0.798	(0.215, 2.959)	0.735	1.751	(0.334, 9.191)	0.508	2.910	(0.553, 15.318)	0.208
Manufacturing and construction personnel	1.108	(0.328, 3.747)	0.868	2.132	(0.445, 10.225)	0.344	3.877	(0.811, 18.531)	0.090*
Social services personnel	0.966	(0.298, 3.131)	0.955	2.345	(0.503, 10.924)	0.278	4.687	(0.997, 22.041)	0.050*
Agricultural production personnel	0.726	(0.150, 3.523)	0.691	3.601	(0.624, 20.766)	0.152	3.709	(0.687, 20.032)	0.128
Clerical support and related workers				1.000			1.000		
Income									
Q1: 0-20,000	0.914	(0.450, 1.858)	0.804	0.958	(0.466, 1.967)	0.907	1.033	(0.600, 1.778)	0.907
Q2: 20,001-36,000	0.795	(0.416, 1.517)	0.486	0.748	(0.388, 1.004)	0.385	0.541	(0.327, 0.893)	0.016**
Q3: 36,001-60,000	0.769	(0.416, 1.423)	0.404	1.479	(0.847, 2.582)	0.169	0.647	(0.405, 1.031)	0.067*
Q4: 60,001-1,000,000	1.000			1.000			1.000		

Variable	Light smokers			Moderate smokers			Heavy smokers		
	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Exposure to secondhand smoking environment									
Almost every day	2.097	(1.262, 3.483)	0.004***	2.575	(1.602, 4.139)	0.000***	3.977	(2.711, 5.835)	<0.001***
>=3 days per week	2.446	(1.081, 5.536)	0.032**	2.188	(0.945, 5.063)	0.067*	1.360	(0.598, 3.092)	0.464
1-2 days per week	1.226	(0.493, 3.051)	0.661	1.019	(0.405, 2.564)	0.968	0.620	(0.251, 1.530)	0.299
<1day per week	0.858	(0.308, 2.395)	0.771	1.017	(0.410, 2.520)	0.971	1.415	(0.712, 2.813)	0.322
Never	1.000			1.000			1.000		
Work-related stress									
Every day	1.859	(0.886, 3.898)	0.101	1.242	(0.629, 2.450)	0.533	0.912	(0.522, 1.594)	0.746
Several times a week	1.436	(0.685, 3.008)	0.338	0.680	(0.326, 1.422)	0.306	0.717	(0.407, 1.263)	0.250
Several times a month	1.033	(0.516, 2.067)	0.927	0.703	(0.374, 1.321)	0.273	0.691	(0.416, 1.149)	0.154
Several times a year	1.198	(0.643, 2.232)	0.570	0.795	(0.453, 1.394)	0.424	0.665	(0.421, 1.050)	0.080*
Never	1.000			1.000			1.000		
Work satisfaction									
Very much satisfied	0.694	(0.059, 8.137)	0.772	2.102	(0.177, 24.909)	0.556	0.742	(0.119, 4.632)	0.749
Somewhat satisfied	0.973	(0.102, 9.253)	0.981	1.702	(0.155, 18.686)	0.664	0.946	(0.168, 5.329)	0.950
Neutral	1.156	(0.122, 10.967)	0.899	1.407	(0.127, 15.547)	0.781	1.070	(0.189, 6.065)	0.939
Not much satisfied	0.600	(0.054, 6.720)	0.678	1.446	(0.120, 17.427)	0.772	0.685	(0.110, 4.254)	0.684
Not at all satisfied	1.000			1.000			1.000		
Unhappiness									
All the time	2.834	(0.733, 8.909)	0.219	1.375	(0.423, 4.379)	0.978	0.349	(0.016, 7.733)	0.506
Frequently	2.696	(0.823, 8.833)	0.101	3.245	(1.014, 11.294)	0.047**	3.694	(1.206, 11.314)	0.022**
Sometimes	1.219	(0.692, 2.148)	0.493	0.954	(0.541, 1.682)	0.870	1.373	(0.883, 2.136)	0.160
Rarely	0.976	(0.553, 1.721)	0.933	1.260	(0.752, 2.109)	0.380	1.175	(0.765, 1.805)	0.461
Never	1.000			1.000			1.000		

Note: reference= non-smokers
OR= odds ratio, 95% CI= 95% confidence interval
* p-value<0.1, ** p-value<0.05, *** p-value<0.01

DISCUSSION

The results of this study indicate that the tobacco smoking rate of the Chinese floating population is 30.5%, which is higher than the tobacco smoking rate of entire Chinese population (26.6%) (2,3). This echoes previous findings that showed that the Chinese floating population is facing a higher tobacco smoking risk than the general population (2,3,10). Among all of tobacco smokers in the Chinese floating population, the heavy smokers account for 55.8%, which is similar to previous studies that suggested that more than half of the current smoking floating population are heavy smokers (3). This result tends to imply that more than half of the Chinese floating population are at risk of experiencing health hazards related to heavy smoking behavior.

The results of the multinomial logistic regression indicate that the male members of the Chinese floating population are more likely to be heavy smokers than female members. This is in line with the studies of Huang and colleagues (2014) and Ji and colleagues (2016) showing that the higher heavy smoking rates were presented in male floating population rather than in the female floating population (.3,11,12) which could be explained by the fact that tobacco smoking is a symbol of masculinity in China(11.12,13,14,15). The Chinese floating population with older age (55-64 years old) are more likely to be heavy smokers than any other age categories. This study draws a similar conclusion to Huang and colleagues (2014), and Ji and colleagues (2016)(3,12) This tobacco smoking pattern could be potentially explained by the degree of nicotine dependence increases with age, which leads older people to potentially smoke heavily and face more difficulty in quitting smoking(16). The Chinese floating population with a lower educational level (i.e., junior and senior education level and below) have a higher possibility to be heavy tobacco smokers, which echoes the studies from Ji and colleagues (2016) (12). Glanz and colleagues (2015) reported that the less-educated floating population could underestimate the risks of tobacco smoking harms and receive less information about hazards of smoking for health, which might lead to heavy smoking behavior (17).

The Chinese floating population who work as managers of organizations and enterprises are 9 times more likely to be heavy smokers. Interestingly, this higher likelihood has not been investigated in prior studies. The previous studies demonstrated that the floating population who worked in construction industry and sex industry might display heavy smoking behavior (2,18,3,19,20,21). This inconsistency might be explained by different category of samples between this study and previous research. The Chinese floating population who get higher yearly income are more likely to smoke heavily, which is similar to the previous research(19,22,23,24). Indeed, Guo and Sa (2015) revealed that the floating population with lower disposable income are less likely to be able to afford the expenditure of cigarette smoking (9). The result of this study shows that the Chinese floating population who are exposed to a secondhand smoking environment almost every day are 4 times more likely to be heavy smokers. However, this factor has not been researched among the Chinese floating population in preceding studies. According to the previous studies investigating other population, this result might be related to the Chinese social interaction culture and the mutual influence of smoking behavior between peers (13,25,26,27) The members of the floating population who felt unhappy frequently were 3.7 times more likely to exhibit heavy smoking behavior. The previous studies indicated that the floating population in the new environment often experienced social isolation, poor living conditions, unstable employment, and social stigma, which could lead to unhappiness and other negative moods, and then resulted in smoking behavior (12,28,29)

Limitations are noted. The variable for unhappiness did not directly investigate the psychological status of the Chinese floating population, and would require a proper measurement tool to be measured accurately. Further studies are needed to better understand the impact of psychological factors on tobacco smoking: proper measurement tools (e.g., Self-Rating Depression Scale, Self-Rating Anxiety Scale, and Depression, Anxiety, and Stress Scale-21 Items) should be used to ensure to what extend psychological negative feelings influence tobacco smoking. Moreover, the China Labor-force Dynamics Survey 2016 (CLDS) was conducted prior to the COVID-19 pandemic and might not reflect the present situation affecting the Chinese floating population.

RECOMMENDATIONS

The awareness of smoking cessation among floating population should be enhanced, especially for male. The smoking cessation interventions for the older floating population should be strengthened. The monitoring of tobacco use among the Chinese floating population should be strengthened by government and organizations. The relationships between psychological determinants and tobacco smoking need to be further investigated for each psychological issue, which would bring a deeper understanding into cigarette smoking.

CONCLUSION

This study investigated the factors influencing tobacco smoking behavior among the Chinese floating population, especially for heavy cigarette smoking. In this study, the analysis of CLDS 2016 shows the smoking rate of the floating population is 30.5%, which is higher than the tobacco smoking rate of the general Chinese population (26.6%). Additionally, more than half of tobacco smokers among floating population are heavy smokers (55.8%). The Chinese floating population who are being male, in the older age (especially for 55–64 years old), with a lower education level, managers of organizations and enterprises, with higher yearly income, exposed to secondhand smoking environment almost every day, and felt unhappy frequently are more at-risk of being heavy smokers. Heavy smokers are less likely to quit cigarettes and are more likely to suffer from tobacco-related diseases compared to light and moderate smokers. Finally, this study proposes some potential recommendations tailored to the most at-risk population that could potentially contribute in reducing Chinese tobacco smoking rate to 20% by 2030.

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FACTORS ASSOCIATED WITH KNOWLEDGE OF SYPHILIS PREVENTION AMONG THE YOUTH VISITING FAMILY PLANNING CLINICS IN BANGKOK, THAILAND

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ABSTRACT

Syphilis has been controlled since 1960 after the WHO globally implemented a strategic program. However, syphilis is now reappearing in some areas in Africa and Southeast Asia, including Thailand. In Thailand, syphilis is reappearing in all regions, especially in the central region. The highest-risk population is the youth aged 15-24 years. Studies should be conducted to determine the factors associated with the current increase of syphilis infections. This study aims to determine factors associate with knowledge of syphilis prevention among youths visiting family planning clinics in Bangkok, Thailand. This cross-sectional study was conducted by using self-administered questionnaires among the youth aged between 15-24 years old who visited PPAT Family Planning Clinics in Bangkok, Thailand (Din Daeng, Pin Klao, Bang Khen) during April to June 2021. A total of 207 participants were recruited by purposive sampling technique. Chi-square statistic was used to determine the association between socio-demographic data and other factors of interest with knowledge of syphilis prevention. Of the 207 participants who joined in this study, 84 were males and 123 females. The Chi-square statistics showed that living status ($P<0.001$), frequency of condom use ($P<0.001$), educational level ($P<0.05$), and reproductive health education ($P<0.05$) were associated with the knowledge level of syphilis prevention among the youths who visited at the PPAT Family Planning Clinics in Bangkok, Thailand. Among 207 participants, almost 1 of 4 participants in this study ever had at least one sexual risk behavior. Results also demonstrated that living status, educational level, frequency of condom use, reproductive health education, and history of reproductive health service use are associated with the knowledge level of syphilis prevention among the youths who visited the PPAT Family Planning Clinics in Bangkok, Thailand. Therefore, it is necessary to highlight the knowledge regarding syphilis prevention among the youths for controlling those sexual risk behaviors. For further study, it is suggested that the researcher should focus on syphilis knowledge level by looking into the participative groups' socio-demography aspects.

Keywords: Syphilis in the youth, knowledge of syphilis prevention, sexually transmitted infection.

INTRODUCTION

Syphilis caused many serious health problems if infected patients did not receive adequate treatment and followed-up. In 1960, WHO implemented a global strategy program to control over syphilis, this program represented one of the most successful health programs by the WHO. At that time, new cases of syphilis around the world decreased gradually. However, syphilis is now reappearing in some areas in Africa and South-east Asia including in Thailand. Later in 2016, the World Health Assembly announced the Global health sector strategy on sexually transmitted infections, 2016–2021. (1) This strategy included rapid scale up of evidence-based interventions and services to end sexually transmitted infections as public health concerns by 2030. The strategy set targets for reductions in gonorrhoea and syphilis incidence in adults and recommended the establishment of global baseline incidences of sexually transmitted infections by 2018.

Thailand had a successful story for controlling HIV and other STIs since 1989, which called "the 100 Percent Condom Program".(2) This program was implemented by the Department of disease control of Thailand (DDC) focused on condom use among sex workers to ensure that clients could not purchase sexual services without using condom. When this program was implemented, the rates of sexually transmitted infection (STIs) dropped quickly and significantly. (2) In 1991, the 100 percent condom program was declared to be a national health policy. Condom use was promoted through mass media, health education, and outreach programs aimed at specific groups throughout the country. The Ministry of Public Health began providing approximately 60 million condoms a year free of charge, mainly distributed to sex establishments. (2)

However, the current situation of syphilis in Thailand has been increased dramatically over 5 times for the last 10 years. Data from the Department of Disease Control of Thailand (DDC) showed that in 2010, incidence of syphilis was 2.16 per 100,000 population and it increased to 11.52 per 100,000 population in 2020 (3). Syphilis cases are major in youths and young adults, its accountable for 20 to 41 percent of all syphilis cases in 2020. (3) DDC believed that this situation is due to decrease rate of condom use among youths and young adults, and some of them believe that syphilis and other STIs can be infected if only they have sexual intercourse with sex-workers. The incidence of syphilis when analysed by region in 2017 showed that syphilis incidence rate in the central region is the highest, equal to 43.8 per 100,000 population. The northern region incidence rate was 24.7 per 100,000 people. The north-eastern region incidence rate was 22.1 per 100,000 population, and the south incidence rate was 13.4 per 100,000 population. However, this situation report of Thailand is likely to be inferior to real situation because it received data from passive surveillance system which documented only cases that visited in hospital. Its mean that people without sign and symptom or people who is in the latent stage will not be reported and not get an adequate treatment. So, they can transmit syphilis to their partners sexually.

Recent study showed that this reappearing of syphilis among youths and young adults was relative with sexual behavior change through advanced in technology, especially internet and social media use17. More than 90 percent of this populations access to the internet and usually use social media in their daily life. (4) As we know, internet is very useful for many purposes, however some of them use internet and social media for nudies, premature sexual intercourse, seeking sexual partner and other sexual proposes. (5) Therefore, "the 100 Percent Condom Program" which emphasized on sex worker in the sex establishments might not as effective as in the past, because the program did not cover internet and social media used.According to school-based reproductive health program of Thailand, recent research reported that there were many obstacles to the teaching of reproductive health education among adolescents and youths, for example; lack of skills in transferring knowledge about reproductive and sex education among teachers, not enough teaching time, lack of proper learning materials (6). The research also suggested that there should have a reproductive health education beginning earlier in a primary school level. Corresponding with the report from the Department of Disease Control of Thailand that there were a lot of misconceptions of syphilis among the youths, some of them believed that syphilis and other STIs can be infected if only they have sexual intercourse with sex-workers(3), and some believed that STIs can transmitted only when semen was secreted, so they used a condom

only at a period of ejaculation. (7) Therefore, a sufficient knowledge and awareness are essential to correct those misconceptions about syphilis and other STIs, and also give a benefit to overall reproductive health among the youths. Another literature supports that knowledge about sexual risk behavior and its consequences are an important factor for prevention and control of STIs. (8) Knowledge is an important prevention factor for STIs. It has been suggested that knowledge about STI transmission might influence sexual behavior. (9)

Health belief model is a well-known behavioral change model that emphasizes on knowledge and perception of individual and aims to change the particular health-related behaviors (10). It consists of the key factors that influence health behaviors as an individual's perceived threat to sickness or disease (perceived susceptibility), belief of consequence (perceived severity), potential positive benefits of action (perceived benefits), perceived barriers to action, exposure to factors that prompt action (cues to action), and confidence in ability to succeed (self-efficacy). Therefore, we applied this model in our study by conducted questionnaires to explore knowledge and perception of participants about syphilis' prevention.

Our study collaborated with the PPAT family planning clinic which is the first non-profit organization and a pioneer in family planning in Thailand. PPAT has a good partnership working with College of Public Health Sciences, Chulalongkorn university and Ministry of Public Health. The clinic provides family-life education, family planning and counselling services to married couples. It also provides services on sexually transmitted infectious, HIV/AIDS, health care for mothers and children, and reproductive health. There are 10 clinics located throughout Thailand, 3 clinics in Bangkok, 3 clinics in the north, 2 clinics in the northeast and 2 clinics in the south. Additionally, the Family planning clinic support a contraceptive service including oral contraceptive pill, contraceptive injection, implantation and condom

.

This study aims to explore the factors that associated with knowledge of syphilis prevention among youths who visit at the Family Planning Clinic, Bangkok, Thailand.

METHOD

Study design

This study is a cross-sectional study conducted among the youths aged between 15-24 year who visit at the Family Planning Clinic, Bangkok, Thailand Clinics (Din Daeng PPAT Medical Clinic, Pin Klao PPAT Medical Clinic, Bang Khen PPAT Medical Clinic). Data was collected during April to June 2021. Knowledge of syphilis prevention was examined by self-administrative questionnaires. This questionnaire was developed by researcher composed of 15 questionnaires to assess knowledge of syphilis prevention. Validity and reliability of the questionnaire were verified by statistical methods and considered by experts. Cronbach's alpha coefficient of this questionnaire was 0.896. All questionaries are in Thai language. There are 2 options of answering the questionnaires depend on participants' preference, answer sheet method, and google form method by using QR code scanning via mobile phone.

Study population

The youths aged between 15-24 year-old who visit at Family planning clinic, Bangkok, Thailand.

Sample

Inclusion criteria

- The youth age between 15-24 years old both male and female.
- The youth who visit at Family Planning Clinic and members of Family Planning Clinic
- The youth who has willing to participate in research.
- The youth who has ability to read and write in Thai language.

Exclusion criteria

- None

Sample size

Sample size in this study was calculated by the Cochran formula (Cochran, 1963)

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

Z = 1.64: Critical value for 90% confidence level
d = 0.05: Absolute precision required
p = 0.50: Percentage picking a choice or response

$$n = \frac{(1.64)^2\ 0.50(1-0.50)}{(0.05)^2}$$

$$n = 269$$

From above formula, the minimal participants are 269 people. 10% additional participants (26 people) are added to avoid person who refuse or not complete answering the questionnaires. So, the total sample size is 295 people.

Sampling technique

Purposive sampling method from the youths visiting at 3 Family Planning Clinics, Bangkok, Thailand. (Din Daeng PPAT Medical Clinic, Pin Klao PPAT Medical Clinic, Bang Khen PPAT Medical Clinic), all participants who meet an inclusion criteria will be recruit in this study.

Data analysis

Descriptive statistics: socio-demographic data, education, sexual behavior, and access to reproductive health service were reported by frequency and percentage.

Analytic statistics: The association between socio-demographic data, education, sexual behavior, access to reproductive health service were and the knowledge of syphilis prevention was analyzed by Chi-square and Fisher's exact test.

Research instruments

Research questionnaires are self-administrative questionnaires in Thai language that composed of 2 parts as following.

Part 1:

1.1 General data & socio-demographic data.
1.2 Sexual preventive behavior
1.3 Sexual and reproductive health education/information
1.4 Sexual and reproductive health service accessibility

Part 2:

2.1 Questionnaires about knowledge of syphilis which compose of 15 questions focused of essential information of syphilis (what syphilis is, how it transmits, what the symptoms are, how to prevent it, etc.). The cut-off points of knowledge score, we follow by Glass' Standard and criteria of assessment (11) which use percentile for classification, and we also consult with expert and advisor from College of Public health science, Chulalongkorn university. The cut-off point in our study is the score above 75th percentile equal to "good knowledge level, and below 75th percentile equal to "fair and poor knowledge score". This cut-off point is corresponding to the study about knowledge and awareness of syphilis in China (12) which also uses 75th percentile to be a cut-off point for their study.

Ethical approval

Ethical approval will be obtained from "The Research Ethics Review Committee for Research Involving Human Research Participants" Chulalongkorn University (COA number 126/2021). The Privacy of participant needs to be concerned because this research's issue is delicate, researcher asks "The Research Ethics Review Committee for Research Involving Human Research Participants" to allow participants not to address or sign their name in this research.

RESULTS

Socio-demographic characteristics of the respondents

The results of the descriptive statistics and tests of association between factors of interest and knowledge of syphilis prevention are shown in Table 1. Total number of participants was 207 people (at the beginning we planned to recruit 295 participants, but due to COVID-19 situation and lockdown policy in Bangkok, so we could recruit only 207 participants). Average age of participant

was 22-year-old (SD 1.74), 93.6 percent of them are age between 20-25 year. Most of participants were female (59.4%) more than male (40.6%). 46.9 percent of them were single and 46.4 percent were married. 2 of 3 of them were employed with full-time job (61.4%). More than half of them had education level of university or higher (57%) and 79.2 percent had a reproductive health education.

Table 1 Baseline characteristics

Characteristics	Number (N=207)	Percent
Socio-demographic data		
Age group		
15-19 year	13	6.3
20-25 year	194	93.7
Gender		
Male	84	40.6
Female	123	59.4
Marital status		
Single	97	46.9
Married, live together	85	41.1
Married, separation	11	5.3
Divorce	14	6.7
Employment status		
Fulltime job	127	61.3
Parttime job	36	17.4
Unemployment	44	21.3
Living status		
Living alone	39	18.8
Living with couple	76	36.7
Living with friend or colleague	14	6.8
Living with family or relative	78	37.7
Education		
Education level		
Junior high school	21	10.1
High school	43	20.8
University or higher	118	57.0
Vocational school	25	12.1
Reproductive health education		
Yes	164	79.2
No	43	20.8
Sexual behavior		
Sexual intercourse		
Yes	203	98.1
No	4	1.9
Medical history of STIs		
Yes	6	2.9
No	201	97.1
Frequency of condom use		
Always	19	9.2
Usually	55	26.6
Sometimes	76	36.7
Rarely	31	15.0
Never use	26	12.6

Characteristics	Number (N=207)	Percent
Syphilis testing		
Yes	43	20.8
No	164	79.2
Sexual risk behavior		
Multiple partners	2	1.0
Condomless sex	43	20.8
Having sex with person who has history of syphilis infection	2	1.0
Having experience with sex-workers	1	0.5
No sexual risk behavior	155	74.9
Never had sexual intercourse	4	1.9
Access to reproductive health service		
Available of reproduction health service		
yes	73	35.3
no	134	64.7
History of reproductive health service use		
Public hospital	52	25.1
Primary care hospital	29	14.0
Private clinic/hospital	22	10.6
Never use service	104	50.2

The knowledge level of syphilis prevention classified by independent variable as shown in table 2.

Sexual behavior

Almost participants in this study ever had sexual intercourse (98.1%), only 2.9 percent had an experience of sexually transmitted infection. However, the rate of "always use" of condom in participants is only 9.2 percent while "never use" of condom is 12.6 percent. In accordance with the sexual risk behavior issue, the highest risk behavior for syphilis infection is comdomless sex (89.5%), follow by multiple partners (4%) and having sex with person who has history of syphilis infection (4%). Regarding the history of syphilis testing, only 20.8 percent of participants had ever done the screening test for syphilis.

Access to reproductive health service

Almost 65 percent of participants replied that there is no reproductive health service available in their living area. Among the participants who had ever visited some the kind of reproductive health services, 50.4 percent of them visited at public, 28.2 percent visited at primary care unit, and 21.4 percent visited at private clinic/hospital.

Table 2 Level of knowledge of syphilis prevention

Characteristics	Total (percent) N=207	Level of knowledge	
		Fair or poor (n=141)	Good (n=66)
Socio-demographic data			
Age			
15-19 year	13(6.3)	10	3
20-25 year	194(93.7)	131	63
Gender			
Male	84(40.6)	56	28
Female	123(59.4)	85	38

Characteristics	Total (percent) N=207	Level of knowledge	
		Fair or poor (n=141)	Good (n=66)
Marital status			
Single	97(46.9)	59	38
Married, live together	85(41.1)	63	22
Married, separation	11(5.3)	8	3
Divorce	14(6.8)	11	3
Employment status			
Fulltime job	127(61.4)	80	47
Parttime job	36(17.4)	27	9
Unemployment	44(21.3)	34	10
Living status			
Living alone	39(18.8)	16	23
Living with couple	76(36.7)	65	23
Living with friend or colleague	14(6.8)	7	7
Living with family or relative	78(37.7)	53	13
Education			
Education level			
Junior high school	21(10.1)	18	3
High school	43(20.8)	31	12
University or higher	118(57.0)	70	48
Vocational school	25(12.1)	22	3
Reproductive health education			
Yes	164(79.2)	105	59
No	43(20.8)	36	7
Sexual behavior			
Sexual intercourse			
Yes	203(98.1)	139	64
No	4(1.9)	2	2
Medical history of STIs			
Yes	6(2.9)	4	2
No	201(97.1)	137	64
Frequency of condom use			
Always	19(9.2)	5	14
Usually	55(26.6)	33	22
Sometimes	76(36.7)	57	19
Rarely	31(15.0)	27	4
Never use	26(12.6)	19	7
Syphilis testing			
Yes	43(20.8)	25	18
No	164(79.2)	116	48
Sexual risk behavior			
Multiple partners	2(1.0)	2	0
Unsafe sex	43(20.8)	32	11
Sex with person who has syphilis infection previously	2(1.0)	1	1
Sex with sex-workers	1(0.5)	1	0
No sexual risk behavior	155(74.9)	103	52
Never had sexual intercourse	4(1.9)	2	2
Access to reproductive health service			
Available of reproduction health service			
yes	73(35.3)	55	18
no	134(64.7)	86	48
History of reproductive health service use			
Public hospital	52(25.1)	39	13
Primary care hospital	29(14.0)	19	10
Private clinic/hospital	22(10.6)	18	4
Never use service	104(50.2)	65	39

Association between Socio-demographic characteristics, sexual behavior, and knowledge level of syphilis prevention

The Chi-square statistics was used to determine the association between Socio-demographic characteristics and knowledge level of syphilis prevention. The result showed that living status (P<0.001), educational level (P<0.05), frequency of condom use (P<0.001), and reproductive health education (P<0.05) associated with knowledge level of syphilis prevention among the youths who visited at the Family Planning Clinic, Bangkok, Thailand. (Table 3)

Table 3 Association between socio-demographic data, education, sexual behavior, access to reproductive health service and the knowledge of syphilis prevention.

Characteristics	P-value
Socio-demographic data	
Age group	0.557**
Gender	0.712*
Marital status	0.216**
Employment status	0.134*
Living status	0.001*
Education	
Education level	0.007*
Reproductive health education	0.014*
Sexual behaviors	
Sexual intercourse	0.594**
Medical history of STIs	1.000**
Frequency of condom use	0.001*
Syphilis testing	0.115*
Sexual risk behavior	0.647**
Access to reproductive health service	
Available of reproduction health service	0.100*
History of reproductive health service use	0.200*

* Chi-square

** Fisher's exact test

DISCUSSION

The knowledge level of syphilis prevention in this study was classified by percentile, individual who has score 10 of 15 or above (over 75th percentile) was classified as "Good knowledge level", others were classified as "Fair or poor knowledge level". Among the youths in this study, 63 percent of them were categorized as "Fair or poor knowledge level". This result raises big challenges to the current syphilis control programs of Thailand, because knowledge is a fundamental of self-protective behavior to prevention of syphilis and other STIs infection as well as overcomes misconceptions about susceptibility to infection. Therefore, its necessary to reorientate a reproductive health education in Thailand to keep up with the changing of perception, preference, and sexual behavior of the youths.

Living status was association with level of knowledge in our study(P<0.001). From the literature review, there were no studies directly demonstrated a living status of youth to the knowledge of syphilis prevention. But there had been some qualitative studies on sexual health literacy in Thailand that mentioned the living status of adolescents could affect the level of knowledge to prevent of sexual risk behaviors (13). This study said that living with parents or relatives provided essential information to avoid sexual risk behaviors as well as they would contribute a trustful counselling when the youths had some sexual issues(13)

In general, sexual risk behaviors are considered to be a determinant of STDs (14). Our study found

that unsafe sex without condom was the highest problem among sexual risk behaviors. Recently, Thai health-related organizations had explored this problem by conducting a survey among adolescents and youths. In year 2019, the Thai Health Promotion Foundation did a survey about attitude of condom use among adolescents and youths. Results from this survey was quite interesting, the top 3rd reasons why they avoid using condom were; price of condom was too expensive compared with meal, afraid to buy condoms especially buying from convenience stores because he was embarrassed by the cashier or afraid of being teased by others, prefer a contraceptive pill instead of condom. (15) Corresponding with the survey from DDC that reported a lot of misconceptions of syphilis and condom use. (7) Additionally, our study found an association between frequency of condom use and level of knowledge. (P<0.001) This finding was consistent with previous publication which studied about the relationship between level of health literacy and sexually transmitted infections among students, they mentioned that an adequate level of health literacy could help young people or students made better decisions about their sexual behavior. Furthermore, they found an incidence of STDs was associated with a low level of health literacy and low levels of condom use.(16)

Educational level (P<0.05) and reproductive health education (P<0.05) these two factors played the important role to enable the youths understood and perceived their own risk of syphilis to avoid sexual risk behaviors. As we mentioned previously that the Thai youths had a lot of misconceptions about syphilis and condom use. To correct this misconception, we need to reform a school-based reproductive health education program in accordance with the current situation, more accessible and broader. This finding was consistent with previous studies from China(12, 17), they found that educational level and reproductive health education associated with both level of knowledge and awareness of syphilis Therefore, a sufficient knowledge and awareness were essential to correct those misconceptions as well as induce preferable sexual behaviors.

Although our study did not find that access to reproductive health services was correlated with knowledge of syphilis prevention, majority of the youths in our study did not have a reproductive health service available in their local area. This problem needs to be solved. The online reproductive health services might fill this gap of accessibility, because currently everyone can access to internet easily through mobile phone, tablet, and laptop. The youths can use internet to access online services for reproductive health education, develop skill for prevent STIs and prevent unplanned pregnancy, online counseling for family planning, etc.

CONCLUSION

The youths are generally recognized as sexually active and vulnerable population for syphilis infection. It is important to highlight the knowledge regarding syphilis prevention by considering the determinant factors that related.

The result of this study demonstrated that living status (P<0.001), frequency of condom use (P<0.001), educational level (P<0.05), and reproductive health education (P<0.05) were associated with knowledge level of syphilis prevention among the youths who visited at the Family Planning Clinic, Bangkok, Thailand.

RECOMMENDATION

For future and further study, it is suggested that the researcher should focus on syphilis knowledge levelby looking into the participative groups' socio-demography, sexual behavior and access to reproductive health service aspects.

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EVALUATION OF ANTIRETROVIRAL MEDICATION ADHERENCE COUNSELING IN TAUNGGYI, SOUTHERN SHAN STATE, MYANMAR: A MIXED METHODS STUDY

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ABSTRACT

National guidelines in Myanmar only provide the critical measures to support adherence rather than defining the quality criteria for adherence support counseling for people living with HIV (PLHIV). As a result, the medication adherence counseling received by the patients is diverse and inconsistent even among the same facility due to a lack of quality guidelines. This mixed-method research aimed to evaluate antiretroviral treatment (ART) adherence counseling in both public and private settings in Taunggyi, Myanmar. Fifty ART patients and ten peer lay counselors were interviewed with semi-structured questionnaires, and eighteen counseling sessions were observed from April to May 2018. Data triangulation of the findings between patient interviews, counselor interviews, and observations was applied by comparing different data sources. The findings from these data sources indicate that the content of the counseling contained weaknesses in supporting the behavior skills of patients, such as strategies for delayed doses, for managing inconvenience in keeping appointments, for overcoming barriers to strict adherence, and for avoiding interaction with other substances with ART. The interpersonal skills of counselors, such as rapport building, informing patients about their right to confidentiality, and respecting it, still require improvement. In the context of counseling, the counseling place needed much more privacy as it is not only recommended by both patients and counselors themselves but also during the observation. Some of the counseling sessions were found to be interrupted during the sessions. The counselors' communication skills, including usage of the appropriate language level for the patients with low education, and avoidance of information overload, are other areas to be improved. Hence, the skillfulness of the counselors should be promoted through the development of guidelines for ART adherence counseling. Accordingly, this study recommended the development of a comprehensive drug adherence counseling guideline for ART drug adherence counseling in clinical practice in Myanmar.

Keywords: Antiretroviral therapy, adherence counseling, counselor, HIV/AIDS, Myanmar

INTRODUCTION

In 2015, there were 224,794 people infected from HIV in Myanmar. Throughout the continuum of care, there are many challenges to optimally adhere to treatment which is fundamental for viral suppression for People Living with HIV (PLHIV). In 2017, the level of adherence to Anti-retroviral Therapy (ART) conducted at a private sector in Myanmar is 84% (1) and adherence at a level of less than 95% may lead to emergence of drug resistance (2). A large ART program in Myanmar have shown that the 10-year cumulative incidence of failing on first line ART was 22% and of switching to a second-line ART regimen was 12% (3). Hence, it is critical that patients should be counseled carefully prior to the initiation of ART for optimal long-term outcome in PLHIV in Myanmar.

The Information-Motivation-Behavior (IMB) model rationalized that, supporting the medication adherence of patient requires basic information about the illness, sufficient motivation to overcome the barriers and the moment-to-moment behavioral skills to take medicines correctly and timely (4). Number of studies evidenced that effects of HIV adherence counseling can advance the patients drug adherence and improved biological outcomes of PLHIV (5-9).

Myanmar national guideline only provides the important measures to support adherence rather than defining the quality criteria for adherence support counseling for PLHIV (10). As a result, the type of medication adherence counseling received by the patients are diverse even among the same facility. Hence, patients' perceived information and knowledge might be different which can impact the health outcome.

This study aimed to evaluate the situation of ART drug adherence counseling currently conducted in the clinical setting in Taunggyi, Myanmar by identifying the content and context of counseling, the barriers and challenges of counselors and patients' satisfaction over counseling.

METHODOLOGY

Study Design

This study was conducted from April to May in Taunggyi, Southern Shan State, Myanmar; one is hospital-based ART clinic (Integrated HIV Care Program, IHC) implemented by International Non-governmental Organization (INGO) and another setting is government organized ART clinic (National AIDS Program, NAP). Apart from hospital based and clinic based, there was not much difference between the sites regarding counseling.

This is a mixed-method research, consisted of three components: patient's interview, counselors' interview and observation of the counseling sessions. The first, second and third counseling sessions from the same patient were being observed and it took 2 weeks to one month for a patient to complete their counseling sessions. Hence, cross sectional study was applied in patients and counselors' interview and longitudinal study was applied for observation.

The respondents were recruited until data saturation was achieved and the sample size for the individual interview of the patients was 50 (25 from each clinic) who were 18 years old and above and those who have been taking ART for at least 1 month but not more than 6 months. PLHIV who has been initiated ART from the other organizations were excluded. Every counselor (10 counselors) at the study sites were interviewed. Before initiation of ART, patient was counseled for 3 times by the same counselor. Eighteen counseling sessions were observed from the total 6 patients with 6 different counselors.

Development of Guideline and Checklist

Topic guided semi-structured interview with open-ended questions were used to assess the patients perceived counseling. Existing guidelines from Myanmar and other countries (10, 11) were referenced to develop the interview guideline by the researcher. Questions concerning with patient satisfaction (12) on the counseling session. The questionnaires were shown in Table 1.

Table 1 Sample questionnaires for patient interview

No.	Topics	Questions
1.	Information - Knowledge of disease	- To your understanding, can you tell me what HIV is? - What AIDS is? - How HIV can be transmitted? - How can you prevent further transmission of HIV to your partner or spouse or children? - To whom have you been disclosed about your HIV status? - Why do you have to take the blood tests?
2.	Information - Knowledge of treatment	- How do you have to take ART? (Dose/Time) - What are the possible side effects of ART? - Are you taking any other drugs? - How are you taking those drugs together with ART?
3.	Information - Knowledge on adherence and Motivation towards adherence	- How long do you have to take ART? - What kind of consequences can occur for not taking ART as prescribed? - How often do you have to come to the clinic? - Is it difficult for you to come back on the next appointment date? If yes, in what way?
4.	Motivation and Behavioral skills	- What will you do if you ever missed any dose of ART? - How will you deal if any kind of side effects occurred after taking ART? or What did you do when you suffered from drug side effects? - How do you manage your time to take ART on time every day? - What will be the barriers to take the ART regularly? - How will you overcome it? - If you face any inconvenience on the appointment date, how will you manage?
5.	Perception and recommendation	- Your perception upon counseling and counselors? - What would you like to advise on the counseling to improve care and support to patients

Topic guided semi-structured open-ended questions' validity and reliability was obtained from experts and then used to assess for counselor interview including roles and responsibilities as counselors in supporting drug adherence, barriers and challenges in delivering the counseling to the PLHIV and recommendation for future counseling sessions as shown in Table 2.

Table 2 Sample questionnaires for counselor interview

No.	Topics	Questions
1.	Roles and responsibility of counselor to support ART adherence	- How long have you been working as a counselor? - Have you ever trained for the counseling skills? If so, how many times? - What kind of things do you talk about when discussing about HIV and ART with a patient? Please explain about the counseling process. - How do you support patient to be adherent to ART? Prompts: Can you give some examples?
2.	Barriers in providing adherence support	-What kind of problems are you facing in delivering counseling? What do you do to solve the problems?
3.	Recommendation for future counseling	-What would you like to recommend to improve the counseling?

Existing guidelines from Asia-Pacific and other countries (13,11) are used to develop checklist of the observation of the counseling sessions. The checklists can be seen in Table 3.

Table 3 Checklist for observation

No.	Topic	Checklist
1.	Content of counseling	Information on disease, treatment and adherence Strategies on adherence
2.	Context of counseling	Delivery method Unit of delivery Counseling setting Exposure duration
3.	Attitude of counselor	Approach to patient i. Introduction ii. Appreciation iii. Active listening iv. Discuss misunderstanding v. Questioning vi. Problem solving vii. Non-verbal behavior viii. Reaction/Response to questions ix. Choosing words (showing empathy) Provision of motivational support Additional support

Data Collection

Recruitment of the participants was drawn from the patients' lists of the clinic during their follow up visits to get the patients with desirable characteristics. Data was collected by researchers through field notes and audio recordings. The verbal and written consent were taken with thorough explanation and some treatment related information was extracted from the medical records with patients' informed consent. The confidentiality of patients data were maintained throughout the study by using codes instead of names.

Data analysis

Data collected from patient interview was compared with the data attained from observation and counselor interview in terms of triangulation. All the collected audio records and interview field notes data were transcribed, translated to English and manually recorded in the Microsoft Word®. Content analysis and initial coding was done according to pre-identified themes. Following the initial coding, additional categorizing according to specific questions was done. The coded themes and categories from the Microsoft Word® were transferred and grouped in the Microsoft Excel® for data analysis. Fifteen percent of the transcripts were reviewed by an external health researcher to identify commonalities and differences for external validity. At the same time, descriptive analysis was utilized for the quantitative data using Microsoft Excel® spread sheet for the part of content of the counseling. The following equation was used to calculate the adherence level of the patients.

$$\%\ of\ adherence = \frac{No.of\ doses\ should\ have\ taken - No.of\ doses\ missed}{No.\ of\ doses\ should\ have\ taken} \times 100 \quad (13)$$

RESULTS

Content of counseling

Information - Knowledge on HIV and AIDS

From patient interview, all of the patients have good level of understanding that HIV cannot be cured. However, patients were found less understanding of what HIV infection is, its mode of transmission (especially mother to child), preventive behavior (especially Prevention of mother to child transmission, PMTCT) and the reasons of undertaking blood investigations regularly.

> *"I know that I have to take care of myself. That's why I keep my children in a separate room and I also keep separate personal utensils for food."*

On the other hand, from counselor interviews and observation of the counseling sessions, counselors mentioned and found to be less explained about what HIV infection is and the

reasons of undertaking blood investigation regularly. However, the counselors well explained about the mode of transmission and preventive behavior. 92% of the patients did spouses and/or children testing and 88% of them has disclosed their status though those were found to be less explained from counselor interview and observations.

Information - Knowledge on Treatment

From patient interview, most of the patients well understood the purpose of ART. They could explain though ART cannot cure HIV, it can control the viral replication Regarding the dose and schedule of the ART regimen, all of the patients were taking their medicines correctly as prescribed at the right time with the right dose.

> *"As far as I remember, HIV didn't cause direct harm to body. It made the body weak and hence diseases followed. ART can prevent that and made us live long. But without ART it can lead to AIDS. I have to take ART regularly for the whole life until drugs that can cure HIV available."*

Similarly, from counselor interview and observation, almost all of the counselors were found to be well explained regarding treatment.

Patients' knowledge on short-term side effects on their own regimen is satisfactory while only 12% could comprehend the long-term side effects. Likewise, it was found to be less explained in counselor interview and observation.

Only two counselors stated about the drug interaction of ART and other medicines including traditional medicines and alcohol from counselor interview and observation.

Information - Knowledge on Adherence

Among the total 50 patients, 90% of them are "100%" optimal adherence. All of the patients understood the importance of adherence that ART should be taken lifelong at the right time. Patients understood that regular appointment is important but some still disclosed that they are not informed about how often they should come to the clinic routinely. Half of the counselors also explained about the routine schedule of the follow-up visits of the clinic for the continuum of care. Regarding the difficulties in attending the appointments, they talked about occupational barrier, transportation barrier, financial barrier and absence of supporter. Relatedly, counselor interview and observation could confirm that patients were well explained.

52% of the patients had satisfactory knowledge on the consequences of non-adherence as "drug resistance". Besides, from counselor interview and observations, patients were found to be well informed about the drug resistance as a result of treatment interruption.

Motivation

Patients showed positive personal motivation after taking ART. They believed that with regular treatment, they can live long like a normal disease-free person. And most importantly, patients received motivation as their counselors disclosed that they were also taking ART and shared their experiences. In the same way, counselors consoled patients in many different ways: "HIV is a treatable disease", "some chronic diseases also needed lifelong treatment as HIV", "you are not alone" and "strict adherence to ART will make PLHIV live long like a normal disease-free person". In term of social motivation, some patients received the phone numbers of their counselors to seek help, some got home-based-care and some received help from the counselors in linking with other INGO for nutrition and social support.

When assessing counselor interview and observation, all of the counselors could use their strength as a peer counselor very well to support the patients' personal motivation.

Behavioral skills

Regarding the behavioral skills of the patients, they were advised and suggested the appropriate skills to overcome the potential barriers of strict adherence. From counselor interview and observation, they found to be well explained about how to deal with side effects of ART and how to take ART timely and correctly with appropriate suggestion of reminder tools. Patients' interview verified these facts.

"I set 2 alarms, with phone and clock. My family also notice me at the time of medicine."

Nevertheless, some important behavioral skills such as how to manage missed or delayed doses and how to solve in case of inconvenience on the appointment were still lack in some of the patients. Likewise, counselor interview and observation also found out that counselors failed to state the management of missed or delayed doses and how to take other medicines together with ART to avoid drug interaction. From the observation of the counseling sessions, some counselors missed to explain about the strategies to solve potential barriers of adherence such as travel, occupation, daily activities and worried to be seen by others.

Patients' satisfaction on counseling

All of the patients stated that counseling was useful for them and they got enough time to discuss and also responded well to their misunderstandings. However, patients who were ill at the time of counseling, forgetful patients and patients with language barriers did not understand well according to the observation of the counseling sessions.

"Yes, it is useful. I am more knowledgeable and I can even share to other persons and motivate them."

Patients and counselors' recommendation of the future counseling

Counseling room with much more privacy is mostly recommended by both patients and counselors. Patients desired more information about disease, food to eat and avoid, about conception for infected women, more motivational support, less waiting time and health education to uninfected persons to reduce discrimination.

Furthermore, counselors recommended 3-4 counseling rooms at a site and much more refresher trainings. Almost all of them suggested a regular training for counselors for updated information. Some recommended a guideline to follow for counseling.

Barriers and challenges of counselors

Similarly, from patients' interview, being ill and forgetful were the reasons for them not understanding the explanation of the counselor.

"As I was very ill during hospitalization, they came to hospital as I couldn't walk. And they can just talk with my grandma and I just listened. I could remember only a few."

During observation, one patient needed repeated explanation by the counselor as he kept forgetting what have said and the counselor even decided to do counseling one more time. In this study, some counselors disclosed that some patients were afraid to be seen by others. Those patients were less concentrated in the counseling and the counselors stated it as a challenge (see details in Table4).

Table 4 Barriers and challenges of counselors during counseling

Challenges of counselors	Count of Answer
Severely ill patients	4
Patients who couldn't accept their status	3
Patients who didn't pay attention	3
Alcoholic patients	3
Intravenous Drug User (IDU) patients	2
Patients who were more knowledgeable than counselors	2
Forgetful patients	1
Sex workers	1
Patients who were afraid to be seen by other persons	1
Patients who were hospitalizing at private hospital	1
When counseling has to be conducted at patients' room during hospitalization	1
Barriers of counselors	
Language barrier	1

Context of counseling

While the counseling sessions were being observed, most of the counseling were done individually. Regarding the counseling setting, counseling room at NAP is a cabinet attached to ART clinic and also there was inadequacy of counseling room. Hence, some of the counseling sessions were done at one of the clinic's office which had less privacy and interrupted by others. On the other hand, at IHC, counseling room is just parted with curtains. Flip-charts was used by some counselors and most of them did verbally without aids. One counseling session last for 15 minutes to 35 minutes.

Attitude of the counselors

Concerning with their interpersonal skills, counselors were aware of showing respect and empathy and tried to avoid preaching. However, some missed rapport building, less appreciation and failed to inform the confidentiality of patients. In communication skills, they were good at active listening and promptly discussed the misunderstanding. However, some of them were one-way communicator. Lastly, some of the counselors were found to have weakness in using the appropriate language level for the patients with low education level and some failed to avoid information overload.

DISCUSSION AND RECOMMENDATION

Effective medication adherence counseling is one of the structural interventions to promote the adherence of patients (14).
The content of the counseling should comprise all of the constructs of information, motivation and behavioral skills for optimal adherence of PLHIV according to IMB model. However, from the triangulation of the data in this study, significant weaknesses in delivering

information during counseling were found. Qualitative studies in Africa also indicated that adequate HIV knowledge is desired for optimal adherence in resource limited settings (15, 16). Though, some studies from Myanmar and other countries shown to have no association between information construct of IMB and adherence (1, 17, 18). However, the sample in this study was diverse in terms of age, educational level, disease staging and severity of symptoms at that moment, which can affect the understanding and answers of the patients. Regarding the patients' adherence related motivation, patients attained personal motivation much more than social motivation. All of the counselors are acknowledged to use their strength as peer counselors showing the positive patient-providers relationship for empowerment in adherence and retention in care as shown in a study done in South Africa (19). This study discovered the weaknesses in delivering the patients' behavioral skills which are significantly associated with adherence (20) and previous studies have revealed that appropriate behavioral skills is significantly associated with adherence (1, 17, 18, 21).

The most prominent finding is although all of the counseling was done individually for the confidentiality of the patients, the privacy of counseling rooms should be maintained. Mental Health and HIV/AIDS, basic counseling guideline for ART Program by WHO suggested that counseling environment must be ensured with privacy for the patients to be comfortable and safe enough to disclose their personal matters (22). Besides, previous studies also proved that privacy is an alarming issue (12, 15, 23).

All of the counselors are peer lay counselors. They have received different kinds of training with different duration. Some counselors had good interpersonal skills but not communication skills and vice vasa. WHO has considered the peer counselors as a cost-effective intervention for treatment adherence (24) and studies revealed that efficacy of lay health workers improved the ART adherence and patients' information knowledge (19, 25, 26). Interpersonal skills of counselors such as showing respect and empathy, avoidance of preaching, rapport building, appreciation, informing confidentiality and motivation should be considered. And communication skills of counselors such as active listening, promptly discuss misunderstanding, using appropriate language level and avoiding information overload should be instructed well (22).

Therefore, the skillfulness of the counselors should be promoted through developing of guideline for anti-retroviral therapy drug adherence counseling in Myanmar context. The

training curriculum for lay counselors should be strengthened considering the area to be improved found in this study according to "HIV counseling trainer's manual and tools for the Asia-Pacific" (27, 28). Moreover, specific training, regular refresher training with adequate amount of training duration and on-job coaching of peer lay counselors are recommended for sustainability of the effective counseling. Regular supervision of the counselors is needed to ensure the quality of counseling. And standardized monitoring and evaluation framework should be developed to be able to measure inputs, outputs, process and outcome. Records and checklists should be developed and implemented to assess the actual understanding of the patients in the counseling process (27).

One significant finding of this study was counselors mentioned that alcoholic, IDU, sex workers were difficult to counsel and non-adherent to ART. Studies found out that receiving initial adherence counseling and ART knowledge and attitudes towards treatment are significantly associated with adherence in sex workers (29, 30). Likewise, counselors in this study also complained to be difficult to counsel the alcoholic and IDU patients. Studies revealed that non-adherence to ART is relating with patients substance-use (31) and alcohol drinking (14). Studies also indicated that patients with perceived stigma is also a barrier of adherence (32) and in this study, some counselors also disclosed that some patients who were afraid to be seen by others were less concentrated in the counseling.

The findings from this study recommended the development of guideline for ART drug adherence counseling in clinical practice in Myanmar context. Moreover, counseling rooms should be maintained taking into consideration of patients' privacy and confidentiality. Continuous counseling is also mandatory throughout the continuum of care. Refresher training and on-job coaching of peer lay counselors are also recommended for sustainability of the effective counseling. Regular supervision of the counselors is needed to ensure the quality of counseling. Records and checklists should also be developed during the counseling process. Audiovisual assist would be able to enhance the patients' understanding. In addition, there should be more specific guideline for counseling addressing special needs especially for sex workers and alcohol and drug users.

CONCLUSION

The findings from this study highlight the area to be improved in counseling which can be beneficial for the counseling guideline, counselors training manual development and the privacy of the counseling place. This study only focuses on the evaluation of medication adherence counseling but not included pre and post-test counseling, disclosure counseling and counseling to the patients with special needs. It could be more beneficial if a comprehensive HIV counseling package is evaluated at a time. Since this study was conducted in PLHIV of 18 years old and above, the counseling situation should also investigate in children and adolescents living with HIV.

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BREASTFEEDING AND CHILD HEALTH CARE PRACTICES OF MOTHERS INFLUENCING ON DIARRHEA AMONG CHILDREN AGED 0–23 months IN MYANMAR: A SECONDARY DATA ANALYSIS

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ABSTRACT

Diarrhea among children aged 0–23 months remains a huge challenge for Myanmar because it is the fourth leading cause of death among children under 5 years of age. This study aimed to find the association between breastfeeding and child healthcare practices of mothers and diarrhea among children aged 0–23 months in Myanmar. Cross-sectional data were obtained from the 2015 Myanmar Demographic and Health Survey used for the study. A total of 1,655 children aged 0–23 months, who are the youngest and lived with their mothers, were selected for this study. The prevalence of diarrhea among Myanmar children aged 0–23 months was 13.6%. After analyzing with multivariate logistic regression, the child's age [AOR = 2.21; 95% CI = 1.51–3.12], not given early initiated breastfeeding [AOR = 1.31; 95% CI = 1.02–1.81], not given exclusive breastfeeding [AOR = 3.11; 95%CI = 1.41–6.82] were all significantly associated with diarrhea among children aged 0–23 months in Myanmar. Dissemination of health education about breastfeeding behavior to mothers and related factors can reduce the prevalence of diarrhea among children aged 0–23 months in Myanmar.

Keywords: diarrhea status, Myanmar, maternal behavior, Myanmar Demographic and Health Survey

INTRODUCTION

In recent years, increasing size of population and overgrowth industrialization effect enormous changes in global environment. That visible changes in global environment mostly impact poor people who are suffered more related with waterborne and vector-borne diseases, which are malaria, diarrhea and dengue (1, 2). Globally, among waterborne diseases, 1.7 billion of children are suffered by diarrhea. Among them, 525,000 children die because of diarrhea (3). In 2016, life expectancy at birth in Myanmar is 64.7 years which is the lowest one among ASEAN countries. The under-five mortality rate(U5MR) is 72 deaths per 1000 livebirths which is too high, by comparing with 29 in Cambodia and 12 in Thailand. Infant mortality rate is 62 per 1000 livebirth, as compared to 11 in Thailand and 25 in Cambodia. Diarrhea is one of the common causes of under-five mortality death (4). In Myanmar, Ministry of Health is striving to reduce under-five mortality rate to align with sustainable development goals in 2030 (5).

Children aged 0–23 months are prone to diseases due to inadequate immune system. According to UNICEF report of diarrhea in 2018, in South Asia and sub-Saharan Africa, most deaths from diarrhea occur among children aged 0–23 months old (6). According to some report, children aged under 3 years living in low-income countries suffer diarrhea averagely three times every year (7). In Southeast Asia region, diarrhea is still a main problem which can rise rate of mortality in children aged 0–23 months (8). Comparing with neighborhood countries, prevalence of diarrhea in Myanmar is 17% in under-two children which is approximately same with Indonesia in which prevalence of diarrhea is 17.6% (3). In Myanmar, neonatal mortality rate is 25 deaths per 1000 livebirths, and infant mortality rate is 40 deaths per 1000 livebirths (5). Among the causes of under five children death, diarrhea is the fourth leading cause of death. Additionally, in Myanmar, prevalence of diarrhea are highest in children aged 6–11-months (14%) and 12–23-months (17%) among any other age groups (5).

The role of mother distinctly influences the life of the children and also important to reduce morbidity and mortality of children. Children of mother with high income have a lower risk to get diarrhea comparing with children of mother with poor income. Maternal education and health literacy level have a remarkably relationship with prevalence of diarrhea. Mother with lower education have 1.61 times higher for their children to get diarrhea than mother with higher education (9). Behavior of mother is highly influenced in child health (9). Related with maternal behavior, breastfeeding practice also plays in an important role to prevent diarrhea. Globally, death of 823,000 children (<5yr) are related with the non-presence of breastfeeding according to recommendation(10). The World Health Organization (WHO) recommended three breastfeeding practices for children aged 0–23 months , which are exclusive breastfeeding, early initiated breastfeeding and continued breastfeeding (11). According to some research, Children (0-5mth) who were not breastfed exclusively have a 165% risk to get diarrhea (12).

Corresponding with vitamin A supplementation, children aged between 6–59 months need to take two high dose vitamin A supplementation every year to boost their immune system until they become five years old and also can reduce 15 % of prevalence of diarrhea (6). Mothers are responsible mandatorily to give their children updated vaccination according to their aged group. According to WHO and UNICEF reports, they clearly mention that measles vaccination can decrease the incidence of pneumonia and the associated mortality (13). In the study of Pakistan and India, it mentions that children who get measles vaccination reduce the risk about 12–22% to cause diarrhea (13).

In our country, Myanmar, prevalence of diarrhea is higher in children aged between 0 to 23 months old than any other age groups of under 5 children like mentioned above. Research from some countries mostly focus on environmental sanitation as a main causal factor for diarrhea and also specify in children aged under 5 years. Some few literature reviews of neighboring countries show a relation between breastfeeding and child health care practices of mothers and diarrhea status among children aged 0–23 months but it cannot apply for my country, Myanmar, because of different socio-economic status and financial situation. This research aims to find association between maternal behavior in child care and diarrhea in children aged 0–23 months in Myanmar. The information got from this study will be very useful for Ministry of Health and

Sports (MOHS) in Myanmar for strategy drawing, planning, monitoring and evaluation activities to reducing infant and neonatal morbidity and mortality.

METHOD

Study Design and Data Source

This study was reviewed as a secondary data from Myanmar Demographic Health Survey (MDHS) 2015–16 which was the cross-sectional study represented the whole nation of Myanmar. It described and analyzed factor associated to behavior of mothers in child care on prevalence of diarrhea among children aged 0–23 months in Myanmar. This data was collected by one hundred and forty-eight field staffs which was grouped by nine teams. Each team were supervised by health staffs who were trained by DHS program. Data collection time was from December 7, 2015 to July 7, 2016. International Coaching Federation (ICF) gave technical assistance for the DHS program. In this study, researchers used the questionnaire of women and household for data analysis.

Study Population and Sampling

MDHS data was stratified by two-stage sample. Firstly, 442 clusters from rural and urban areas of seven States and eight Regions are selected randomly by using enumeration areas or village or ward tract. As a second stage, thirty households from each cluster (total = 13,260 households) are chosen by using systematic sampling with equal probability. The study population for this research was 0–23 months old children who were living with their mothers in each household in Myanmar. There were 1, 655 children aged between 0 to 23 months old who were living with their mothers in this study. All youngest children aged between 0 to 23 months were selected from total population of children aged under-five years from MDHS (2015–2016) after exclusion of not alive children (0 children), children not living with their mothers (0 children). The final total population of children aged between 0 to 23 months was 1,655 children (N=1,655).

Inclusion and Exclusion Criteria

The youngest children aged 0–23 months old including disability who were alive, living with their mothers, having permanent residence were included. Mothers who were mentally disordered and all children aged 0–23 months living in institution such as hotel, barracks were excluded.

Variables

Dependent variables

Diarrhea among children aged 0–23 months means that children aged between 0–23 months suffer the passage of three or more loose or liquid stools per day in last 2 weeks (14).

Independent Variables

Independent variables in this study are sociodemographic data which is child's age, child's sex, place of residence and mother's age. Maternal education level in this study refers to the completed highest-level education of mother. The data was divided into four groups as follows: 1) No education, 2) Primary, 3) Secondary and 4) Higher. Maternal occupation means usual or principal work such as household chores or business of mother, especially as a means of earning a living. Household Wealth Status in this study means that a measure of a household's cumulative living standard. Household wealth status can be categorized into the poorest, poorer, middle, richer and the richest (15). Breastfeeding behavior of mother in that study means to assess early initiating of breastfeeding, exclusive breastfeeding and continued breastfeeding practices of mother. Practices of mother for child health care means practices of mother for her child to get adequate health care such as measle vaccination and vitamin A supplementation.

Data analysis

Before doing analysis, researcher weighted the datasets to become national level representative survey according to demographic health survey guideline. In this study, the researcher used SPSS version 25 for data analysis. To describe frequency, mean, median, mode, standard deviation and percentage of the variables, researcher used descriptive statistical analysis.

For finding the association between dependent and independent variables, inferential static method was used. The descriptive statistics was used to get prevalence of diarrhea among children aged 0–23 months and the second objectives were to explore maternal behavior. Then, inferential statistics was used to answer third objectives. Multivariate logistic regression was used to find association between maternal behavior in child care and prevalence of diarrhea among children aged 0–23 months.

Ethical Consideration

The MDHS survey was approved by Department of Medical Research, Ministry of Health and Sport and ICF Institutional Review Board. Permission to analyzed MDHS-2015 data was requested by researcher to Demographic Health Survey Program for this study (5). The DHS program approved on 7th January 2021 to analyze data and send the link

https://dhsprogram.com/Data/ for downloading the data. This survey was also approved by The Research Ethic Review Committee of Chulalongkorn University on 2nd March 2021.

RESULTS

This research was performed with secondary data analysis using the data of Myanmar Demographic and Healthy Survey 2015-2016. The 1655 of 0–23 months old children and their caregivers were the samples studied.

Descriptive Statistics of demographic and socioeconomic status

Descriptive statistics of demographic and socioeconomic status is shown in Table 1. One thousand six hundred and fifty-five children aged 0–23 months were included in this survey. A proportion of male children (54%) were more than that of female children (46%). Most of proportion of the children in this survey were 6–23 months old (71.4%). Most population of mothers (51.6%) were between 25 to 34 years old. Over half of the mothers were not working (52.9%). Most population of mother were primary education level (43.8%) living in rural area (74.9%). Approximately half of the mothers (48.4%) were living in poorest and poorer household.

Table 1 Demographic and socioeconomic status among children aged 0–23 months in Myanmar

Variables	Number	Percent
Child' sex (1655)		
Male	894	54
Female	761	46
Child's age(N=1655)		
0-5 month	473	28.6
6-23 month	1182	71.4
Min=0mth, Max=23mths, Median=11mths		
Mother's age(N=1655)		
15-24 years	436	26.3
25-34 years	854	51.6
35-47 year	365	22.1
Min=15 yr, Max=47 yr, Median=29		
Place of residence(N=1655)		
Urban	415	25.1
Rural	1240	74.9

Variables	Number	Percent
Maternal education level(N=1655)		
No education	260	15.8
Primary	726	43.8
Secondary	526	31.8
Higher	143	8.6
Household wealth status(N=1655)		
Poorest	442	26.7
Poorer	360	21.7
Middle	285	17.2
Richer	295	17.8
Richest	273	16.5
Maternal occupation(N=1654)		
Working	779	47.1
Not Working	875	52.9

Descriptive statistics of breastfeeding and child health care practices of mothers among children aged 0–23 months in Myanmar

Breastfeeding and child health care practices of mothers among children with diarrhea aged 0–23 months in Myanmar are presented in Table 2. According to Table 2, majority of mothers who gave early initiated breastfeeding to her children were 65.9%. Among children aged 0–5 months old, the proportion of not getting exclusive breastfeeding (55.1%) were more than that of getting exclusive breastfeeding (44.9%). Most population of mothers (86%) gave breastfeeding continuously. Majority of children aged 9–23 months (70.2%) had taken measles vaccination at least one time. Most population of children aged 0–23 months (51%.) received vitamin A supplementation.

Table 2 Breastfeeding and child health care practices of mothers related with diarrhea among children aged 0–23 months in Myanmar

Variables	Number	Percent
Breastfeeding Behavior		
Early Initiated Breastfeeding(N=1655)		
No	564	34.1
Yes	1091	65.9
Exclusive Breastfeeding(N=473)		
No	261	55.1
Yes	212	44.9
Continued Breastfeeding(N=1655)		
No	232	14.0
Yes	1423	86.0
Practices of mother for child health care		
Measles vaccination (N=1048)		
No	726	70.2
Yes	312	29.8
Vitamin A supplementation (N=1182)		
No	603	51
Yes	579	49

a Exclusive breastfeeding variable is analyzed among children aged 0-5months
b Vitamin A supplementation variable is analyzed among children aged 6-23 months
c. Missing values of all variables are handled according to DHS guideline.
d. Measles vaccination variable is analyzed among children aged 9-23 months.

Diarrhea status among children aged 0–23 months in Myanmar

Table 3 presented diarrhea status among children aged 0–23 months in Myanmar. According to Table 3, the prevalence of diarrhea among children aged 0–23 months was 13.6%.

Table 3 Diarrhea status among children aged 0–23 months in Myanmar

Variables	Number	Percent
Diarrhea status(N=1655)		
No	1430	86.4
Yes	225	13.6

Multivariate logistic regression to find association between breastfeeding and child health care practices of mothers and diarrhea

After the bi-variate analysis, child's sex, mother's age, maternal education level and vitamin A supplementation were not significant with diarrhea among children aged 0–23 months. According to Table 4, after multivariate logistic regression, children aged 6–23 months likely to cause diarrhea about 2.21 times more than children aged 0–5 months. Children aged between 0–23 month who did not get early initiation of breastfeeding likely to suffer diarrhea about 1.31 times more than Children aged between 0–23 month who got early initiation of breastfeeding. Children aged between 0–5 months who were not exclusively breastfed likely to cause diarrhea about 3.11 times more than children aged between 0–5 months who exclusively breastfed.

Table 4 Multivariate logistic regression between breastfeeding and child health care practices of mothers and diarrhea among children (0-23months)

Variables	Diarrhea		AOR	P-value
	No	Yes	95%CI	
	N (%)	N (%)		
Socio-demographic status				
Child's age(N=1655)				
0-5 month	435(26.3)	37(2.3)		
6-23 month	995(60.1)	188(11.4)	2.21(1.51-3.12) *	0.001
Place of residence(N=1655)				
Urban	366(22.1)	50(3)	1.05(0.71-1.62)	0.812
Rural	1063(64.3)	176(10.6)		
Household wealth status(N=1655)				
Poorest	373(22.5)	69(4.2)	1.34(0.81-2.41)	0.303
Poorer	301(18.2)	59(3.6)	1.45(0.81-2.51)	0.185
Middle	247(14.9)	38(2.3)	1.16(0.71-2.12)	0.605
Richer	267(16.1)	28(1.7)	0.79(0.51-1.42)	0.423
Richest	241(14.6)	32(1.9)		
Maternal Occupation(N=1654)				
Working	772(46.6)	103(6.3)		
Not Working	657(39.7)	122(7.4)	0.77(0.61-1.12)	0.081
Breastfeeding Behavior				

Variables	Diarrhea		AOR	P-value
	No	Yes	95%CI	
	N (%)	N (%)		
Early Initiated Breastfeeding(N=1655)				
No	474(28.6)	90(5.4)	1.31(1.02-1.81) *	0.04
Yes	956(57.7)	135(8.2)		
Exclusive Breastfeeding(N=473)				
No	231(48.8)	30(6.3)	3.11(1.41-6.82) *	0.005
Yes	204(43.1)	8(1.7)		
Continued Breastfeeding(N=1655)				
No	194(11.7)	38(2.3)	1.31(0.91-1.91)	0.201
Yes	1236(74.6)	187(11.4)		
Practices of mother for child health care				
Vitamin A supplementation (N=1182)				
No	478(40.4)	101(8.5)		
Yes	517(43.7)	86(7.3)	1.31(0.91-1.72)	0.138

*AOR=adjusted odds ratio, CI confidence interval
* Significant predictors at p-value < 0.05.

DISCUSSION

According to the result, the prevalence of diarrhea among children aged 0–23 months in Myanmar is 13.6%. It means that one in six children aged 0–23 months in Myanmar suffers diarrhea. The prevalence of diarrhea among children aged 0–23 months in Myanmar was relatively low comparing with neighboring country like Indonesia in which prevalence of diarrhea is 17.16% in 2018 because percentage of giving exclusive breastfeeding (13.14%) in Indonesia was very low comparing with that of Myanmar (44.9%) (3).This finding was valuable in strategic planning to decrease prevalence of diarrhea among children aged 0–23 months in Myanmar.

Among the demographic and socioeconomic variables, children aged 6–23 months in Myanmar had more risk to cause diarrhea than children aged 0-5 months old. This finding was consistent with Asfaha from Ethiopia, which mentioned that prevalence of diarrhea was highest in children aged 6–23 months(16). This finding pointed out the important of infant and young child care which is urgently needed in Myanmar. Other variables such as maternal education, household wealth status, maternal occupational status, were not significant with diarrhea in this study. This finding was because of that nearly half of the mothers (47.1%) were working and they could be not primary caregivers of children who cared children in most of the time.

Related with early initiated breastfeeding, children aged between 0–23 month who did not get early initiation of breastfeeding can suffer diarrhea about 1.31 times more than children aged between 0–23 month who got early initiation of breastfeeding. Researchers from Bangladesh and India found same result such as receiving early initiation of breastfeeding can prevent diarrhea (17, 18). Additionally, in UNICEF report, it explored that all children aged 0–23 months who received early initiated of breastfeeding can reduce the 33% mortality Therefore, the findings in this study indirectly agreed the UNICEF report because diarrhea was fourth leading cause of death in young children in Myanmar (5, 19). Corresponding with exclusive breastfeeding, children aged between 0–5 months who were not exclusively breastfed can cause diarrhea about 3.11 times more than children aged between 0–5 months who exclusively breastfed. Similarly, researchers from Saudi, Indonesia and Ethiopia revealed that exclusive breast feeding can be protective factor of diarrhea among children aged 0–5 months (3, 20, 21). Above findings in this study about breastfeeding behavior of mother identified that mothers who has children aged 0–

23 months will critically need to promote their knowledge about breastfeeding.

The findings in this study were very useful in strategy drawing and project implementation for health-related organizations including government sectors. In this study, researchers cannot find the association between rotavirus vaccination and prevalence of diarrhea because this survey was done in 2015 and rotavirus vaccine was firstly included in routine immunization schedule in Myanmar, 2020. The data was collected from mother's reports and health card. Therefore, some questions can cause overtaxing memory of mothers.

CONCLUSION

This study was aimed for finding association between breastfeeding and child health care practices in child care influencing on diarrhea status among children aged 0–23 months in Myanmar. Child's age, early initiated of breast feeding and exclusive breastfeeding remain significant association with diarrhea among children aged 0–23 months in Myanmar. Dissemination of health education about breastfeeding behavior to mothers, increasing coverage of infant and young child health care services especially in rural areas, advocating for setting breastfeeding space at workspace for mothers can reduce the prevalence of diarrhea among children aged 0–23 months in Myanmar.

RECOMMENDATIONS

The findings in this study from discussion identified that breastfeeding behavior of mother, child's age influence diarrhea status among children aged 0–23 months in Myanmar. Increasing more coverage of infant and young child health services is strongly recommended for policy makers according to objective of Myanmar National Health Plan (4). Additionally, project implementer needs to advocate for publishing a policy about setting breastfeeding space at work for mothers, dissemination health education about systematic breastfeeding practice to mother. Mothers who have children aged 0–23 months are encouraged to give early initiated breastfeeding and exclusive breastfeeding to their children. In further research, results related with child health could be more precise if researcher ask not only mother but also primary caregiver who care children in most of the time.

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THE EFFECT OF EARLY CHILDBEARING ON WOMEN'S LABOR FORCE PARTICIPATION AMONG EVER MARRIED WOMEN IN MYANMAR

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ABSTRACT

Women's labor force participation is important not only for individual development of the women, but also for family and country economic devleopment. However, the women's labour force participation was being influence by multidimentional factors, and marriage and childbearing were the major reason for women's drop out from their job. The earlier the childbearing, the more stronger effect to women's labour force participation was expected because early initiation of the motherhood interupt the human capital development of the women and reduce the women capacity to work. In Myanmar, only half of the working age women were in labour force and most of them drop out from their job after marriage and childbearing. However, there are limited studied that have identified the effect of early childbeairng to women's labor force participation in Myanmar. Therefore, this study intends to identify the relationship between the early childbearing and women's labor force participation among the ever-married women in Myanmar. This study uses secondary data analysis with data from Myanmar Demographic and Health Survey, which is a nationally represented cross-sectional survey. A total of 7,718 ever married women with at least one child was selected as the sample and, bivariate and multivariate logistic regression methods were used for analysis with labor force participation being the main dependent variable. Women who experienced early childbearing were 18% (AR=0.82, 95%, CI=0.70-0.97) less likely to participate in the labor force and the effect does not significantly differ between age groups. The currently breastfeeding or married, having younger children and having secondary or higher education lowers the women's labor force whereas living in the rural areas, having 60-69 elderly at home encourage the women to work outside. Therefore, it can be concluded that early childbearing lowers women's likelihood of labor force participation and there is no evidence that the effect is diminished over time.

Keywords: Labor Force Participation, Early Childbearing, Women

INTRODUCTION

Women labour force participation is important not only for individual development of the women but also for promoting the family income and reducing the poverty of the country. According to the study from Israel, couple-headed households with working women were 21.8 % less likely to be poor than the households with women who did not work (1). According to International Labour Organization (ILO), the women who were currently working (employed) and women who have the potential to work in future (unemployed) were defined as women in labour force and, globally, only 48% of the working age women were in labour force in 2018 (2, 3). The marriage and childbearing were the major factors that interfere the women's working status and women quit from their job after marriage and childbearing and some of them also shift from full-time to part-time job (4), as a result, their income were also being affected (5). The earlier the marriage and childbearing, the greater impact on women's labour force participation was expected. According to the data definition from UNICEF, the women who have their first birth before the age of 18 was defined as women with early childbearing (6) and almost 7% of the women (25-49 years) in Myanmar were reported for having the history of early childbearing (7). According to the human capital theory, the human capital development of the women such as education, experience and on-job training were relatively important for women labour force participation (8) and early childbearing interrupted those human capital development of the women by reducing their education attainment, working experience and development opportunity in their jobs (9, 10).

According to the study by Chevalier and fellow researchers in 2003, early childbearing reduces 12 to 14% of the education potential and almost 3 years working experience of the women (9). Moreover, one study by Taniguchi in 1991 also highlighted that delaying the childbearing until the age of 28 increase the pre-birth working experience and wages of the women (10).

Not only the timing of the childbearing, other marital and fertility factors were also influencing on the women's labour force participation. According to Myanmar Demographic and Health Survey (MDHS), currently married women were 14% less likely to work than the widow, separated and divorced women. The number and age of the children also defined the women's labour force participation and the higher the number of children, the lower the women's labour force participation was expected (4, 11). According to the study by Joshil in 1996, each additional children reduce the women's potential to participate in full-time job (4). Moreover, the women with younger children were more likely to discontinue their job no matter their job were full-time or part-time (4, 12). However, the effect of the marriage and childbearing were expected to be reduced as if women were well educated and good socioeconomic background. According to the studies, women with higher education were less likely to quit their job and return to their job quicker than the lower educated one after childbirth (12). However, the lower educated women were sometime more likely to be in labour force than the educated women because unskilled and casual labour were highly available in the labour market while the skilled job for educated women were highly competitive (13). In general, women in higher socioeconomic have higher education status and higher financial resource to hire someone for taking care of the baby increase their participation to labour force (14). However, the financial limitation and needs for daily survival may also have the potential to increase the labour force participation of the women with lower socioeconomic status whereas higher socioeconomic women were waiting for the better job opportunities (11). Therefore, International Labour Organization (ILO) have highlighted that it is important to consider the local context when studying the women's labour force participation as the labour market availability status and policies of every countries were unique (15). Similarly, the age-specific labour force participation of the women was also different from one country to another (16). Countries with higher accessibilities of the elderly and childcare services, policies to support the maternity leaves and flexible working hours for breastfeeding mother, and higher job opportunity for women with children have the higher women's labour force participation than the countries who were not (4, 12, 17). Furthermore, having the other adult at home was expected to increase the women's labour force participation by sharing the household and childcare responsibilities (12). However, this is not true for every cases, the relationship of the women with household member also decide the women's labour force participation and women who live with mother-in-law were less likely to be in labour force than the women with their biological mother because of the traditional belief of the women as the care giver for the family member of the husband (18, 19).

Therefore, women's labour force participation was being influenced by multi-dimensional factors and

marriage and childbearing were playing background for most of the factors. Moreover, the earlier the childbearing, the stronger effect was expected. In Myanmar, only half of the working aged women in Myanmar were in labour force (7) because most of them drop out from their job after marriage and childbearing (20). Although women's labour force participation was important for individual women, family income and country's economic development, and it was being affected by marriage and childbearing, there are limited studies to identify the effect of childbearing, especially, early childbearing to women's labour force participation in Myanmar. Therefore, this study tries to fill this knowledge gap and aimed to identify the relationship between early childbearing and women's labour force participation in Myanmar. This study will also serve as supportive evidence for promoting the women's labour force participation in Myanmar through reducing the early childbearing and strengthening the policies that can create the flexible working environment for women to continue their job after marriage and childbearing.

METHODS

This study was conducted using secondary data analysis from Myanmar Demographic and Health Survey (MDHS) 2015-2016, which is the nationwide cross-sectional survey. This survey has applied the stratified random sampling method and 15-49 years reproductive age women and men were selected for the sample. Total 12,885 women and 4,737 men from 13,260 households were interviewed in this survey and total response rate was 95% for women and 90% for men. In this study, the 7,718 women who were 15-49 years, ever married and have at least one child were selected as the sample in order to assess the effect of early childbearing on the women's labour force participation. For dependent variable, the women who were currently working, on-paid leave during last seven day, have been worked in last 12 months and women who were in the family or own business were defined as the "working" women and the rest were coded as "not working". The major independent variable, early childbearing was defined as binary variable in this study and follow the definition from UNICEF as mentioned above. The age of the women was also included as major independent variables and categorised into five years age group. However, the 15-19 years and 20-24 years ages groups were combined in order to manage the small sample of 15-19 years women. Moreover, other fertility, socioeconomic and household factors were also included as the control variables, and all of them were also considered as the categorical variables. The fertility factors included currently breastfeeding, total number of children ever born, age of the youngest child. The socioeconomic factors included current marital status, education level of women and their husband, and occupation status of the husband. Furthermore, the household wealth status of the women, place of residence, number of household member, relationship to household head and age of the oldest person at home were included as the household variables.

This study used univariate, bivariate and multivariate logistic regression in order to identify the relationship between early childbearing and women's labour force participation. Chi-square test was used for bivariate analysis and binary logistic regression was used for the multivariate analysis. Three different models were applied for the binary logistic regression analysis and their results were compared. In the first model, only the main variables of early childbearing and age of women were included and their relationship with women's labour force participation was assessed without controlling for other variables. Then, other fertility, socioeconomic and household factors were added to the second model as control variables and the special analysis for the influence of age upon the effect of early childbearing was assessed in the third model by adding the interaction term. The likelihood ratio test was also conducted for defining the best fitted model and the second model is the best fittest model. The pseudo-R2 for the best fitted model is 0.0446 and the Chi-square for this model is 0.000. The variance inflation factors "vif", multicollinearity test was also conducted and the mean "vif" for best fitted model is 3.93. For ethical consideration, MDHS was approved by ethical review board from Ministry of Health, Myanmar and this study was also approved by ethical review board from Institute of Population and Social Research, Mahidol University.

RESULTS

As described in table 1, the descriptive study showed 11% of the women in this sample had the history of early childbearing and the sample was almost equally distributed among the different age groups of the women. Moreover, 90% of them were currently married women and 26% were currently breastfeeding mothers. Almost half of the women in the sample have three children and above, and 33% of women were mother of under 2 children. Nearly half of the women completed the primary education and only 36% of the women in the sample were secondary or highly

educated. In contrast, about half of their husband were secondary or highly educated and only 39% completed the primary education. Moreover, 84% of the husband in the sample were unskilled labour. Seventy-four per cent of the women in the sample lived in the rural areas and the sample was equally distributed among the different wealth quintiles. Over half of the women in the sample lived in the household with four to six family member and 62% of the women in the sample were wife of the household head. Three quarters of the women in the sample lived in the household where the oldest family member was younger than 60 years.

Table 1 Descriptive and Bivariate Analysis for Women's Labour Force Participation

Characteristics	Total Women		Women's Labor Force Participation: WLFP n=7,718				
			Not Working		Working		
	Number	Percent	Number	Percent	Number	Percent	Chi-Square
WLFP	7,718	100.0	2,302	29.8	5,416	70.2	
Early Childbearing							
Yes	847	11.0	280	33.1	567	66.9	0.029
No	6,871	89.0	2,022	29.4	4,849	70.6	
Age of the Women							
15-24	737	9.6	317	43.0	420	57.0	<0.001
25-29	1,213	15.7	421	34.7	792	65.3	
30-34	1,449	18.8	407	28.1	1,042	71.9	
35-39	1,521	19.7	403	26.5	1,118	73.5	
40-44	1,442	18.7	396	27.5	1,046	72.5	
45-49	1,356	17.6	358	26.4	998	73.6	
Currently Breastfeeding							
Yes	2,026	26.3	873	43.1	1,153	56.9	<0.001
No	5,692	73.8	1,429	25.1	4,263	74.9	
Total Child Ever Bron							
1 child	1,991	25.8	612	30.7	1,379	69.3	0.425
2 children	1,948	25.2	588	30.2	1,360	69.8	
3 or more	3,779	49.0	1,102	29.2	2,677	70.8	
Youngest Child Age							
Under 2 year (0-2 years)	2,543	33.0	1,070	42.1	1,473	57.9	<0.001
Preschool (3-5 years)	1,711	22.2	422	24.7	1,289	75.3	
Primary (6-9 years)	1,571	20.4	346	22.0	1,225	78.0	
Over 10 years	1,893	24.5	464	24.5	1,429	75.5	
Currently Marital Status							
Currently Married	6,966	90.3	2,160	31.0	4,806	69.0	<0.001
Separate/Widow/Divorce	752	9.7	142	18.9	610	81.1	
Women Education Level							
No Education	1,271	16.5	353	27.8	918	72.2	<0.001
Primary	3,648	47.3	1,037	28.4	2,611	71.6	
Secondary or Higher	2,799	36.3	912	32.6	1,887	67.4	

Characteristics	Total Women		Women's Labor Force Participation: WLFP n=7,718				
			Not Working		Working		
	Number	Percent	Number	Percent	Number	Percent	Chi-Square
Husband Education Level							
No Education	1,353	17.5	405	29.9	948	70.1	0.067
Primary	3,041	39.4	864	28.4	2,177	71.6	
Secondary or Higher	3,224	43.1	1,033	31.1	2,291	68.9	
Husband Occupation							
Unskilled Labor	6,527	84.6	1,951	29.9	4,576	70.1	0.771
Skilled Labor	1,191	15.4	351	29.5	840	70.5	
Wealth Index							
Poorest	1,714	22.2	536	31.3	1,178	68.7	0.034
Poorer	1,639	21.2	456	27.8	1,183	72.2	
Middle	1,554	20.1	433	27.9	1,121	72.1	
Richer	1,502	19.5	464	30.9	1,038	69.1	
Richest	1,309	17.0	413	31.6	896	68.5	
Place of Resident							
Urban	2,002	25.9	684	34.2	1,318	65.8	<0.001
Rural	5,716	74.1	1,618	28.3	4,098	71.7	
Number of Household Member							
1-3 members	1,422	18.4	359	25.3	1,063	74.8	<0.001
4-6 members	4,462	57.8	1,309	29.3	3,153	70.7	
7 or more	1,834	23.8	634	34.6	1,200	65.4	
Relationship with Household Head							
Household Head	629	8.2	146	23.2	483	76.8	<0.001
Wife	4,825	62.5	1,410	29.2	3,415	70.8	
Daughter or Granddaughter	1,306	16.9	393	30.1	913	69.9	
Daughter in Law or Other	958	12.4	353	36.9	605	63.2	
Age of oldest person at home							
>60 years	5,711	74.0	1,741	30.5	3,970	69.5	0.106
60 to 69 years	1,012	13.1	273	27.0	739	73.0	
70 to 79 years	675	8.8	190	28.2	485	71.9	
80 years or older	320	4.2	98	30.6	222	69.4	

For bivariate analysis, the women with early childbearing had lower participation to the labour force than the women without early childbearing and only 67% of the women with early childbearing have participated while 71% of the women without early childbearing were in labour force (see figure 1). The 15-24 years women worked the least, and the participation increased as the women grow older except for a small fall between 40-44 years (see figure 2).

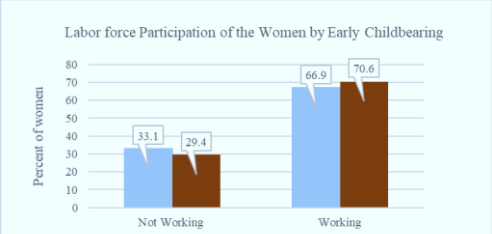

Figure 1 Women's Labour Force Participation by Early Childbearing

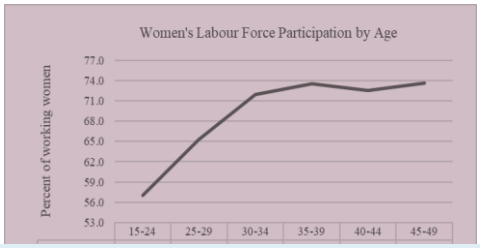

Figure 2 Women's Labour Force Participation by Age of the Women

As shown in table 1, the women who were currently breastfeeding worked less than those who were not and only 56% of currently breastfeeding women have participated in the labour force whereas it was 75% for women who were not. The mothers with six to nine years primary school children were highest participation among the women with different age group of the children. Currently married women had a lower participation rate than those who were widowed, divorced and separated, and only 69% of them participated in the labour force while 81% of other women were working.

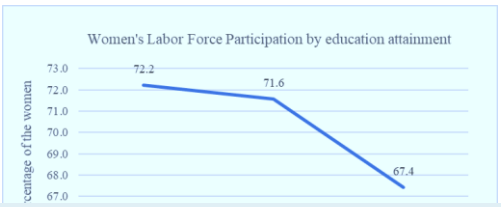

Figure 3 Women's Labour Force Participation by Education Attainment

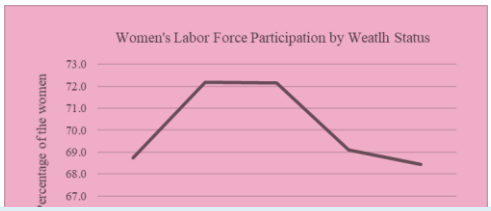

Figure 4 Women's Labour Force Participation by Wealth Status

As illustrated in figure 3, the lower educated women more participated in labour force than the higher educated women and 72% of the women with no education in the sample were working. The women in poorer and middle wealth quintile had the highest participation rate among the women with different wealth quintile and over 70% of women in these quintiles participated in the labour force. As described in table 1, the women in rural areas work more than women in the urban areas and 71% of women in rural areas participated in labour force. The higher number of family member lowers the women's labour force participation and about 74% of the women in household with 1-3 member participated in labour force. Household head women participated higher than other women and being the daughter-in-law of household head participated the least. The women who lived with 60-69 years elderly were highest participation among the women who live with different age group of elder persons and 73% of the women who lived with 60-69 years elder persons participated in labour force. The husband education and occupation status, and number of children were not significantly associated with the women's labour force participation with chi-square 0.067, 0.771 and 0.425 (see table 1).

According to the multivariate binary logistic regression analysis in table 2, early childbearing has a significant effect on the women's labour force participation and women with early childbearing were 18% less likely to participate in the labour force than those without early childbearing. However, the age of the women did not significantly change the effect of the early childbearing on women's labour force participation. Women aged 30-34 years and 35-39 years were 1.39 times and 1.30 times more likely to work than the women aged 15-24 years and labour force participation of women in other age group were not significantly different with 15-24 years women. The mothers who were currently breastfeeding were 30% less likely to be in the labour force than those who were not breastfeeding. Women with older children were more likely to be in the labour force than those with under two years children, and mothers of three to five years pre-schooler were 1.69 times, mothers of six to nine years primary school children were 1.92 times and mothers with over 10 years children were 1.72 times more likely to work than the women with under two years children (see table 2)

Table 2 Multivariate Binary Logistic Regression for the relationship between Women's Labour Force Participation and Explanatory Variable

Dependent Variable:	Labor Force Participation n=7,718								
	Model 1			Mode 2			Mode 3		
	AR*	P-Value	CI**	AR*	P-Value	CI**	AR*	P-Value	CI**
Early Childbearing (Reference: No Early Childbearing)									
Yes	0.91	0.224	(0.78 - 1.06)	0.82*	0.022	(0.70 - 0.97)	0.85	0.37	(0.59 - 1.22)
Age of the Women (Reference: 15-24 years)									
25-29	1.4***	0.000	(1.16 - 1.69)	1.14	0.19	(0.94 - 1.40)	1.17	0.164	(0.94 - 1.46)
30-34	1.91***	0.000	(1.59 - 2.30)	1.39**	0.002	(1.12 - 1.73)	1.41**	0.004	(1.12 - 1.78)
35-39	2.07***	0.000	(1.72 - 2.49)	1.3*	0.026	(1.03 - 1.64)	1.27	0.058	(0.99 - 1.62)
40-44	1.97***	0.000	(1.63 - 2.37)	1.06	0.636	(0.83 - 1.37)	1.08	0.584	(0.82 - 1.41)
45-49	2.08***	0.000	(1.72 - 2.51)	1	0.995	(0.76 - 1.32)	0.98	0.907	(0.73 - 1.32)
Early Childbearing*Age of the Women									
Reference (15-24 *Having Early Childbearing)									
25-29* Having Early Childbearing							0.81	0.456	(0.47 - 1.40)
30-34* Having Early Childbearing							0.89	0.651	(0.53 - 1.49)
35-39* Having Early Childbearing							1.22	0.47	(0.71 - 2.08)
40-44* Having Early Childbearing							0.83	0.488	(0.49 - 1.41)
45-49* Having Early Childbearing							1.13	0.652	(0.65 - 1.97)
Currently Breastfeeding (Reference: No current breastfeeding)									
Yes				0.7***	0	(0.60 - 0.83)	0.7***	0	(0.60 - 0.83)
Total Children Ever Born (Reference: 1 child)									
2 children				0.89	0.129	(0.76 - 1.04)	0.89	0.147	(0.76 - 1.04)
3 or more				0.89	0.169	(0.74 - 1.05)	0.89	0.187	(0.75 - 1.06)
Age of the Youngest Child (Reference: 0-2 years)									
Preschooler (3-5 years)				1.69***	0	(1.42 - 2.01)	1.69***	0	(1.42 - 2.01)
Primary School Age (6-9 years)				1.92***	0	(1.57 - 2.35)	1.93***	0	(1.58 - 2.36)
10 years or older				1.72***	0	(1.38 - 2.14)	1.73***	0	(1.39 - 2.15)
Currently Married (Reference: Separate/Widow/Divorce)									
Currently Married				0.58***	0	(0.46 - 0.73)	0.58***	0	(0.46 - 0.73)
Women Education Level (Reference: No Education)									
Primary				0.89	0.15	(0.76 - 1.04)	0.89	0.141	(0.76 - 1.04)
Secondary or Higher				0.82*	0.034	(0.68 - 0.98)	0.82*	0.031	(0.68 - 0.98)

Significant level *<0.05, **<0.01, *<0.001**

Dependent Variable:	Labor Force Participation n=7,718								
	Model 1			Mode 2			Mode 3		
	AR*	P-Value	CI**	AR*	P-Value	CI**	AR*	P-Value	CI**
Husband Education Level (Reference: No Education)									
Primary				1.13	0.108	(0.97 - 1.32)	1.14	0.105	(0.97 - 1.32)
Secondary or Higher				1.1	0.28	(0.93 - 1.29)	1.1	0.272	(0.93 - 1.30)
Husband Occupation (Reference: Unskilled)									
Skilled Labor				1.13	0.112	(0.97 - 1.32)	1.13	0.11	(0.97 - 1.32)
Wealth Index (Reference: Poorest)									
Poorer				1.12	0.172	(0.95 - 1.30)	1.12	0.167	(0.96 - 1.31)
Middle				1.12	0.188	(0.95 - 1.32)	1.12	0.181	(0.95 - 1.32)
Richer				1.04	0.686	(0.87 - 1.24)	1.04	0.675	(0.87 - 1.24)
Richest				1.07	0.529	(0.86 - 1.33)	1.08	0.509	(0.87 - 1.33)
Place of Resident (Reference: Urban)									
Rural				1.44***	0	(1.26 - 1.66)	1.45***	0	(1.26 - 1.66)
Number of Household Member (Reference: 1-3 members)									
4-6 members				0.94	0.458	(0.80 - 1.10)	0.94	0.444	(0.80 - 1.10)
7 or more				0.85	0.107	(0.70 - 1.04)	0.85	0.104	(0.70 - 1.03)
Relationship with Household Head (Reference: Household Head)									
Wife				1.08	0.499	(0.86 - 1.36)	1.09	0.487	(0.86 - 1.37)
Daughter or Granddaughter				0.96	0.773	(0.73 - 1.26)	0.96	0.768	(0.73 - 1.26)
Daughter in Law or Other				0.84	0.222	(0.63 - 1.11)	0.84	0.215	(0.63 - 1.11)
Age of oldest parson at home (Reference: <60 years)									
60 to 69 years				1.39***	0	(1.17 - 1.65)	1.39***	0	(1.17 - 1.66)
70 to 79 years				1.21	0.058	(0.99 - 1.48)	1.22	0.054	(1.00 - 1.48)
80 years or older				1.02	0.88	(0.78 - 1.33)	1.02	0.871	(0.79 - 1.33)
Intercept	1.35			2.11			2.09		
R-Square	0.01			0.0446			0.045		
Log Likelihood	-4,656.14			-4,493.54			-4,491.82		
LR Chi2	94.21			419.4			422.85		
Prob>chi2	0.000			0.000			0.000		

***AR- Adjusted Ratio, **CI- Confident Interval**

Consistent with the findings from Myanmar Demographic Health Survey, currently married women were 42% less likely to work than widowed, divorced and separated women and women with secondary and higher education were also 18% less likely to work than the women with no education. Again, the women in the rural area were 1.4 times more likely to be in labour force than the women in the urban area and women who lived in the household with 60-69 years oldest family member were 1.39 times more likely to work than the women who live with younger family members. Most of the factors affecting the women' s labour force participation were highly significant, p-value were lower than 0.001 and the significant levels were almost the same for both model 2 and model 3, as well as for the strength of their relationship to the women's labour force participation. Please find the detail in table 2.

DISCUSSION

According to the findings from the study, women who have their first birth before the age of 18 were less likely to be in job than the women who have their birth after 18, and lower chance to accumulate the human capital such as education and working experience in their early life as result of early initiation of the motherhood was expected as the major reasons for the effect of early childbearing to the women's labour force participation, as mentioned by the human capital theory (8) and previous studies (9, 10, 21, 22). Moreover, the study also found out that the age of the women did not significantly change the effect of the early childbearing, and this mean that the effect of the early childbearing was persistent throughout the life of women and its effect was not vary for the different age group of the women. Although age does not change the effect of early childbearing, it has own effect to the women's labour force participation and women who were between 30-34 years and 35-39 years were more likely to work than women in 15-24 years. The completion of the education, being unmarried and less responsibilities for children may encourage the women to focus on their professional life and increase the labour force participation of 30-34 years and 35-39 years women. However, the labour force participation of the older women who were over 40 years were not significantly different with the women in 15-24 years because older women were expected to have higher number of children and responsibilities for childcaring.

The study also found out that women with currently breastfeeding were less likely to be in job than the women who were not, and difficult to control the timing of breastfeeding during working hours and lack of comfortable environment for breastfeeding at job interrupt the women to continue their job and force them to lose their job for breastfeeding (4). Moreover, the mothers of younger children were less likely to work and the lesser burden for childcaring responsibilities and higher financial need for education of the older children may play background for this relationship (4, 12, 23). Furthermore, the currently married women were less likely to work than the women who were widow, divorced and separated, and lack of financial support from their husband allow the widow, separated and divorced women to work more than currently married women (20). In contrast with the finding from the previous study (12), this study found out that the women with secondary and higher education were less likely to work than the women with no education, and highly competitive and limited job availability for higher educated women was expected as the reason for this relationship (13).

This study also identified that the women in rural areas were more likely to work than the women in urban area and women involvement in their family agricultural works may explain for this finding (20). The women who lived in households with oldest family member between 60-69 years were also more likely to work than the women from households without elder person who were over 60 years and participation of the grandparents in taking care of the children may explain for this finding (24). Therefore, according to the findings, it can be said that early childbearing has impact to the women's labour force participation and other marital and fertility factors such as being married, having younger child and breastfeeding were also influencing to the women's labour force participation in Myanmar. Therefore, delaying the marriage, childbearing and creating the flexible working environment for women with children may help to increase the women's labour force participation in Myanmar. Moreover, the education level, resident status and having the other adult at home

were also identified as the factors that have significant relationship with the women's labour force participation in Myanmar and promoting the education of the women and creating the job opportunity at the urban areas were also expected to increase the women's labour force participation in Myanmar.

As this is the cross-sessional quantitative study, the effect of early childbearing on working duration and employment gaps was unable to be assessed and further study using longitudinal data is highly recommended to assess this relationship. Under considering the scope of the study, the indirect effect of the early childbearing through education and other fertility factors were not observed in this study and further study for this effect is also recommended. The working experience and wages of the women were also unable to assess in this study because of data unavailability.

CONCLUSION

In summary, early childbearing have significant relationship with women's labour force participation in Myanmar and women with early childbearing were less likely to work than the women who delay their birth until after 18 years of age. Moreover, there is no evidence that the effect of the early childbearing accelerates or decreases by the age of the women because the effect of the early childbearing was not significantly different for the women in different age group. Although the labour force participation was higher for 30-34 years and 35-39 years women, the labour force participation of the older women who were over 40 years were not significantly different with the younger women. The women who were currently breastfeeding, currently married and women with secondary or higher education were less likely to work and, mothers of under two years old children, women who live in the rural areas and women lived with 60-69 years' oldest family members were more likely to work. Similar with the finding from the 2014 Myanmar census, this study can also conclude that marriage, childbearing and household responsibilities were major barriers for women's labour force participation in Myanmar and delaying the marriage and childbearing may benefit the women to work outside.

RECOMMENDATIONS

As this study identified that early childbearing reduce the women's labour force participation in Myanmar, the interventions for delaying the childbearing may help to increase the women's labour force participation in Myanmar. The reproductive health education programme for contraception and increase the accessibilities of the family planning services may help the women to delay their pregnancy and increase their participation to the labour force. Moreover, the fertility factors such as childbearing and breastfeeding were identified as the factors for lower labour force participation in Myanmar, the policies that help the women to continue their job after childbearing were also likely to improve the women's labour force participation. Policy for maternity leave and flexible working hours for breastfeeding mothers will reduce the women drop-out from their job after childbirth and increasing the availability of the childcare services may also reduce the women burden for childcare and continue to work after childbearing.

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DEPRESSION AND SLEEP QUALITY DURING PREGNANCY AMONG MYANMAR-ORIGIN MIGRANT WORKERS IN SAMUT SAKHON PROVINCE, THAILAND

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ABSTRACT

Depression and poor sleep quality are common mental health problems during pregnancy among pregnant migrant women from Myanmar working in Thailand who experience physiological changes and psychological stresses related to economic problems and the need to plan for the future. These problems have effects on the health of the mother and baby, including premature delivery. Migrant workers are at high risk because of the treatment gap in Thailand's healthcare system. This study looks at depression and sleep quality during the first trimester of pregnancy in the province of Samut Sakhon, which has the second-highest number of migrant workers in Thailand. This study aims to estimate the prevalence of depression and poor sleep quality among migrant pregnant women from Myanmar in Krathum Baen Hospital, Samut Sakhon. This is a cross-sectional study using secondary data from a previously published birth cohort study. The sample was derived from the birth cohort study, which resulted in 124 participants. The sampling method was to select all the participants in the birth cohort study that had all the required data for interpretation. The measurement tool for collecting data was by questionnaire. Statistical analysis was extracted through descriptive statistics. The results showed that of the 108 participants sampled from the birth cohort study, 36 (33.33%) had depression as assessed by Patient Health Questionnaire 9 (PHQ-9), and 31 (28.7%) had poor sleep quality as accessed by the overall Pittsburgh Sleep Quality Index (PSQI). The majority of the pregnant women were aged under 30 years (63.9%), had graduated higher than primary school (58.3%), were still working (78.7%) and reported second-hand smoking (54.6%). Around 50% of the women were classified as having minimal depression, 10.2% had moderate depression, and 19.4% had mild depression. It can be concluded that around a quarter of pregnant migrant workers from Myanmar had poor sleep quality, and most of them reported mild to minimal depression. Almost half of the women had been exposed to second-hand smoking, and most were working during the first trimester of pregnancy. Public health education for migrant workers should include sleep quality and depression among pregnant women in order to help them attain a better quality of life.

Keywords: Pregnancy, depression, sleep quality, migrant women, first trimester.

INTRODUCTION

Pregnancy is a crucial part in the life of most women. They may have many positive feelings, such as being happy about becoming a mother and bringing a new member of the family into the world. However, they can also have negative feelings, such as concern about the future with a baby due in the next few months and depression because they have to struggle with several problems or do not want to have child. Negative feelings in pregnancy are still hard to talk about; society expects mothers to feel good about their pregnancy. This mismatch between women's expectations to have positive feelings about their pregnancy and their true emotional state of sadness can lead to the underreporting of symptoms of depression(1). Medical staff tend to focus on the physical health aspects of pregnancy more than psychological health. Thus, depression in pregnancy does not always gain the attention that it should(2). Also, it may be hard to identify whether symptoms like fatigue, loss of energy, sleep disturbance and depressed mood derive from the physiological changes of pregnancy or are predominantly a sign of depression(3, 4).

Depression in pregnancy is generally considered in term of post-partum depression, in other words, after the woman has delivered. The mental health of women during pregnancy is much less often considered. Previous studies have shown the rate of depression in pregnancy to be 7-20% in high-income countries and approximately 20% or more in middle- and low-income countries. Some studies have found that depression is at its highest in the first trimester (when it affects about 11% of pregnant women), and decreases in the third trimester (to 8.5%); however, this is a matter of some controversy since other research shows it as lowest in the first trimester (7.4%) and highest in the third (around 12%)(5)

The findings for factors related to depression during pregnancy are also inconsistent. Some studies have found that younger mothers have a higher risk of depression than do older mothers(6-8), while others have found differently.9-11 Further factors found to have an association with depression during pregnancy are low education(8, 12, 13), unemployment(12, 14, 15) low income(12, 15, 16) and ethnicity(7, 17, 18).

Sleep quality is another problem found among pregnant women. Previous study show poor sleep quality in pregnancy have been 39.0% in USA(19), 52.2% in Turkey(20), 52% in Australia21, 16.9% in Peru(22) and 53% China(23). In Thailand, a previous study of 132 pregnancy patients at Chaophraya Abhaibhubejhr Hospital in Prachin Buri Province found that 125 (94.7%) had poor sleep quality as measured by a score of more than five using the Pittsburgh Sleep Quality Index (PSQI)(24). This indicates that Thai women have poor sleep quality during pregnancy.

Again, factors related to sleep quality during depression vary according to the literature. One study has found that lower aged increases the likelihood of poor sleep quality (and economic situation does not have a significant association with sleep quality)(25), while another study has found no association between sleep quality and the age of the mother(26).

The causes of poor sleep quality during pregnancy may be linked to physiological change, including increased frequency of urination, inability to find a comfortable sleeping position and mood disturbance. Regarding effects, poor sleep quality in pregnancy leads to preterm birth, depression and suicidal ideation(27). Thus, if we can identify pregnant women who have poor sleep quality during the first trimester, we will have time to make plans for the treatment of their symptoms during the pregnancy and after.

Unfortunately, Thailand does not currently have a system to survey sleep quality and depression among pregnant Myanmar-origin migrant women (28). Individuals receive treatment for depression or poor sleep quality if they talk to a doctor about their symptoms. In other words, there is a treatment gap in Thailand. If a system is developed that can detect poor sleep quality and depression for this population, their problems can be solved or reduced by receiving advice about how to tackle the issues they face.

The study of sleep quality and depression status among pregnant migrant women is limited. However, several factors make these women more likely to have poorer sleep quality and more depressive symptoms, including their living status, being away from home and lack of social support. It would therefore be useful to gain a

better understanding of sleep quality and depression in this group of pregnant women.

The province of Samut Sakhon has the second-highest number of migrants from Myanmar in Thailand after Bangkok (29). In this study using data from a preliminary birth cohort study, the objective was to determine the prevalence of depression and poor sleep quality during the first trimester among Myanmar migrant pregnant women at Krathum Baen Hospital, Samut Sakhon province, Thailand.

METHODS

Study design

This was a cross-sectional study using secondary data gained from a birth cohort study conducted between June 2018 and April 2019 at Krathum Baen Hospital, Samut Sakhon province, Thailand(30). The birth cohort study was conducted to identify the association between heavy metals in maternal blood, brain-derived neurotrophic factor (BDNF) and pregnancy outcome. The study population inclusion criteria were 1) Myanmar-origin migrant pregnancies attending the antenatal care (ANC) at Krathum Baen Hospital, 2) age 18-35 years old, 3) gestational age under 14 weeks, 4) able to read or communicate in Burmese and 5) able to give blood samples (for use in the birth cohort study). Exclusion criteria were 1) multiparous woman (over five parities), 2) under one year pregnancy interval and 3) a history of depression. The sample size calculation was made using the birth cohort study with the result that 108 patients were recruited to this study. The sampling technique used was intentional sampling from the birth cohort study, which involved selecting patients who met the criteria (had all the data needed for analysis) and then asking them to participate in the study.

Ethical approvals for both the birth cohort and present studies were obtained from the Research Ethics Review Committee for Research Involving Humans, Chulalongkorn University, Thailand (COA No. 251/2018 and COA No. 094/2021, respectively).

Questionnaire

Research team of birth cohort study was organized at Krathum Baen hospital. The study research team was organised at Krathum Baen Hospital. It was composed of the researcher, who controlled the process; a research assistant, who was a migrant from Myanmar with good Burmese language skills to help participants answer the questionnaire; and three trained nurses at Krathum Baen hospital, who facilitated the participant involvement. The researcher and research assistant administered the structured self-report questionnaires to the participants. These included questions on socio-demographic data, health behaviour, sleep quality and depression. Participants with questions about any part of the questionnaire could ask the researcher or research assistant for explanations.

The socio-demographic and health behaviour data were collected by a dedicated questionnaire. Depression was assessed by Patient Health Questionnaire 9 (PHQ-9). This is a nine-item questionnaire for assessing depression over the previous two weeks with a depression module scoring based on the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) criteria. Scores for each question range from 0 to 3 (not at all = 0, several days = 1, more than half the days = 2 and nearly every day = 3). The total score ranges from 0 to 27. The level of depression severity is classified as no depression (total PHQ: 9: 0), minimal (1-4), mild (5-9), moderate (10-14), moderate to severe (15-19)and s evere (20-27)(31). Sensitivity for the PHQ-9 is 88%, and specificity is 88% for a score of ≥10 to major depression(31). The original version of the PHQ-9 is in English. Translation from English to Burmese was done separately by two English-Burmese speakers using forward and backward translation. There was no need to test validity as this is a standard questionnaire. A reliability test using Cronbach's alpha gives 0.771.

Sleep quality during the previous month was accessed using the PSQI questionnaire. This has nineteen self-rated items classified into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction. The total score for each component ranges from 0 to 3. Subjective sleep quality is subdivided into four categories (very

bad, fairly bad, fairly good and very good). Sleep latency is subdivided into: ≤15 minutes, 16-30 minutes, 31-60 minutes and >60 minutes. Sleep duration is calculated from an average number of sleep hours during the night. Sleep duration is categorised into four, thus: <5 hours, 5.0-5.9 hours, 6-6.9 hours and ≥7 hours. The sleep efficiency scale is grouped thus: ≥ 85%, 75%-84%, 65%-74% and < 65%. Sleep disturbance is rated from nine items of trouble with sleeping subdivided into three or more times a week, once or twice a week, less than once a week and not during the past month. Information on use of sleep medication was accessed and categorised in the same way. The Global PSQI score is calculated from a summation of each component and ranges from 0 to 21. Based on the previous literature, participants with a score of five or lower were classified as good sleepers, and those with a score of 6 or higher were classified as poor sleepers. The internal consistency and reliability coefficient was 0.83 for the seven components(32). Again, the original version of the PSQI is in English, so translations were made as above (for the PHQ-9), and a validity test was unnecessary. A reliability test using Cronbach's alpha gives 0.581.

Statistical analysis

Statistical analysis was performed using SPSS version 22.0. The general participant characteristics were reported by counts (percentages) for category data. Participant depression levels were reported by percentage level for each question and finally summarised as percentage of depression level. Sleep quality was measured similarly; each question for sleep quality was reported by percentage and finally summarised as percentage of sleep quality.

RESULTS

From the birth cohort study data, there were 108 participants with complete data available for recruitment in this study. The socio-demographic and health behaviour data are given in Table 1. These show that 69 of the participants (63.9%) were younger than 30 years old; only one (0.9%) was not married but lived with her husband, while the others were married; 63 (58.3%) had an education level higher than primary school; 85 (78.7%) were working; 71 (65.7%) had a monthly income higher than 549 USD per month; only two (1.9%) had smoked in the past, and the rest had never smoked; 59 (54.6%) experienced second-hand smoking; 18 (16.7%) had drunk in the past and the rest never; and 85 (78.7%) did not exercise during their pregnancy.

Table 1. General characteristics of participants

General characteristics	Number	Percentage
Age		
<30	69	63.9
≥ 30	39	36.1
Married status		
Married	107	99.1
Not married but living together	1	0.9
Education		
Primary school and lower	45	41.7
Higher than primary school	63	58.3
Occupation status		
Working	85	78.7
Not working	23	21.3
Monthly income		
≤ 549 USD	71	65.7
> 549 USD	37	34.3
History of smoking		
Not current	2	1.9
Never	106	98.1
Second-hand smoking		
No	49	45.4
Yes	59	54.6
Drinking history		
Never	90	83.3
Not current	18	16.7
Exercise		
Yes	23	21.3
No	85	78.7

The PHQ-9 questionnaire for depression results are shown in Table 2. Half (50.9%) of the participants had minimal depression; this was followed by mild depression (19.4%), no depression (15.7%), moderate depression (10.2%) and moderate to severe depression (3.7%). No participants had severe depression. Following PHQ-9 criteria of a cut-point higher than a score of nine, participants with moderate depression or higher are grouped as at risk of having a major depressive disorder. Therefore, this study revealed that 13.9% of the participants had depression.

Table 2. Depression scores of participants

Depression scale	Number	Percent
Little interest or pleasure in doing things		
Never	75	70.4
Several days	25	23.1
More than half of days within two weeks	1	0.9
Almost everyday	6	5.6
Feeling down, depressed or hopeless		
Never	77	71.3
Several days	23	21.3
More than half of days within two weeks	3	2.8
Almost everyday	5	4.6
Trouble falling or staying asleep, or sleeping too much		
Never	66	61.1
Several days	28	25.9
More than half of days within two weeks	5	4.6
Almost everyday	9	8.3

Depression scale	Number	Percent
Feeling tired or having little energy		
Never	51	47.2
Several days	35	32.4
More than half of days within two weeks	11	10.2
Almost everyday	11	10.2
Poor appetite or overeating		
Never	41	38.0
Several days	33	30.6
More than half of days within two weeks	19	17.6
Almost everyday	15	13.9
Trouble concentrating on things such as reading the newspaper or watching TV		
Never	94	87.0
Several days	9	8.3
More than half of days within two weeks	2	1.9
Almost everyday	3	2.8
Moving or speaking so slowly that other people could notice; or the opposite, being so fidgety or restless that you have been moving around a lot more than usual		
Never	89	82.4
Several days	12	11.1
More than half of days in the past two weeks	5	4.6
Almost everyday	2	1.9
Thoughts that you would be better off dead or of hurting yourself		
Never	94	87.0
Several days	11	10.2
More than half of days within two weeks	0	0
Almost everyday	3	2.8
How often have these problems made it difficult for you to do your work, take care of things at home or get along with other people?		
Never	90	83.3
Several days	17	15.7
More than half of days within two weeks	0	0
Almost everyday	1	0.9
Total depression level		
No depression	17	15.7
Minimal depression	55	50.9
Mild depression	21	19.4
Moderate depression	11	10.2
Moderate to severe depression	4	3.7
Severe depression	0	0

The PSQI questionnaire for sleep quality results are shown in Table 3. Over a quarter of the participants (28.7%) had poor sleep quality.

Table 3. Sleep quality score of participants

Sleep quality scale	Number	Percentage
Component 1: Subjective sleep quality		
0 = Very good	10	9.3
1 = Good	76	70.4
2 = Bad	21	19.4
3 = Very bad	1	0.9
Component 2: Sleep latency		
0	37	34.3
1	43	39.8
2	22	20.4
3	6	5.6
Component 3: Sleep duration		
0 = > 7 hr.	92	85.2
1 = 6-7 hr.	12	11.1
2 = 5-6 hr.	3	2.8
3 = < 5 hr.	1	0.9
Component 4: Sleep efficiency		
0 = > 85%	106	98.1
1 = 75-84%	2	1.9
2 = 65-74%	0	0
3 = < 65%	0	0
Component 5: Sleep disturbance		
0 = 0	18	16.7
1 = 1-9	74	68.5
2 = 10-18	16	14.8
3 = 19-27	0	0
Component 6: Use of medication		
0 = Did not use in last month	100	92.6
1 = Use less than once a week	5	4.6
2 = One or two times a week	1	0.9
3 = Three times a week or higher	2	1.9
Sleep quality scale		
Component 7: Day time dysfunction		
0 = 0	79	73.1
1 = 1-2	24	22.2
2 = 3-4	4	3.7
3 = 5-6	1	0.9
Total sleep quality		
Good = 0-4 score	77	71.3
Poor = 5-21 score	31	28.7

DISCUSSION

In this study, 108 participants were recruited. The result of the test for depression during pregnancy showed that 13.9% of the participants had depression. A previous study of 455 participants in Thailand showed the prevalence of depression in pregnancy to be 19.82%(33) This indicates that the prevalence of depression during pregnancy varies with study design and population group. Indeed, previous studies in other areas have found a depression prevalence of 10.2% in Sweden,(34) 22.1% in Hongkong(35), 9.9% in the USA(36) and 26.5% in Ethiopia(37), with a literature review of 173 studies conducted in 2021 giving an average of 21.2%(38). There are several reasons for this inconsistency in results.

One reason for the variation is trimester period. Different studies focus on different trimesters leading to different results. Nevertheless, there is still inconsistency among the studies regarding which trimester has the highest rate of depression.5 A second reason is variation in the definition of depression and questionnaires used. Many questionnaires are used to evaluate depression, and if different questionnaires are used, different results may be gained. Another reason is target population. As mentioned above,

differences in a country's level of economic development can lead to different results. Finally, there is the issue of migration. It is possible that migrants will have problems living in another country and that this will lead to depression, especially during pregnancy. Against this suggestion, a systematic review of migrant and depression levels made by Foo et al. found no significant differences in prevalence of depression between migrants and native people(39). However, this review covered studies that were significantly different from the present

one. It did not focus on pregnant women, the participants were aged between 25 and 65 years old, nearly half (11.25) of the studies were from the USA, and more than half of the studies used English (15/25).

Regarding sleep quality, this study found that 28.7% of participants had poor sleep quality during pregnancy. A previous study in Thailand found prevalence of poor sleep quality during pregnancy to be 94.7%(24) Again, the rate of poor sleep quality varies by area. It has been put at 16.9% in Peru(22), 52.2% in Turkey(20), 52% in Australia21 and 39.0% in USA(19). Again also, the inconsistent results can have many reasons; as in the case of depression, these may include differences in trimesters, questionnaires and target populations.

This study supports the evidence for depression and poor sleep quality during the first trimester of pregnancy among migrant populations. However, several limitations should be noted. First, it analyses data from a birth cohort study made at a hospital. Therefore, the number of participants was small, and the generalisability of the study results is limited. Second, this study is a cross-sectional study. Depression and sleep quality in the first trimester was observed but sleep quality worsens during the second and third trimesters. A longitudinal study is suggested to observe the situation across trimesters. Third, this study focuses on a specific population in Thailand, migrant workers. This restricts any comparison of the results with those from other studies and other populations. Last, even though the PSQI is a standard questionnaire to access sleep quality, the reliability of the Burmese language PSQI is found to be low.

CONCLUSION

This study has found the prevalence of depression among Myanmar-origin migrant women to be 13.9% and the prevalence of poor sleep quality 28.7%. These two results vary from those of other studies. However, the studies used for comparison have employed a variety of questionnaires for evaluation, focused on different trimesters and had different participant characteristics.

RECOMMENDATIONS

Depression and poor sleep quality during pregnancy can have bad effects on the future health of the mother and baby. For policymakers, therefore, this study suggests that hospitals in Thailand should have a screening and treatment system for depression and poor sleep quality among pregnant women that extends to outpatient departments for both Thai and migrant patients. Specifically, the Krathum Baen Hospital should have the screening and treatment system provided also in Burmese as there are high numbers of Myanmar-origin migrants in its catchment area.

Future studies should have more participants and recruit participants from more than one hospital. They should also include trimester comparisons.

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ASSESSMENT OF KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS SOCIAL DISTANCING DURING COVID-19 PANDEMIC AMONG UNDERGRADUATE STUDENTS IN MEDICAL FIELDS IN SAMARINDA, INDONESIA

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ABSTRACT

Coronavirus disease 2019 (COVID-19), an infectious respiratory illness caused by a newly discovered coronavirus, has become a well-known global challenge and threat for humanity. Social distancing is one of the World Health Organization (WHO)'s recommendations for COVID-19 prevention. However, the survey reported that the majority of young people ignored social distancing. As undergraduate students in the medical field are considered young public health role models, understanding their social distancing practice against COVID-19 prevention is essential. This study aimed to investigate Indonesian undergraduate students' knowledge-attitude-practice (KAP) in medical fields regarding social distancing and find the reason for not practicing social distancing. A cross-sectional descriptive online survey was conducted from March to April 2021 among 422 undergraduate students from pharmacy, medicine, and public health faculties at Mulawarman University in Samarinda, Indonesia. Self-administered online questionnaires were validated with the Item-Objective Congruence (IOC) index and reliability tested with Cronbach's Alpha and KR-20 before data collection. Spearman's rho correlation was performed to identify the association between the study variables. P-value significant level at <0.05 was used. Out of 422 respondents with age range 18-25 years old, 76.8% were female from the pharmacy (45.0%), public health (26.3%), and medical faculties (28.7%). The result indicated that the majority of respondents have a good knowledge level (65.5%), a positive attitude (53.3%), and a good level of practice of social distancing (52.1%). Spearman's rho correlation analysis showed significant and positive correlations between attitude-practice ($r=0.235$, $p < 0.001$). The top three reasons for not practicing social distancing were 1) social pressure, 2) work duties, and 3) uncomfortable feelings. The level of KAP towards social distancing during the COVID-19 pandemic of undergraduate students in medical fields was respectively high, and students with a good attitude can lead to good practice towards social distancing. Thus, this study suggests that stimulating a positive attitude towards social distancing among undergraduate students through health campaigns is essential to raise community awareness to comply with social distancing in the new normal era.

Keywords: COVID-19, KAP, social distancing, undergraduate students

INTRODUCTION

Globally, Coronavirus Disease (COVID-19) quickly infected over 181 million people and caused almost 4,000 deaths worldwide (1). The virus continues to evolve and health protocol violations has setback the efforts of governments and health authorities in controlling the wider spread of COVID-19 (2). The World Health Organization (WHO) recommended social distancing as an effective strategy to suppress the spread of COVID-19 (3-5). Social distancing should still be applied even though most of people have been fully vaccinated (3). Vaccines only relieves the symptoms, not completely cure the virus. Moreover, vast majority of active carriers are asymptomatic (6). However, the protocols faced several problems during the implementation (2, 4). Violation of social distancing has contributed the massive increase of COVID-19 case numbers around the world (7). Therefore, comply the social distancing is needed during new normal era (8, 9).

Undergraduate students in medical fields are considered as the future leaders of health promotion (10,11). This population is tended to endorse the benefits of positive health behavior and intensely exposed with health information rather than non-health students (12, 14). Nevertheless, research that studying KAP regarding social distancing and its influencing factors among Indonesian undergraduate students is still inadequate, especially students in medical fields. Previous studies have not yet focus on undergraduate students that dominantly fill in with young people rather than on master or doctoral student, these was considered as study limitations and thus further study is required (4, 15).

Knowledge, attitude, and practice (KAP) is an essential cognitive key in public health regarding health prevention and promotion (10). This survey is representative of a specific population in studying the health behavior, believe and done to a particular topic (16, 17). Some studies have found that adherence is likely to be influenced by knowledge and attitudes towards COVID-19 (18,19). A cross sectional study found that students who have good level of knowledge will show positive attitudes and practice social distancing well rather than those who not (4). By assessing KAP towards COVID-19 prevention measures, deeper insights into existing perception and practices can be achieved, thereby helping to identify attributes that influence the community in adopting healthy practices and responsive behavior (20).

Considering the lack of studies related to coronavirus pandemic and how to facilitate outbreak management of COVID-19 within Indonesia context, there is an urgent need to understand the key population's KAP towards social distancing. Therefore, we aimed to investigate KAP towards social distancing during the rapid rise period and its associated factors along with the reason for not practicing social distancing among Indonesian undergraduate students in medical fields. The findings may beneficial for public health officials on further public health interventions and policy improvements pertaining to the COVID-19 outbreak.

METHODS

Study design, settings, and population

This study was designed as online-based cross sectional survey study. Undergraduate students in medical fields from Samarinda city, Indonesia was the population of this study. East Kalimantan is the leading province with positive confirmed cases of COVID-19 in Kalimantan. Meanwhile, Samarinda as the capital city of East Kalimantan province is the most populous city on entire island of Kalimantan and classified as High-Risk Zonation of COVID-19 transmission. The online questionnaires were distributed through research assistants at each health faculty includes: (1) Faculty of Medicine, (2) Faculty of Public Health, and (3) Faculty of Pharmacy. Participants were asked to read information sheet and consent forms before answering the online questionnaire through Google form link and followed up every 3 days until the end of data collection period.

The participants were recruited using convenience sampling that meets the eligibility. The minimum sample size was 418 subjects that calculated using infinite population formula with the proportion of doing social distancing = 0.55 (15). The data was collected from March 2021 to April 2021. Undergraduate medical students who aged 18 years old and above, willingly sign informed consent and actively study in medicine, public

health and pharmacy faculty were included in the study. Participants that without smartphone, access of internet and unable to filling the questionnaire were excluded.

Ethical approval

This study was performed in accordance with declaration of Helsinki and has approved by research ethical committee of University of Mulawarman (No.25/KEPK-FK/III/2021) and University of Muhammadiyah Jakarta, Indonesia (No.059/PE/KE/FKK-UMJ/II/2021). The study questionnaire contained section that stated the purpose of study, voluntary participation, confidentiality and anonymity.

Knowledge, attitudes, and practices questionnaire design

This study used an online self-administered questionnaire designed based on guidelines, reports and previous related study (9, 21-23). This questionnaire consisted five parts assessed the participant's general characteristic, knowledge related to social distancing, attitude towards social distancing, practice of social distancing, and section of reason not practicing social distancing.

The validity of questionnaires was tested using Item-Objective Congruence Index (IOC) method with three experts consist of professor in public health, lecturer in expertise of epidemiology and medical doctor. Reliability of questionnaires regarding attitude and knowledge was tested with Cronbach's alpha coefficients and Kudar-Richardson formula 20, respectively. Cronbach's alpha coefficient of attitude was 0.73 and knowledge scale was 0.65.

For variable knowledge, it was measured by calculating the median score as data is not normal distributed and categorized as good knowledge (if participants score ≥ median) or poor knowledge (if participants score < median). For attitude, it was measured with five-point Likert's scale. All answers were computed to obtain total scores; then, median score due to non-normally distributed data was calculated to categorize as positive attitude or negative attitude. For practice, it was measured by Likert's scale and categorized as good practice (if participants score ≥ median) or poor practice (if participants score < median).

Statistical analysis

Bivariate analysis was conducted to analyzed data of this study using Statistical Software. The distribution of data was tested with scatter plots and Shapiro Wilk test. For those data not normally distributed, median was taken to use as cut-off point. Categorical data was calculated as frequencies and percentages. Spearman's rho correlation was performed to identify any correlation between knowledge, attitude and practice with P <0.05 considered to indicate statistical significance.

RESULTS

General characteristics

A total of 422 undergraduate students in medical fields participated, approximately 50.5% of participants were age between 18-21 years old (n=213). The majority were pharmacy students (45.0%, n=190) followed by medicine (28.7%, n= 121) and public health (26.3%, n=111). The majority were female students (76.8%, n=324). The vast majority of students have spent 3 years or more at university (71.8%, n=303). More than half of participants came from family with monthly income at 3.100.000 IDR or more (53.3%, n=225) (Table 1).

Table 1 General characteristic of participants **(**N=422**)**

Characteristic	Number	Percent
Age (Mean±SD;21±1.76)		
18-21 years old	214	50.5
22-25 years old	208	49.5
Faculty		
Medicine	121	28.7
Public Health	111	26.3
Pharmacy	190	45.0
Sex		
Male	98	23.2
Female	324	76.8
Length of study spent in university		
<3 years	119	28.2
>= 3 years	303	71.8
Family Income*		
<3.100.000 IDR	197	46.7
>=3.100.000 IDR	225	53.3

*1 IDR (Indonesia Rupiah) = 0,000069 USD (US dollars)

As shown in Figure 1, the main reasons mentioned were social pressure (22.2%), work duties (20.9%), and uncomfortable feeling (13.3%). Followed by family actively not stay at home (10.1%), many people not social distancing (7.4%), less activity at home (5.4%), hardship in using technology (5.1%), thoughts that social distancing is ineffective (4.8%) and not know the benefit of social distancing (1.5%).

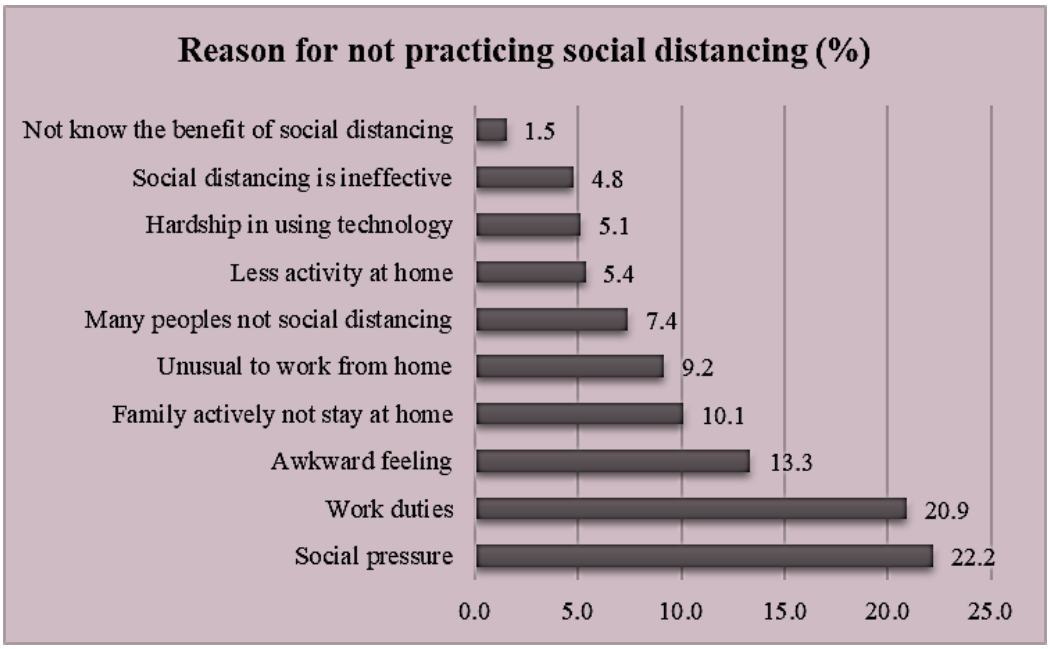

Figure 1 Reasons for not practicing social distancing

As shown in Table 2, we observed that vast majority of participants have good level of knowledge (65.6%, n=227), good attitude (53.3%, n=225) and good practice towards social distancing (52.1%, n=220), respectively.

Table 2 Proportion of participants KAP towards social distancing

Variable	Good	Poor
	N (%)	
Knowledge regarding social distancing	277 (65.6)	145 (34.4)
Attitude towards social distancing	225 (53.3)	197 (46.7)
Practice of social distancing	220 (52.1)	202 (47.9)

As shown in Table 3, in "COVID-19 cause and transmission" topic, mostly students have ever heard of COVID-19 (100%), know that COVID-19 is infectious diseases (98.6%) and cause of COVID-19 (99.8%). The majority of participants understand about COVID-19 can transmit by direct contact (94.1%), coronavirus transmitted through objects or surfaces contaminated by infected person's droplets (97.9%), main transmission of COVID-19 (79.1%) and common symptoms of COVID-19 (98.1%).

About "Definition of social distancing" topic, the vast majority correctly answered that social distancing is action by keeps distance at least 1 meter (92.2%), social distancing means staying home and keep distance from others (97.9%) and social distancing is community actions that could prevent disease transmission (99.8%).

Regarding "Implementation of social distancing" topic, participants mostly chose correct answer about questions that asking about the purpose of social distancing (99.1%), social distancing can be endorsed by keep in touch with online communication (99.8%), social distancing is ineffective to control the spread of COVID-19 (76.1%), go vacation to various places or hometown still allowed during pandemic (79.6%), shake hands still allowed (94.5%) and social distancing is unnecessary when vaccines have distributed (93.1%).

In "Importance of social distancing" topic, most of the participants answered correctly on question asked about COVID-19 carriers might be asymptomatic (96.9%), social distancing helps limit opportunities to get contact with contaminated surface by COVID-19 virus (99.3%), could protect the vulnerable people (99.3%), helps the hospitals to accommodate severe cases outside the COVID-19 (94.8%), protects from coronavirus through airborne transmission in special circumstances (94.5%) and people can also catch COVID-19 if they breathe in droplets of infected person (94.3%) (Table 3).

Table 3 Participant's knowledge regarding social distancing

Items	Incorrect answer	Correct answer
	N (%)	
COVID-19 cause, symptoms and transmission		
Have you ever heard of COVID-19	0 (0.0)	422 (100)
COVID-19 is an infectious-diseases	6 (1.4)	416 (98.6)
What causing COVID-19	1 (0.2)	421 (99.8)
COVID-19 could transmit by direct contact	25 (5.9)	397 (94.1)
COVID-19 could transmit through objects and surfaces contaminated with droplets of infected people.	9 (2.1)	413 (97.9)
Main transmission of COVID-19	88 (20.9)	334 (79.1)
Common symptoms of COVID-19	8 (1.9)	414 (98.1)

Items	Incorrect answer	Correct answer
	N (%)	
Definition of social distancing		
Social distancing is an action that is keeps a distance of at least Meter.	33 (7.8)	399 (92.2)
The practice of social distancing means staying home and keep distance from others as much as possible.	9 (2.1)	413 (97.9)
Social distancing is one of the community actions that can prevent disease transmission such as COVID-19	1 (0.2)	421 (99.8)
Implementation of social distancing		
Social distancing can be endorsed by keep in touch with others through online communication.	1 (0.2)	421 (99.8)
The purpose of practicing social distancing is to break the chain of COVID-19 transmission	4 (0.9)	418 (99.1)
Social distancing is ineffective to control the spread of COVID-19*	101 (23.9)	321 (76.1)
cancelling or postponing large meetings or conference includes as examples of social distancing?	45 (10.7)	377 (89.3)
Online classes could help reduce the spread of COVID-19	22 (2.6)	411 (97.4)
Going on vacation to various places or hometown allowed during pandemic*	86 (20.4)	336 (79.6)
Shake hands allowed during this pandemic period*	23 (5.5)	399 (94.5)
Social distancing is unnecessary when vaccines have distributed*	29 (6.9)	393 (93.1)
Importance of social distancing		
COVID-19 carriers might be asymptomatic	13 (3.1)	409 (96.9)
Social distancing helps limit opportunities to get contact with contaminated surface by COVID-19 virus	3 (0.7)	419 (99.3)
Social distancing could protect the vulnerable people	3 (0.7)	419 (99.3)
Social distancing can help the hospitals to accommodate severe case outside the COVID-19.	22 (5.2)	400 (94.8)
Social distancing can protect us from coronavirus through airborne transmission in special circumstances	23 (5.5)	399 (94.5)
People can also catch COVID-19 if they breathe in droplets of infected person	24 (5.7)	398 (94.3)

*Negative questions

We observed that majority of the participants have correct answer on question about "opinion on social distancing". Majority agreed that social distancing is effective (82.9%), work from home could prevent the coronavirus (87.2%), stay at home helps reduces the spread of COVID-19 (86.7%) and they with family should work/study from home (84.6%).

They also disagreed that social distancing is ineffective (72.0%) or it is okay that ignore social distancing when many persons not do it (74.6%), young people with fit and healthy body cannot be infected without comply social distancing (80.1%).

In social interaction dimension, most of students disagree feeling discomfort in keep distance with friends (35.1%) and mostly agree about close of school/universities (73.0%) or closure the malls (77.0%) and by prohibits family from leaving house without urgent needs could limit the spreads of COVID-19 (89.3%). Moreover, mostly participants agreed that stop travelling between cities could control the spread of COVID-19 virus (79.1%) (Table 4).

Table 4 Participant's attitude towards social distancing **(**N = 422**)**

Items	Strongly agree/ Agree	Neutral	Strongly disagree/ Disagree
	N (%)		
Opinion on Social distancing			
I think social distancing could effectively prevent the transmission of COVID-19	350 (82.9)	50 (11.8)	22 (5.2)
I think work from home prevent the spread of coronavirus	368 (87.2)	38 (9.0)	16 (9.0)
I think myself and family should follow advices to study from home	357 (84.6)	47 (11.1)	18 (4.3)
I think social distancing is ineffective in preventing COVID-19*	64 (15.2)	54 (12.8)	304 (72.0)
I think it is okay to getting close to another person <1 meter when many persons still do it too*	56 (13.3)	51 (12.1)	315 (74.6)
I agree with health protocol to work/study at home	350 (82.9)	52 (12.3)	20 (4.7)
I think young people with fit and healthy body cannot infected even though they not practicing social distancing*	44 (10.4)	40 (9.5)	338 (80.1)
I think that COVID-19 pandemic still existing because social distancing ineffective*	179 (42.4)	126 (29.9)	117 (27.7)
Opinion about social distancing that is ineffective to prevent the COVID-19 *	87 (20.6)	77 (18.2)	258 (61.1)
Opinion about stay at home helps could reduce COVID-19 transmission	366 (86.7)	44 (10.4)	12 (2.8)
Social interaction limitation			
I feel discomfort to keep distance with my friends or colleague	136 (32.2)	138 (32.7)	148 (35.1)
Opinion towards the recommendation to prohibit family from leaving the house when feeling unwell	377 (89.3)	27 (6.4)	18 (4.3)
Opinion about by keep socialize with family and friends without physical distancing could limit the COVID-19 transmission *	159 (37.7)	93 (22.0)	170 (40.3)
Opinion about closure of schools can reduce the spread of COVID-19 virus	308 (73.0)	83 (19.7)	31 (7.3)
What is your opinion closure of malls reducing the spread of COVID-19 virus	325 (77.0)	68 (16.1)	29 (6.9)
What is your opinion about stop travelling between cities can control the spread of COVID-19?	334 (79.1)	66 (15.6)	22 (5.2)

*Negative questions

Out of 422 participants, 197 (46.7%) had poor practice and 225 (53.3%) have good practice of social distancing. Most of students often maintain a minimum distance of 1 meter in public places or transport facility (46.2%, n=195), always isolate themselves when having symptoms of COVID-19 or have just met a positive corona patient (67.1%, n=283), and often avoid the crowded or mass gathering (38.4%, n=162).

The majority always avoid the physical contact with friends or stranger (49.3%, n=208) and always advised their family and others not to leave the house without urgent need (42.7%, n=180).

The vast majority always implementing physical distancing in crowd at public places (49.1%, n=207) and often follow the physical distancing (>1 meter) every time meet other people (43.1%, n=182). Mostly, often stay at home (43.8%, n=185) but sometimes gone to any crowded places (68.5%, n=289) (Table 5)

Table 5 Participant's practice of social distancing **(**N = 422**)**

Items	Number	Percent
I maintain a minimum distance of 1 meter from people around in public places or in public transports facility.		
Never	0	0.0
Sometimes	72	17.1
Often	195	46.2
Always	155	36.7
I will isolate myself if I have symptoms of fever, cough, shortness of breath and have just met a positive corona patient		
Never	19	4.5
Sometimes	32	7.6
Often	88	20.9
Always	283	67.1
I avoid the crowded or mass gathering.		
Never	8	1.9
Sometimes	125	29.6
Often	162	38.4
Always	127	30.1
I avoid the physical contact with friends or stranger.		
Never	3	0.7
Sometimes	96	22.7
Often	115	27.3
Always	208	49.3
I advise family and others not to leave the house if there is no urgent need		
Never	13	3.1
Sometimes	80	19.0
Often	149	35.3
Always	180	42.7
I implementing physical distancing when in the crowd at public places such as stations, markets or malls.		
Never	0	0.0
Sometimes	57	13.5
Often	158	37.4
Always	207	49.1
I follow the physical distancing (>1 meter) when I go to meet other people.		
Never	3	0.7
Sometimes	86	20.4
Often	182	43.1
Always	151	35.8
Do you stay at home during this COVID-19 pandemic?		
Never	4	0.9
Sometimes	113	26.8
Often	185	43.8
Always	120	28.4

Items	Number	Percent
In recent days, have you gone to any crowded place??*		
Never	58	13.7
Sometimes	289	68.5
Often	52	12.3
Always	23	5.5

*Negative questions

Correlation was interpreted using the following criteria: 0-0.25 = weak correlation, 0.25-0.5= fair correlation, 0.5-0.75= good correlation and greater than 0.75= excellent correlation (24).

We found the significant positive correlations between attitude-practice (r=0.235, p <0.001). The findings reaffirm the association between attitude and practice of social distancing as shown in Table 6.

Table 6 Correlation between knowledge, attitude, and practice scores

Variable	Correlation coefficient	P-value*
Knowledge-Attitude	-0.017	0.729
Knowledge-Practice	-0.014	0.773
Attitude-Practice	0.235	< 0.001*

*correlation significant at 0.05 level (2 tailed)

DISCUSSION

Mostly respondents had good level of knowledge regarding social distancing. Generally, students in medical fields seems to have greater knowledge in health behaviors (12, 25). This attribute to the exposure of accurate information regarding to COVID-19 preventive measures and training in both area, clinical medicine and public health (10, 11). Medical students had better score knowledge in context of healthy lifestyle compared to non-medical students (26). Health students are likely to be the leaders of health promotion in future and thus they supposedly have good score of knowledge regarding to social distancing. Moreover, university students can be a source of increased health awareness and health education for themselves and community.

In this study, the results revealed that dominantly respondents showed positive attitude. This is because attitudes are formed by several aspects, one of which is opinion (27). We observe that the majority of respondents respond that social distancing is effective in preventing corona virus transmission. From this opinion positive attitude towards social distancing could constructed. The current study similar to previous studies revealed that health science students had a greater awareness of health behavior risks (11, 12, 28). Health education campaigns for university students in raising health awareness towards social distancing could be beneficial (12).

We observed that vast majority of respondents had good score on practice of social distancing. Similar to the previous studies, they reported that medical students had proactive practices during the COVID-19 crisis (25, 29-31). Students in medical fields tends to have proactive practice towards COVID-19 (10, 11). The obligations and responsibilities as future medical professionals driven students in medical fields to present more proactive practices during this public health emergency (11, 28). Peltzer et al has reveals that health science students were fewer found in doing addictive behavior that risk their health (12).

In inferential analysis we found attitude is positively correlated with practice of social distancing among respondents. In agreement with our study, previous studies found that health science students endorsed the benefit of positive health behavior significantly more often than non-health science students. (13, 32). This finding concurs with previous studies and can be utilized in positive health behavior intervention programs (14).

Interestingly, from the results of the association test conducted, we found that there was no significant relationship between knowledge and the practice of social distancing. The possible explanation is the living context of respondents which had impact why knowledge not associated with practice of social distancing. Knowledge insufficient to stands alone in constructs health behavior, supportive adolescents' environment and school setting are also important (33, 34). Our study suggests that comprehensive prevention programs should be designed at living environment and in academic setting.

The participants were asked to answer the reasons for not practicing social distancing and we examined the three main reasons reported by respondents were social pressure, work duties and uncomfortable feeling. In context of social pressure, respondents were driven to ignore social distancing by peers or seniors either in formal meeting or informal such as invitation to hang out together or conducted a meeting.

Social pressure defined as external pressure on the social life of individual to achieved acceptance in society (38). The young should follow the norms in peer group even to the decision that encouraged to let loose and participated in activities that could be detrimental for own health (39).

Second top reason was respondent were having work that only could be done by meeting person face-to-face that tends to ignore social distancing such as collecting data with human as subjects (gather specimen, conduct interview, body assessment), laboratories work, and conduct consultation with senior doctors that unfamiliar with online meeting. The third ranked reason is uncomfortable feeling in practicing social distancing. The possible explanation of this is because in their ages, students still developing the ability to cope with crises and strong bonds with peers. For some students, isolation may feel scarier than the virus itself. The sense of belonging and peer acceptance is outweighing judgment (36).

The limitation of this study was generalizability due to only one setting area in the country. Thus, it might not be able to represent the whole population of Samarinda city. Moreover, the use of online questionnaire platform can limit some group of population who does not have internet access in order to respond to online questionnaires. This study only conducted bivariate analysis that should elevated to multivariable level for deeper knowledge of relationship between variables. Further studies should be conducted to facilitate the comprehensive overview of health protocols had implemented at various states and countries to accelerate efforts of achieving zero cases of COVID-19.

CONCLUSION

In summary, the proportion of KAP regarding social distancing among undergraduate students was respectively high. The main reasons for not practicing social distancing are social pressure, work duties and uncomfortable feeling. This study found out that there is a positive correlation between attitude towards social distancing and practice of social distancing indicates the need of continuity activities of health awareness raising.

RECOMMENDATIONS

Our findings suggest that development of effective health awareness raising programs in university level that involved undergraduate students in medical fields is needed, since we found attitude and practice was positively correlated. Considering that current study found social pressure was top reason for not practicing social distancing, academic institution should encourage its students to comply health recommendations.

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TRACK 2: 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

DEVELOPMENT OF TARGETED NANOPARTICLES SPECIFIC TO BREAST CANCER-ASSOCIATED FIBROBLASTS

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ABSTRACT.

Fibroblast activation protein (FAP) is most noticeably expressed on cancer-associated fibroblasts (CAFs), which support tumorigenesis and chemoresistance, especially in breast cancer. Due to targeting CAFs as an anti-tumor strategy, this study aims to fabricate targeted nanoparticles (NPs) selectively specific to FAP on CAFs for enhancing chemotherapeutic drug delivery to breast cancer cells. Polymeric nanoparticles were loaded with Coumarin 6 fluorescence dye as the model drug and specifically conjugated with anti-FAP monoclonal antibodies via amide coupling reaction. Flow cytometry and fluorescent microscope were performed to analyze the cellular uptake of Coumarin 6-NPs to compare anti-FAP conjugated NPs and unconjugated NPs in PC-B-132(CAF, FAP^{high}) PC-B-142(CAF, FAP^{low}) cell lines. The cell toxicity of NPs in CAF cells was investigated by cell viability assay after being treated for 24 hours. The characterization of NPs conjugated with anti-FAP revealed NPs size 288 ± 9.0 nm. The cellular uptake of NPs was significantly increased in PC-B-132 (CAF, FAP^{high}) and PC-B-142 (CAF, FAP^{low}) by 54.3% and 17.4%, respectively, when compared with unconjugated NPs. Interestingly, NPs conjugated with anti-FAP were shown to effectively cellular uptake up to 41.3 % on PC-B-132 (CAF, FAP^{high}) compared with PC-B-142 (CAF, FAP^{low}). Moreover, the toxicity of nanoparticles revealed no significant difference in both CAF cells. These findings indicated that targeting FAP on CAFs, using NPs conjugated with anti-FAP, leads to specific drug delivery to breast cancer-associated fibroblast that shows high expression of FAP. This strategy could be used as a targeted anti-tumor to enhance chemotherapeutic drug efficacy and reduce drug dosage for breast cancer treatment.

Keywords: Cancer-associated fibroblast, Fibroblast activation protein, Nanoparticle, Breast cancer

INTRODUCTION

Breast cancer is one of the most common cancers that leading cause of the mortality rate among women worldwide. According to the report from Global Cancer Observatory (GCO) in 2020, there are about 2.2 million people were diagnosed with breast cancer, and about 600,000 people deaths from breast cancer (1). Currently, the treatment of breast cancer focuses on reducing the local recurrence of cancer and the risk of metastasis (2). However, the cytotoxic chemotherapy for breast cancer is still limited because of the side effects and the problems in drug resistance that mostly results in reducing drug absorption, including drug transportation to the target cell (3).

As chemotherapeutic drug resistance remains a major problem in breast cancer treatment, nanoparticles (NPs) could be used as a drug delivery system based on nanoparticle properties and actively targeted to the cancer cells because of their size and independent modification (4,5). Polymeric NPs are one of the most NPs widely used in drug delivery systems because they are generated from biodegradable and biocompatible materials (6). The advantages of polymeric NPs are multifunctional properties such as prolongation of their stability in blood circulation, controlling drug release, delivering consistent amounts of drug to the target cell, and overcome drug resistance mechanisms (7). Moreover, surface modification of nanoparticles with a targeting ligand could actively delivery and recognition of biological target (8).

Fibroblast activating protein (FAP) is an integral membrane serine protease that is highly expressed on the cell surface of cancer-associated fibroblasts (CAFs) in the tumor microenvironment (TME) which plays a crucial role in several processes of tumor progression such as tumorigenesis, tumor metastatic and chemoresistance, especially in breast cancer9. FAP is rarely expressed in mammalian normal tissue and becomes a marker for CAF cells together with other specific proteins such as alpha-smooth muscle actin (alpha-SMA) and fibroblast specific protein 1 (FSP-1) (9,10). Anti-FAP monoclonal antibodies have been developed to detect the number of FAP in blood and tissue and also to target FAP-expressing cells (10). Due to the expression of FAP on CAF cell, it attractive for modification of NPs to target breast cancer associated fibroblast by conjugating with anti-FAP that would be a great strategy for breast cancer treatment.

Therefore, this study aims to fabricate NPs conjugated with anti-FAP for selectively specific to CAF of primary breast cancer cells and to demonstrate the cytotoxic effect of NPs in CAF cells.

METHODS

Immunofluorescence staining

Two cancer associated fibroblast of primary breast cancer cell, PC-B-132(CAF) and PC-B-142(CAF) were examined by immunofluorescence using anti-alpha smooth muscle actin (Sigma, USA), anti-fibroblast activation protein (Abcam, UK) and stained nuclease using Hoechst dye (Invitrogen, USA). After staining, fluorescence microscope was performed to observe characterization of CAF cells

Synthesis of Anti-FAP conjugation with NPs

Polymeric nanoparticles were loaded with coumarin-6 fluorescence dye as a model drug and to monitor the NPs when they uptake into the cell. The coumarin-6 loaded NPs were formulated by a solvent evaporation technique. In brief, coumarin-6 and poly (lactic-co-glycolic acid) (PolyScitech, USA) were dissolved in dichloromethane (DCM). To generate emulsion, the mixture was added dropwise into 2.5% (w/v) polyvinyl alcohol solution and then sonicated for 5 minutes to get an O/W emulsion. After that, the O/W emulsion will be stirred at room temperature in a fume hood until all the organic solvents have evaporated. The NPs were obtained by centrifugation, resuspending the pellet and freeze-dry process. The unloaded nanoparticles were prepared using the same method without adding therapeutic agents for using as a control. To conjugate anti-FAP with NPs, coumarin-6 loaded NPs were dissolved in MES buffer (pH 4.75). 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC) and Sulfo N-Hydroxy succinimide (Sulfo-NHS) were added to activate nanoparticles for conjugation of free primary amine groups of antibody molecules with carboxylic group on the surface of NPs. The solution was mixed by rotating for 2 hours at room temperature. Then,

the anti-FAP monoclonal antibody (mAb) in PBS was added to the reaction and mixed by rotating for 12 hours at 4oC. The NPs-anti-FAP were extracted by centrifugation, rinsed the pellet with water and lyophilization for further analysis.

Characterization of NPs

The nanoparticle size, polydispersity and zeta potential of unloaded NPs, coumarin-6 loaded NPs conjugated with anti-FAP and unconjugated one were measured by dynamic light scattering (DLS) detector (Malvern Panalytical, UK) by dissolved in ultrapure water. The values were shown as an average of triplicate measurement in each sample. The conjugation efficiency of antibodies with NPs was investigated by measuring the amount of antibody in supernatant from the original volume by Bradford's assay (BIO-RAD, USA).

Cellular uptake of NPs

Coumarin-6 was used to study cellular uptake and to monitor NPs when they were uptake into the cells. Cellular uptake of anti-FAP conjugated with NPs and unconjugated NPs were analyzed by fluorescence microscope and flow cytometry. Two cancer-associated fibroblast of primary breast cancer cells, PC-B-132(CAF) and PC-B-142(CAF) were cultured for 24 hours in 96 well plates at a density 1x104 cells per well. Then, coumarin-6 loaded NPs conjugated with anti-FAP and unconjugated NPs as a control were treated for 2 hours. The cells were washed with PBS twice after incubation and stain nuclei with DAPI. Then, observed the cells under inverted fluorescent microscope. Finally, flow cytometry was performed to analyze the percentage of cellular uptake and mean fluorescence intensity of coumarin-6 loaded NPs by detecting with FIT-C channel of BD FACS Celesta flow cytometer (Biosciences, USA).

In vitro cytotoxicity of NP

The cytotoxic effect of unloaded NPs, anti-FAP and unloaded NPs conjugated with anti-FAP in cancer-associated fibroblast of primary breast cancer cells, PC-B-132(CAF) and PC-B-142(CAF) were measured by Cell-Titer Blue assay (Promega, USA). The cells were cultured in 96-well plates at a density 1x104 cells per well. After 24 hours of cultivating incubation, difference concentration of unloaded NPs, anti-FAP and unloaded NPs conjugated with anti-FAP were treated into CAF cells and cultivating incubation for 24 hours. Then, washed the cells twice with PBS and added Cell-Titer Blue reagent each well. After 2 hours, the fluorescence intensity was analyzed using microplate reader (BioTek, USA) at 545/560 nm.

Statistical analysis

Statistical analysis is determined by one-way ANOVA, using GraphPad Prism statistical program (GraphPad, CA). Data presented as a mean ± standard error of at least 3 independent experiments. Differences is considered statistically significant at P value of < 0.05

RESULTS

FAP expression on CAF cell surface

Immunofluorescence staining was performed to characterize the CAF cells and investigate the expression of FAP on CAF cell surface as show in Figure 1. The specific protein marker of CAF cells, alpha smooth muscle actin (ASMA) was expressed in both CAF cells, whereas the fibroblast activation protein (FAP) was highly expressed on PC-B-132(CAF) of CAF cell surface and lower expressed on PC-B-142(CAF) as use as a control cell.

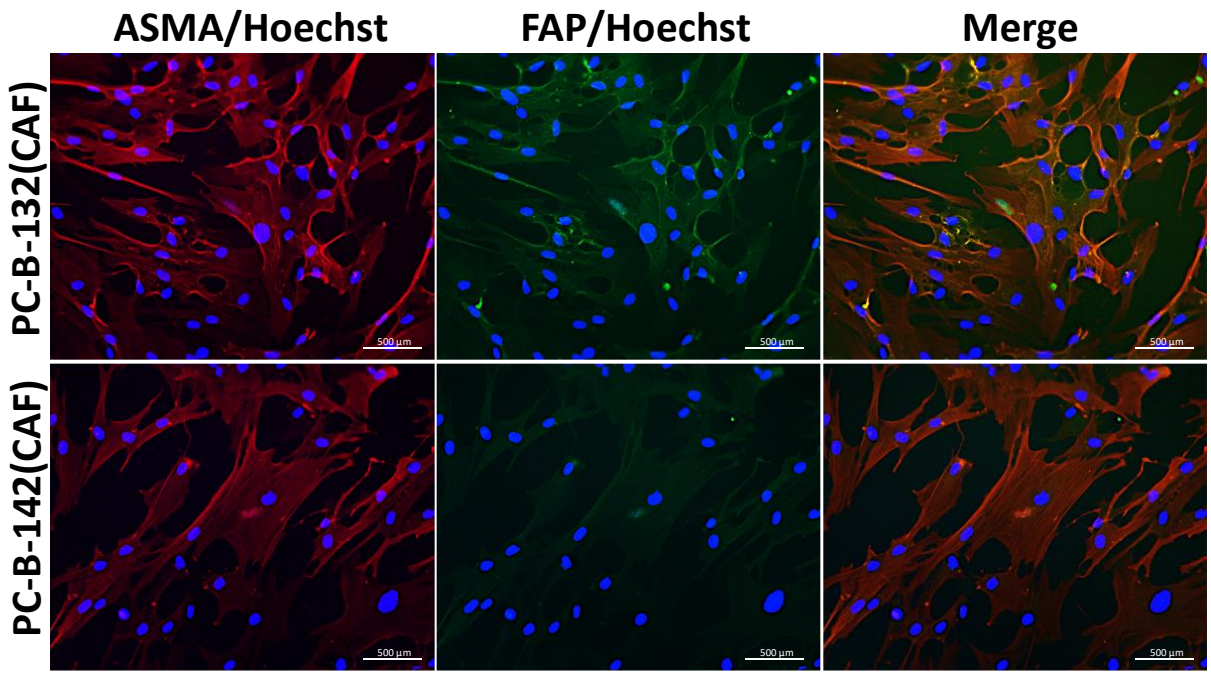

Figure 1 **Immunofluorescence staining of CAF marker proteins in PC-B-**132**(CAF) and PC-B-**142**(CAF) cells.** The cells were demonstrated the expression of fibroblast activation protein (FAP), represented in blue color and alpha-smooth muscle actin (ASMA) represented in red color. Blue color was Hoechst staining of cell nucleus.

Characterization of NPs conjugated with anti-FAP

Three formulations of NPs, coumarin-6 loaded NPs and unconjugated one including unloaded NPs, were shown in Table 1. The average size of NPs in the range of 280-300 nm with polydispersity of 0.037-0.160 detected by DLS. The zeta potentials were negative charge in the range of -15.78 to -31.5 mV, and percentage of conjugation efficiency of anti-FAP conjugated with NPs loaded with coumarin-6 was 79.19 ± 0.30% determine by Bradford's assay.

Table 1 Characterization of nanoparticles

Nanoparticles	Size (nm)	Polydispersity	Zeta potential (mV)	% Conjugation efficiency
Unconjugated NPs	282 ± 3.8	0.160 ± 0.01	-31.5 ± 034	-
NPs + anti-FAP mAb	288 ± 9.0	0.087 ± 0.04	-23.3 ± 7.12	79.19 ± 0.30

In vitro cellular uptake of NPs in CAF cells

The cellular uptake of NPs in CAF cells, using coumarin-6 as a signal for NPs monitoring, was quantitatively analyzed by flow cytometry to compare between PC-B-132(CAF, FAPhigh) cell and PC-B-142 (CAF, FAPlow). The cellular uptake of coumarin-6 NPs conjugated with anti-FAP was significantly increased in PC-B-132 (CAF, FAPhigh) and PC-B-142 (CAF, FAPlow) by 54.3% and 17.4%, respectively, when compared with the unconjugated group of NPs. Interestingly, the conjugated NPs with anti-FAP were shown increasingly cellular uptake up to 41.3% in PC-B-132 (CAF, FAPhigh) when compared with PC-B-142 (CAF, FAPlow) control cell as shown in Figure 2A. Similarly, the mean fluorescence intensity of coumarin-6 loaded NPs were shown in Figure 2B that, the conjugated NPs with anti-FAP were shown mean fluorescence intensity significantly higher than unconjugated NPs in PC-B-132 (CAF, FAPhigh) when compared with PC-B-142 (CAF, FAPlow) cell shown in Figure 2B

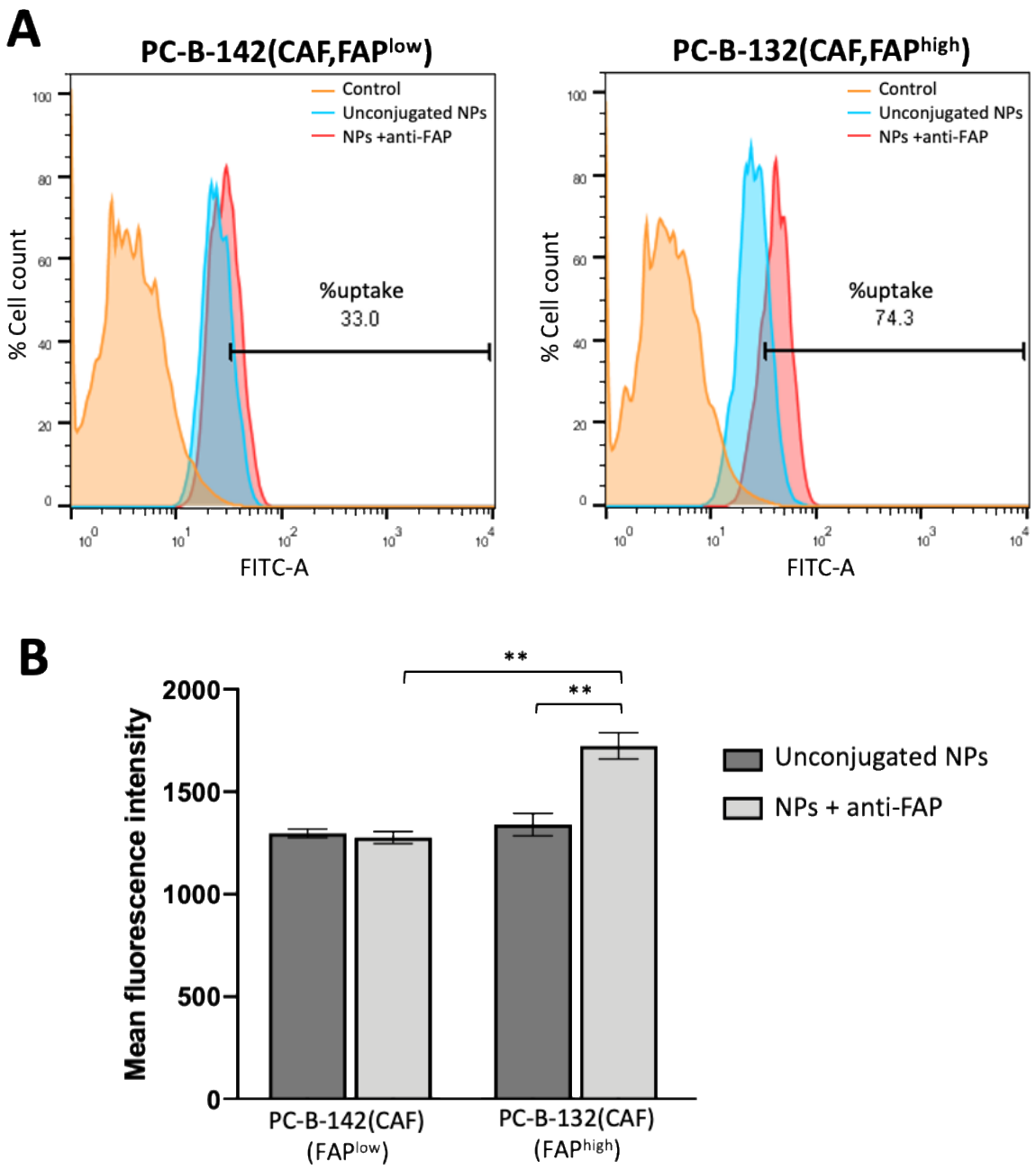

Figure 2 **Quantitative analysis of cellular uptake (A) and mean fluorescence intensity (B) in CAF cells to compare between the group of CAF cells, PC-B-**132**(CAF) and PC-B-**142**(CAF).** Data were analysed by flow cytometry and presented as the mean±SD of three independent experiments**.** *P*<**0.05** were considered significant**.**

The images from the inverted fluorescence microscope were shown fluorescence intensity as same as the result from flow cytometry which indicated that the fluorescence intensity of NPs conjugated with anti-FAP in PC-B-132 (CAF, FAPhigh) cell was significantly higher than PC-B-142 (CAF, FAPlow) cell (Figure 3). This result demonstrated that conjugated NPs with anti-FAP can specifically target FAP on CAF cell surface and may increase drug delivery to CAF cell which highly expression of FAP.

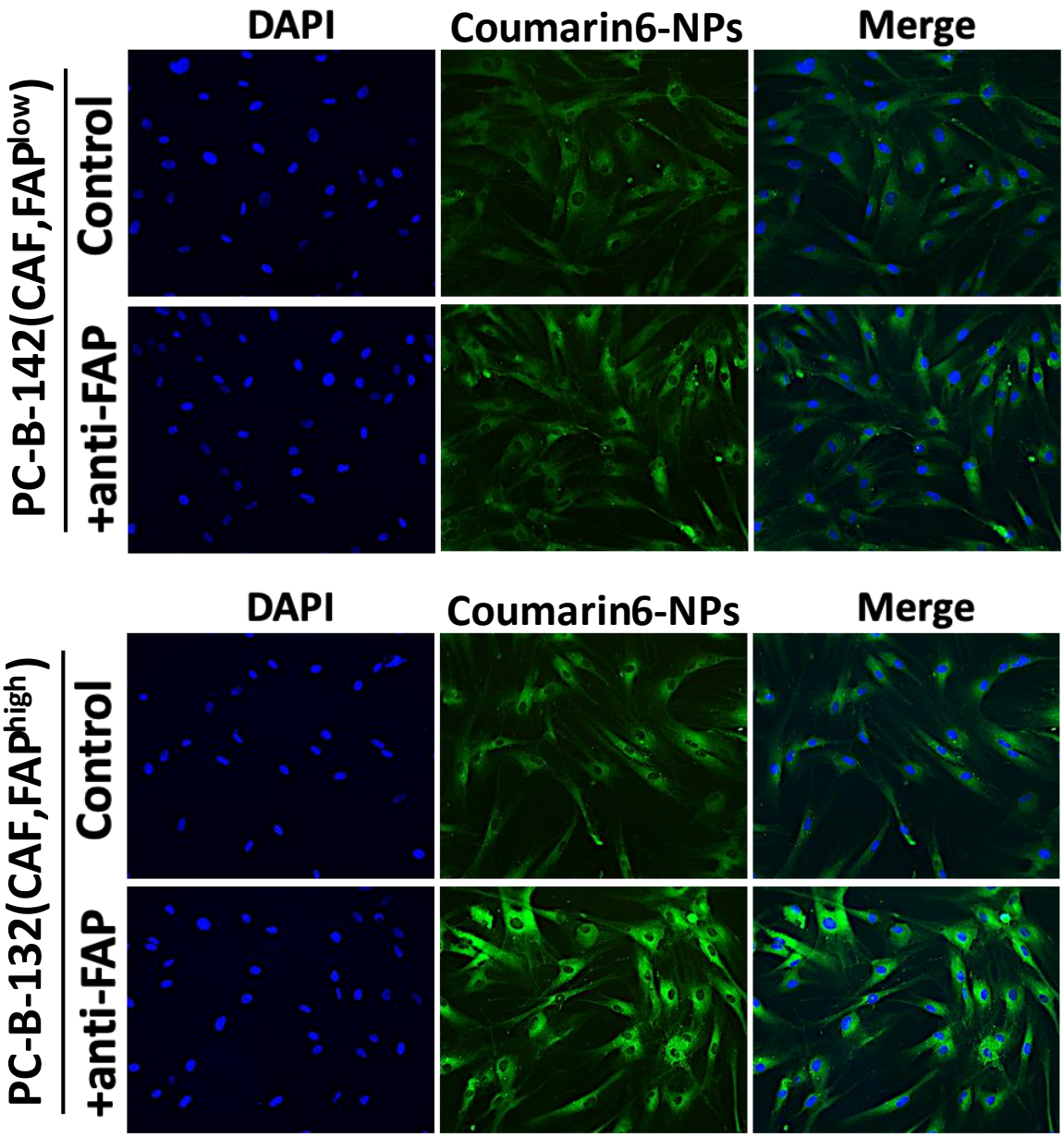

Figure 3 **Qualitative analysis of cellular uptake of CAF cells.**
Coumarin-**6** NPs in CAF cell cytoplasm was detected by fluorescence microscope to compare between the group of NPs **(**anti-FAP conjugated NPs and unconjugated NPs**)** and the group of CAF cells, PC-B-132**(**CAF**)** and PC-B-142**(**CAF**).**

Cytotoxic effect of NPs in CAF cells

The cell viability assay was performed to investigate the cytotoxic effect of NPs including anti-FAP in CAF cells. As shown in Figure 4, the various concentration of unloaded NPs from 10-1000 µg/ml had no cytotoxic effect in both CAF cells, PC-B-132(CAF, FAPhigh) and PC-B-142 (CAF, FAPlow), as same as the concentrations of anti-FAP monoclonal antibody from 1-25 µg/ml. The formulation of NPs conjugated with anti-FAP also had no cytotoxic against CAF cells with highest concentration of NPs at 2000 µg/ml. These results indicated that the nanoparticle and conjugated nanoparticle had no toxic with CAF cells

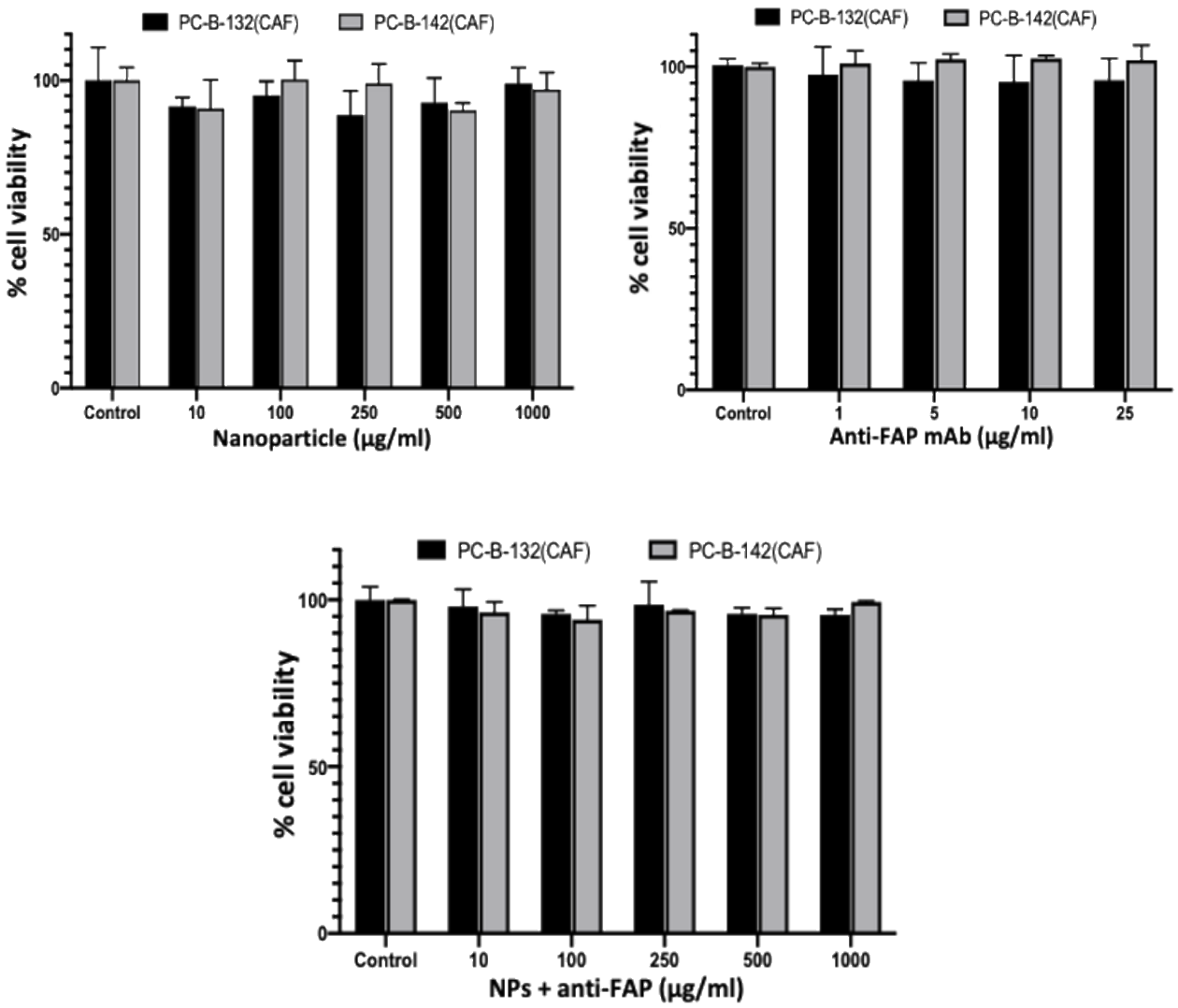

Figure 4 **Cell viability of CAF cells after treatment with unloaded NPs, anti-FAP mAb and formulation of NPs conjugated with anti-FAP at difference concentration after** 24 **hours.** Data were presented as the mean ± SD **(**n=**3)**

DISCUSSION

CAFs are a major component in TME that support the development of tumors including chemoresistance. Recently, CAF populations were discovered in breast cancer. Because of the different subpopulations of CAF, the expression of protein markers was also different in each CAF subpopulation. FAP and alpha-SMA were used to identify the characterization of CAF cells and the expression of FAP on CAF cells was highly expressed in the early stage of breast cancer progression (12,13). The monoclonal antibodies conjugated with NPs have been used widely in medical treatment because of their affinity and specificity to particular targets including the properties of polymeric NPs that present many advantages such as their size in nanoscale, controlling drug release, selectively drug delivery to the target cell, and biodegradation (5,11). The type of monoclonal antibodies that use to conjugate with NPs depends on characterizations of the target tumor cells. In this study, we used anti-FAP monoclonal antibody conjugated with the surface of polymeric NPs because the expression of FAP on CAF cells might be valuable for targeted therapy in breast cancer treatment.

The characterization result of NPs conjugated with anti-FAP revealed the NPs size at 288 ± 9.0 nm with negative charge of NPs (Table 1). In previous studies, the size of NPs in the range of 100-400 nm has been reported to deposit at the cancer site through enhance permeability and retention effect (EPR). Due to the NPs size in this study was in the range size of previous study, they could be able to enhance cellular internalization and accumulation of NPs in the cancer cell (14,15).

Coumarin-6 fluorescence dye was used to monitor the specific intracellular uptake of NPs into CAF cells. The quantitative analysis using flow cytometry was demonstrated that the formulation of NPs conjugated with anti-FAP was increased cellular uptake of NPs in PC-B-132(CAF, FAPhigh) cell through receptor-mediated endocytosis by recognition FAP on the cell surface as shown in Figure 2. Similarly, the images from the inverted microscope were shown qualitative results of cellular uptake that the fluorescence intensity of coumarin-6 loaded NPs were shown in the same way of result from flow cytometry as shown in Figure 3. This outcome was performed similarly to the other previous studies of targeted anti-tumor using monoclonal antibodies conjugated with NPs (16,17). The conjugation efficiency of anti-FAP with NPs was 79.19% detected by Bradford assay. The among of antibody conjugated with NPs in this study was related with previous study result that also increased cellular uptake of NPs into the cancer cell (18).

In Figure 4, the cytotoxic effect of NPs, anti-FAP monoclonal antibody and the formulation of NPs conjugated with anti-FAP were tested that they are no cytotoxic effect in CAF cells at the concentration 1000 µg/ml. The previous result was shown non-toxic of polymeric NPs at concentration 400 µg/ml in A549 lung cancer cell. The cytotoxic effect of NPs is relied on the type of cancer cells and chemical structure of polymeric NPs (19,20). However, Further investigation could be performed to clarify concentration of NPs that has toxic in CAF cells and related to the concentration of NPs that contain cytotoxic drug.

The outcome in this study is a preliminary step to develop the targeted drug delivery specific to breast cancer associated fibroblast. The structure and characterization of drug compounds that might be used to encapsulate inside nanoparticles should be concerned as they might affect the encapsulation efficiency and drug delivery system.

CONCLUSION

The findings indicated that targeting FAP on CAFs, using NPs conjugated with anti-FAP, leads to specific drug delivery to breast cancer-associated fibroblast that shows high expression of FAP. This strategy could be used as a targeted anti-tumor to enhance chemotherapeutic drug efficacy and reduce drug dosage for breast cancer treatment.

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SHORT-TERM ASSOCIATIONS BETWEEN PM2.5 CONCENTRATIONS AND HOSPITAL ADMISSIONS FOR MENTAL AND BEHAVIORAL DISORDERS: EVIDENCE FROM HO CHI MINH CITY, VIETNAM DURING 2019-2020

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ABSTRACT

The evidence for adverse effects of ambient particulate matter pollution on mental and behavioral disorders (MBDs) is limited. Until now, few epidemiological studies have focused on this field, especially in developing countries. In the past decade, the sources of air pollution in Vietnam have increased, leading to a high concentration of air pollution, especially particulate matter with an aerodynamic diameter of 2.5 µm ($PM_{2.5}$). Therefore, it is worthwhile to investigate the short-term association between $PM_{2.5}$ and MBDs. Hospital admission data between 2019-2020 were obtained from Ho Chi Minh City Mental Health Hospital, while $PM_{2.5}$ data were obtained from fixed-site monitoring stations. A quasi-Poisson time series regression model was used to determine the association between $PM_{2.5}$ exposure and daily hospital admission for all-cause mental disorders and two specific disorders, including Schizophrenia and Mood disorder. A natural cubic regression smooth function was adopted to filter out long-term trends and seasonality, and stratified analyses were also performed by age and season. In total, 3,513 hospital admissions for MBDs were collected during 2019-2020. The daily mean all-cause hospitalization was 6.1, ranging from 0 to 14 admission/day, and that of Schizophrenia and Mood disorder were 3.0 and 0.8 admissions/day, respectively. Data from the monitoring station suggested that the daily concentration of $PM_{2.5}$ ranged from 8.7 to 66.0 µg/m^3 with a mean of 25.6 µg/m^3. Regression models revealed that each 10 µg/m^3 increase in $PM_{2.5}$ at lag 7 for MBDs and Schizophrenia corresponded to an increase of 1.25 (95%CI = 1.03-1.52), 1.45 (95%CI = 1.12-1.89) in daily hospital admission among the patient age > 60 years old, respectively. Our findings have provided evidence for building public health programs to prevent and minimize the adverse health effects of air pollution on the elderly.

Keywords: Ho Chi Minh City; hospital admission; mental and behavioral disorders; $PM_{2.5}$; time-series study.

INTRODUCTION

Increasing mental disorder is a serious public health problem, which has brought about a social, economic and disease burden in all countries worldwide. Mental health problems consist of depression, bipolar disorder, schizophrenia, dementia, as well as developmental disorders (autism and other psychiatric disorders) (1). According to the World Health Organization (WHO) report, unipolar depressive disorder ranked the third of disease burden worldwide. It is accounting for 4.3% of the global burden of disease. The estimates for low and middle-income countries are 3.2% and 5.1%, respectively (2). This leads people live with disability related to mental disorders in low and middle-income countries, making up 25.3% and 33.5%, respectively. WHO predicted that depression will be the leading cause of disease burden worldwide by 2030. Additionally, those who suffer from mental disorders often lack educational and income-generation opportunities, restricting their economic development chances and depriving them of social networks and status within society (2).

Many epidemiological studies worldwide have reported the relationship between particulate matter exposure and mental health, notably in developed nations (3-5). A longitudinal research conducted in Sweden suggested that long-term exposure to air pollution were associated with dementia than those who had low exposure (6). Moreover, the evidence also suggested that prolonged exposure to air pollution is associated with schizophrenia (7), depressive and anxiety symptoms (8). In addition, studies also showed that short term exposure are also associated mental illness hospitalization (9, 10). A study by Chen et al. (2018) showed that a 10 µg/m3 of particulate matter increase was remarkably related to increments of 1.27% (95%CI = 0.28%-2.26%) in daily hospital admissions for MBDs (11).

Air pollution in Vietnam increased significantly. According to a report by Air Visual, in 2019, Vietnam ranked 15th in the world for PM2.5 pollution with an average annual concentration of PM2.5 up to 34.06 µg/m3 (12). Especially in Ho Chi Minh City (HCMC) - a large industrial park and leading commercial center of the country with nearly 9 million people (13). In 2017, up to 61% of the total days in HCMC had an average daily PM2.5 concentration exceeding WHO guidelines (25µg/m3) (14). However, there are no studies in Vietnam that concentrate on air pollution impacts on particular mental disorders. A study in HCMC identified that children are at heightened risk of acute lower respiratory infection admissions due to the high level of PM2.5 (15). According to Vietnam National Mental Hospital report in 2014, the proportion of 10 frequent mental health conditions was 14.2%, of which 2.45% belonged to depressive disorders. The rate of suicide in 2015 was 5.87 per 100,000 population (16)

To our knowledge, the study on the association between air pollution exposure and mental health disorder is lacking. Therefore, in this study we investigate the short-term associations between exposure to PM2.5 and hospitalizations for MBDs in HCMC using hospitalization from HCMC Mental Health Hospital.

METHODS

Study setting and population

This research was conducted using a time-series regression analysis. This study was carried out in HCMC, the South of Vietnam, which possesses a tropical climate. The total region of the city is 2,095 km2, comprising 19 urban and 5 suburbans which have a population of 8,993,082 people in 2019 (17). The city has a hot and humid climate year-round, with a mean temperature of 28°C.

The data on hospital admission related to mental and behavioral disorders were obtained from the HCM Mental health hospital during June 2019 to December 2020 which corresponds to the air pollution data from monitoring stations that started to collect in June 2019.

Data used

The hospital admission data obtained from HCMC Mental Health Hospital, including the total number of inpatient hospitalizations due to MBDs. The patient related variables include final diagnosis with ICD-10 (including F00-F99), admission date, discharge date, age, sex, permanent address of the patient. The study protocol was approved by the Ethics Review Committee of Chulalongkorn University (COA No.082/2021).

Daily average PM2.5, temperature and relative humidity data were extracted from 31 monitoring stations (PAS-OA318) located across HCMC. These monitoring stations were organized and maintained by PAM Air as a D&L Technology Integration and Consultancy Joint Stock Company project. The monitoring station provided real-time air quality data, as well as air pollution warnings in Vietnam. The daily average concentrations were calculated from hourly values with a 50% completeness criterion. It means that if less than 12 hours of concentration data were available per day, then the average each day was assigned as 'missing'. Missing values were substituted with the average of one datum before the missing value and one datum after the missing value using the mean-before-after method (18). Other pollutants such as O3, CO, and NO2 are not considered for controlling in the regression model of this study because the information of these data are not available.

Data analysis

A quasi-Poisson time series regression model was used to determine the association between PM2.5 concentration and daily hospital admission for MBDS. The dependent variable is the number of daily admissions due to MBDs and the independent variable is the daily average concentration of PM2.5. We conducted stratify analysis for the risk following the groups, including ICD10 code, age and sex groups.

A flexible spline function of time with 7 degrees of freedom per year was used to control seasonal and long-term trends (19). To estimate the delayed effect, the association was examined when lag terms were modelled one at a time as shown in the equation below using multi-day moving average (from lag0 to lag7).

A cross-basis for PM2.5 with a linear function for the space of the predictor and using the single lag day to estimate individual lag effects were produced. The natural smooth functions of the mean temperature (6, df) and relative humidity (3, df) were used in order to control for the nonlinear confounding effects (9). Day of week were integrated into the model as dummy variable. Hospital admission data for MBDs were extracted for 2 disease groups of Schizophrenia (F20) and Mood disorder (F30-F39).

The most optimal model the smallest Q-AIC criterion (Akaike Information Criterion) was selected (20). The model parameters are described in detail below:

$Yt \sim$ Quasi-Poisson (μt)

$\text{Log}(E(Yt)) = \alpha + \beta * Zt + \text{ns}(time_t, df) + \text{ns}(temp_t, 6) + \text{ns}(rh_t, 3) + DOW$

Where:

α is the intercept

$E(Yt)$ is the number of daily cases due to MBDs, obeying quasi-Poisson distribution for each day t

β represents the log-related rate of MBDs admission rate associated with a unit increase of $PM_{2.5}$

Zt: indicates the daily mean concentration of $PM_{2.5}$ at day t

$\text{ns}(time_t, df)$ is the natural spline function for calendar time

$\text{ns}(temp_t, 6)$; $\text{ns}(rh_t, 3)$ are the natural spline function for temperature and humidity at day t

DOW is the categorical day of the week with a reference day of Sunday

All statistical analysis will be performed using R 4.0.5, using the "tsModel", "Epi", "dlnm", "splines" packages.

RESULTS

During the study period from June 2019 to the December 2020, the total hospital admissions for MBDs was 3,513 admissions at HCMC mental health hospital. The daily all-cause hospitalization ranged from 0-14 admission/day (mean = 6.1 admissions/day). Among these admission, the average schizophrenia admission was 6 admissions/day; which higher than mood disorder which average of 0.8 admissions/day. The daily mean of male patients hospitalized was higher than that of female patients (3.9 vs 2.2). In addition, most hospitalized patients younger than 45 year-old (2,174 cases). Data also suggested that there were more admissions in the wet season (mean, 3.7 admissions/day) than in the dry season (mean, 2.3 admissions/day).

More detail of MBDs admission are listed in Table 1.

Table 2 Characteristics of hospitalizations for mental disorders in HCMC Mental Health Hospital, Vietnam, from June 2019 to December 2020

Characteristics	Mean (SD)	Min	Frequency distribution			Max
			25th	50th	75th	
Hospital admissions for MBDs (total and by groups)						
All cases (3,513)	6.1 (3.0)	0	4	6	8	14
Schizophrenia (1,724)	3.0 (2.0)	0	2	3	4	10
Mood disorder (447)	0.8 (0.9)	0	0	1	1	4
Sex						
Male (2,253)	3.9 (2.2)	0	2	4	5	11
Female (1,260)	2.2 (1.6)	0	1	2	3	8
Age groups						
≤ 44 year old (2,174)	3.7 (2.1)	0	2	4	5	11
45 - 59 years old (1,052)	1.8 (1.5)	0	1	2	3	9
≥ 60 year old (287)	0.5 (0.7)	0	0	0	1	3
Season*						
Dry season (1,360)	2.3 (3.3)	0	0	0	5	14
Wet season (2,153)	3.7 (3.9)	0	0	3	7	14

*Wet season: from May to October; Dry season: from November to April

In terms of climatic conditions, Table 2 summarizes the average daily temperature during the study period. The daily average temperature ranged from 24.1°C to 33.2 °C (mean = 29.6 °C), while the daily average humidity ranged from 50.0% to 88.4% (mean = 68.8%).

The daily concentration of PM2.5 ranged from 8.7 to 66.0 µg/m3 with an annual average concentration of 25.6 µg/m3, which slightly exceeded the national standard of Vietnam (25 µg/m3) and was nearly 2.5 times the WHO air quality guideline value for annual average PM2.5 (10 µg/m3) (21, 22) . During the study period, the daily averages of PM2.5 exceeded the Vietnamese national standard (50 µg/m3 for 24-h average) on only 6 days (1.0% of the study period) but exceeded the WHO guideline (25 µg/m3 for 24-h average) on 145 days (25% of the study period).

Table 2. Summary statistics of $PM_{2.5}$ and meteorological variables in HCMC Mental Health Hospital, Vietnam, from June 2019 to December 2020

	Mean (SD)	Min	Frequency distribution			Max
			25th	50th	75th	
Meteorology						
Temperature (°C)	29.6 (1.4)	24.1	28.7	29.6	30.5	33.2
Relative humidity (%)	68.8 (7.3)	50.0	63.8	68.4	73.5	88.4
$PM_{2.5}$ (µg/m^3)	25.6 (8.5)	8.7	20.8	24.8	29.9	66.0
Dry season	30.0 (7.8)	16.8	23.7	28.6	33.7	66.0
Wet season	22.3 (7.5)	8.7	17.1	22.1	26.6	47.7
	Number of day of $PM_{2.5}$ exceed of standard level			**(n)**	**(%)**	
QCVN 05:2013*	50 µg/m^3 24-hour (day)			6	1.0	
WHO (World Health Organization, 2005)	25 µg/m^3 24- hour (day)			145	25.0	

*National Technical Regulation on Ambient Air Quality (Vietnam)

Figure 1 shows the temporal patterns of air pollutants and hospital admissions. The number of hospital admissions and the concentration of PM2.5 were fluctuated during the study period. The daily hospital admissions were lowest in April 2020 (3.8 cases/day). Meanwhile, the concentration of PM2.5 increased from the middle to the end of the year and there was a spike in the concentration of PM2.5 around a fews day at the end of September 2019 (from 10.0 to 47.7 µg/m3).

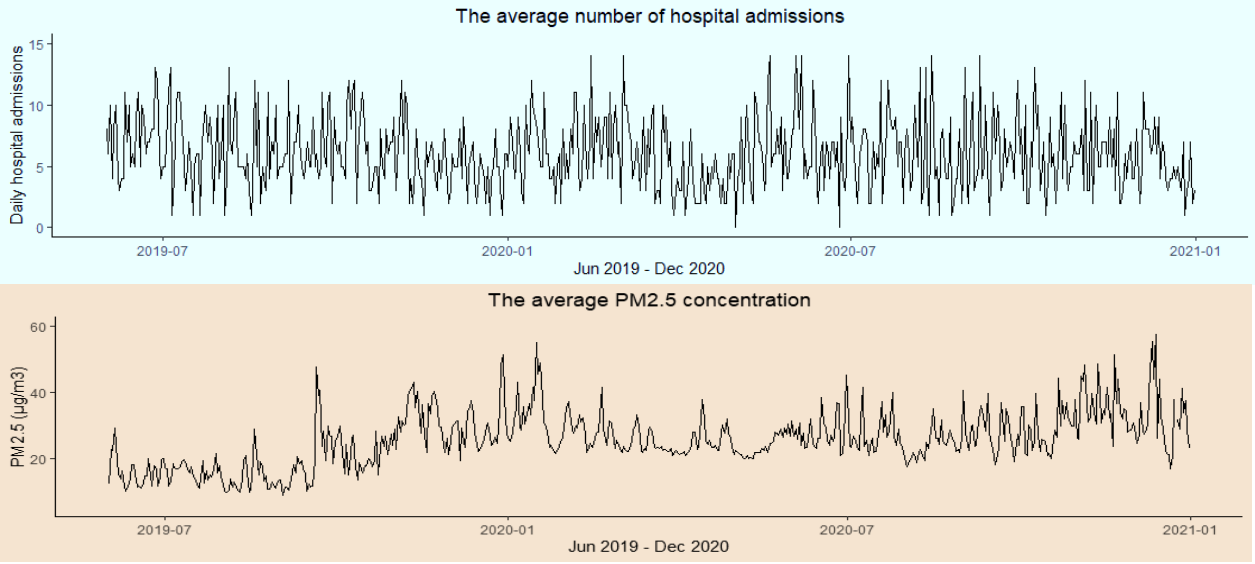

Figure1 Distributions of daily hospital admissions for MBDs and daily mean concentration of $PM_{2.5}$ (µg/m^3) in Ho Chi Minh city during the study period (Jun 2019 – Dec 2020)

The stratified analyses by age groups are shown in Figure 2. The delayed effects of PM2.5 were significantly associated with total MBDs and Schizophrenia on lag 7 in ≥ 60 year old group. The relative risk (RR) for each 10 µg/m3 increase in PM2.5 were 1.25 (95% CI = 1.03 - 1.52) and 1.45 (95% CI = 1.12 - 1.89), respectively. In addition, it can be seen from lag 4 onwards that the risk of admission among the elderly tends to increase gradually. No statistically significant associations were found between PM2.5 and both ≤ 44 years old and 45-59 years old groups admissions in any lag structures.

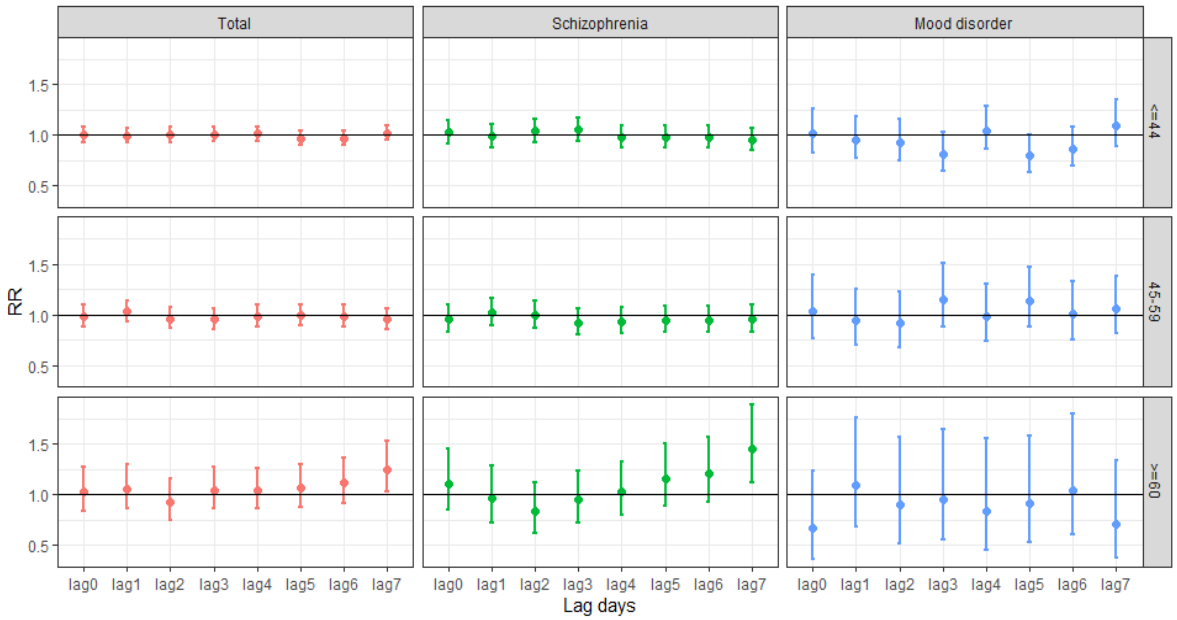

Figure 2 Association between $PM_{2.5}$ and hospital admissions for MBDs by age groups

The risk of MBDs admission when exposed to PM2.5 by two season (dry/wet) is presented in Figure 3. For total MBDs admission, significant association was found at lag 7 with RR = 1.10 (95%CI = 1.02-1.18) in wet season. Similarly, the concentration of PM2.5 positively associated with the hospitalizations for Schizophrenia RR = 1.14 (95%CI = 1.01-1.29), but no significant association was observed in dry season. Among Mood disorder, negative association was observed between PM2.5 and hospitalization at lag 1 with RR = 0.78 (95%CI = 0.65-0.94) in the dry season. In contrast, significant positive association was observed in the same lag with RR = 1.23 (95%CI = 1.04-1.47) for wet season.

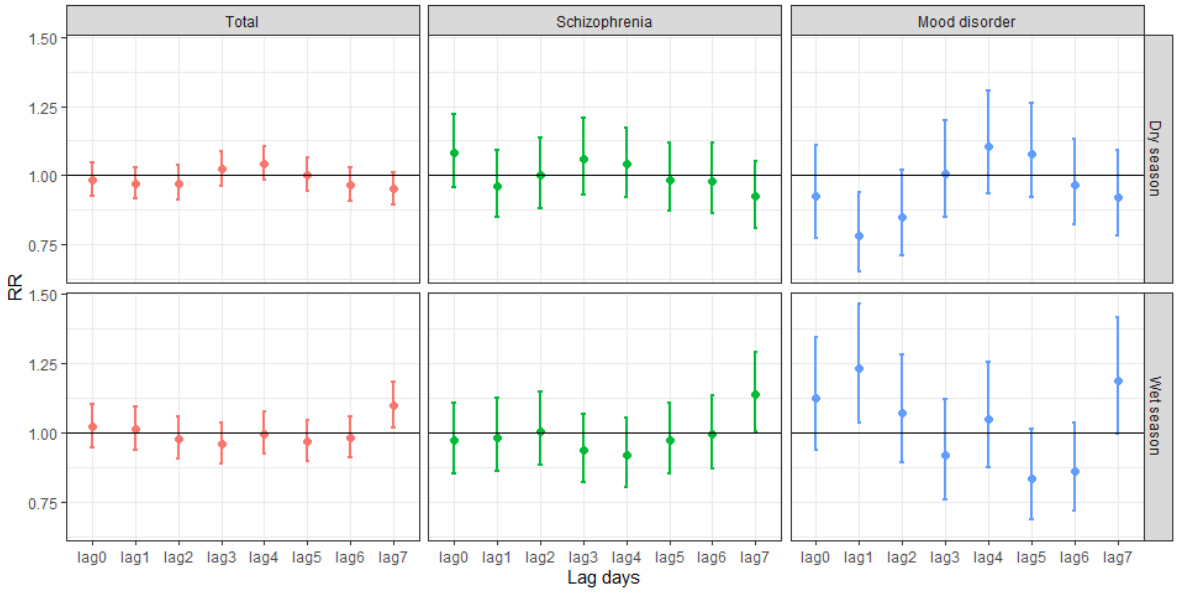

Figure 3 Association between $PM_{2.5}$ and hospital admissions for MBDs by seasons

DISCUSSION

This research provide more understanding of how air pollution affects human health, especially on mental health. Our study showed that the average daily mean concentrations of PM2.5 in HCMC were 25.6 µg/m3. These values were exceed 24-hour mean concentrations for PM2.5 recommended by WHO Air quality guidelines (AQGs), which is 25 µg/m3 (21). In addition, we found that each 10 µg/m3 increase in PM2.5 was associated with an increase of 1.25 (95%CI = 1.03-1.52) and 1.45 (95%CI = 1.12-1.89) risk of total MBDs and Schizophrenia admission among the elderly, respectively. Moreover, results indicated a generally stronger association of PM2.5 with MBDs in the wet season than in the dry season.

Association between $PM_{2.5}$ and hospital admissions for MBDs by age groups

Age is an important element that can influence mental and neurological functioning in humans. In this study, we observed that particulate matter had a detrimental effect on the elderly at lag 7 in single lag effect. Our finding was generally consistent with previous studies. A study conducted in the United States revealed that older persons living in locations with higher PM2.5 concentrations had poorer cognitive performance (23). The result is also comparable with earlier observations by Jie Song et al. (2018), which showed that the association between PM2.5 and the group of 45 years and older is more prominent than the other groups (9). Our results suggest that the elderly are vulnerable at lag 7, which can in part be explained by cumulative exposure to the previous days which can lead to hospitalization outcomes. In addition, there may be a delay of a few days before it is possible to arrange to go to the hospital for examination.

Another important finding is that the elderly with schizophrenia are susceptible to PM2.5. This finding is comparable with a study in China (2017) which also found that every 10 µg/m3 of PM2.5 increase was associated with a 1.00% increase in schizophrenia admissions at 0–6 cumulative lag days (24). Similarly, a study in Japan also indicated that OR associated with significantly increased PM2.5 levels for schizophrenic patients over 65 years of age (25). These associations were potentially explained by the characteristics of ambient particulate matters which also contain biological components or chemical composition, including metal elements that can have an effect on neurological system. These components may play roles in infection and affect the host neuro system (26-28). Another possible reason was the characteristic of the elderly. At the same time, PM2.5 also has the ability to accelerate inflammation of the nervous system, known as 'inflamm-aging', which is clearly associated with deterioration of immune function, called 'immunosenescence' that occurs naturally due to aging. (29).

Association between $PM_{2.5}$ and hospital admissions for MBDs by seasons

In this study, we found a significant association between the number of hospital admissions for all mental illnesses at lag 7 with RR = 1.10 (95% CI: 1.02–1.18) in the wet season. Especially for disease subgroups, significant associations were found between PM2.5 and hospitalization for schizophrenia at lag 7 with RR = 1.14 (95%CI = 1.01 - 1.29). Similar finding was reported by Gao et al. (2017) who also indicated that during the warm period (from May to October), PM10 increased 1.94% risk of schizophrenia admissions at lag 6. However, the association of MBDs and PM2.5 in different season were still inconsistent among studies (9, 24, 30). This complex association might be related to PM concentrations which are influenced by meteorological conditions and consequently affect humans' health differently.

Our results revealed a notably finding that the dry season had a negative association between PM2.5 and total hospitalizations considered single lag at lag 1 RR = 0.78 (95%CI = 0.65-0.94). This association may result from the small sample size which might have limited the power of the statistics. Furthermore, sociodemographic factors such as economic status, socioeconomic, lifestyle, household and neighborhood characteristics may alter the actual association (31). Moreover, people may have more outdoor activities in the dry season than in the wet season. Being more active is probably less of a risk for mental health-related illnesses. In addition, these differences may be due to the complex constituents of the particulate matter, climatic conditions, and exposure patterns in different regions. Therefore, the precise seasonal patterns are yet unknown and need to be investigated further.

Our study had some limitations. Firstly, due to the small size of the data on hospital admissions in some other mental and behavioral disorders groups, we could not do a comprehensive analysis of all groups. Secondly, the present study only measured outdoor pollution, and that may not be representative of total individual exposures and other potential confounding factors that we could not control for in this study. Moreover, we cannot further adjust for potential confounding factor due to the limitation of secondary data from monitoring station.

CONCLUSION

Our findings have provided evidence for building public health concern to prevent and minimize the adverse health effects of air pollution exposure on the elderly, and which may be varied by season. Also, thorough epidemiological, individual's characteristics, mechanistic and translational studies to identify how air pollution impacts mental health with the goal of eventual intervention and prevention of mental disease are greatly needed.

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FACTORS ASSOCIATED TO GLYCEMIC CONTROL IN ADULTS WITH TYPE 2 DIABETES MELLITUS DURING COVID-19 OUTBREAKS IN JAKARTA, INDONESIA

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ABSTRACT

Large-Scale Social Restrictions (LSSR) in Indonesia were introduced on 10 April 2020 to respond to the COVID-19 pandemic. The prolonged restrictions may affect glycemic control and diabetes self-management routines. This study aims to identify glycemic control and its associated factors among type 2 diabetes mellitus (type-2 DM) patients during COVID-19 in Jakarta, Indonesia. In this cross-sectional study, patients with type-2 DM who were 25–54 years old, checked HbA1c during COVID-19 and had no COVID-19 were included from Primary, Secondary, and Tertiary hospitals in Jakarta during March 2021. An online structured questionnaire was administered using Google Forms. The survey included questions on general characteristics, diabetes conditions, consultation factors, and self-care during COVID-19 outbreaks. HbA1c level (%) was reported by the participants from their latest laboratory result between June 2020 to March 2021. Data analysis was performed using descriptive statistics and Chi-square test (Cl 95%) in SPSS program version 22. A total of 205 patients were included in this study, with a mean (SD) age of 47 (7.0) years and a duration of diabetes 6.6 (4.1) years. As many as 57.1% of patients have poor glycemic control (HbA1c≥7%) during COVID-19 outbreaks. It was significantly associated with gender ($p<0.001$), income ($p=0.047$), body mass index or BMI ($p<0.001$), medication type ($p<0.001$), telemedicine experience ($p=0.039$), consultation during COVID-19 ($p<0.001$), meal plan compliance ($p=0.041$), regular exercise ($p=0.002$), and family support in using telemedicine ($p=0.004$). However, only 18.5% of participants used telemedicine to consult a doctor during the pandemic. Glycemic control among patients with type-2 DM remains unsatisfactory during COVID-19 outbreaks. Therefore, good compliance in a healthy lifestyle and staying connected with a doctor during LSSR are advised to ensure optimal blood glucose control and reduce the incidence of diabetes complications.

Keywords: COVID-19, telemedicine, type 2 diabetes

INTRODUCTION

COVID-19 was categorized as a global pandemic by the World Health Organization (WHO) since 11th March 2020 after affected more than 114 countries and killed over 4,000 people(1). In Indonesia, the first case of COVID-19 was reported on 3rd March 2020 (2). The number of cases keeps increasing until it has surpassed the total case of COVID-19 in mainland China with more than 3,409,658 confirmed cases and 94,119 deaths, as of 01st August 2021. Jakarta is the province with the highest COVID-19 cases in Indonesia (23.9%) (3).

In response to the COVID-19 pandemic, the Indonesian government has proactively implemented Large-Scale Social Restrictions (LSSR) since 10th April 2020 (4). During the restrictions, people are advised to stay at home unless there is an important matter. This unexpected situation may impact lifestyle and reduction of access to usual care (5). People with chronic illness who need continuing care are predicted to be the most suffer during the restriction. Therefore, telemedicine expects to become a new norm in healthcare delivery and considered as the most ideal solution to address the changing of chronic disease management during the pandemic.

Diabetes is a chronic illness that requires continuing care and self-management to prevent complications (6). Unfortunately, during the restriction, diabetes care has been severely disrupted. Many diabetic patients in Indonesia were reported to experience difficulties in attending diabetes consultation, access medication, control diet, check blood glucose, and perform regular exercise during the pandemic (7). Further, the disruption in diabetes care would have probably led to worsening of glycemic control (8). Although previous studies have examined the impact of lockdown on glycemic control, the results are not consistent. Some studies found that lockdown implementation may improve the glycemic control among diabetic patients (9, 10), but some others found otherwise (11, 12).

This study aims to determine the associated factors related to glycemic control among type-2 DM patients during COVID-19 outbreaks in Jakarta, Indonesia.

METHODS

Study Design and Population

This cross-sectional study was conducted during 1st to 31st March 2021. A total of 205 participants were included with criteria: age 25-54 years, diagnosed type-2 DM by doctor before 2020, check HbA1c during COVID-19 (June 2020–March 2021), live in Jakarta for at least 6 months without migration or move to another city, and have no COVID-19. Pregnant women, patients who hospitalized for any cause, and patients who have a cognitive or psychiatric problem were excluded.

We collaborated with healthcare professional from primary, secondary, and tertiary hospital in Jakarta to enroll the participants. A Google Form link were given to the potential participants which consists of screening survey, informed consent, and a questionnaire. The self-constructed questionnaire in English have been reviewed for content validity by 4 experts including 2 medical doctors from Indonesia, 1 medical doctor from Thailand, and 1 public health from Thailand. The Index of Item-Objective Congruence (IOC) score less than 0.8 has been revised and/or deleted. The validated questionnaire translated into Indonesia language using backward translation. Pilot study have been conducted to 30 samples outside Jakarta who had similar criteria.

General characteristics (e.g., age, gender, education level, employment status, income, marital status, smoking status, BMI, and family/household size), diabetes conditions (e.g., diabetes duration, medication type, and comorbidity), consultation factors (e.g., telemedicine experience, consultation type, and family support in using telemedicine), self-care (e.g., meal plan compliance, restriction compliance, frequency of eating, snacking habit, regular exercise, medication compliance, and self-monitoring blood glucose/SMBG), and HbA1c level were recorded online using a structured questionnaire via Google Form. HbA1c was self-reported by the participants from their latest laboratory result between June 2020–March 2021.

Ethical Consideration

Ethical approval was obtained from the Ethical Review Board, Faculty of Medicine and Health, University of Muhammadiyah Jakarta, Indonesia No.052/PE/KE/FKK-UMJ/II/2021. The collected data was uniquely coded to protect participants' privacy and confidentiality, also deleted after the study finished.

Statistical Analysis

Data was analysed on SPSS version 22.0 software (licensed by Chulalongkorn University). Descriptive statistics presented using categorical data (e.g., frequency and percentage) and continuous data (e.g., mean/median and standard deviation). Normality data analysed using Kolmogorov-Smirnov and Saphiro-Wilk. Chi-square was used to identify association between categorial variables. A two-sided α less than 0.05 was considered as statistically significant (CI 95%).

RESULTS

General characteristics

The general characteristic of the participants is shown in Table 1. All continuous data (e.g., age, family/household size, diabetes duration, frequency of eating, and regular exercise) were not normally distributed, so the median value was used as a cut-off point for data categorization in bivariate analysis. Body mass index (BMI) were using WHO standard which consists of underweight, normal, overweight, and obese.13 Level of income was compared to before and during the pandemic.

Mean (SD) of participants' age were 47 (7) years. Many of them were female (53.2%), graduated from senior high school (44.4%), and employed during COVID-19 outbreaks (66.8%). There was a reduction in mean (SD) of income before and during the COVID-19 outbreaks from 537 (747) to 516 (734) USD. Approximately 91.2% participants were married and 86.8% never smoke. Mean (SD) of BMI was 26.7 (5.0) kg/m2 and family/household size was 4 (2) people.

Table 1 General characteristics of participants (n=205)

Characteristics	Number	Percent
Age (years), mean ± SD	47 ± 7	
Gender		
Male	96	46.8
Female	109	53.2
Education level		
Elementary school	6	2.9
Junior high school	4	2.0
Senior high school	91	44.4
Bachelor's degree	72	13.7
Master's degree	32	15.6
Employment status		
Unemployed	68	33.2
Employed	137	66.8
Income (USD), mean ± SD		
Before COVID-19	537 ± 747	
During COVID-19	516 ± 734	
Marital status		
Married	187	91.2
Single	10	4.9
Divorce	4	2.0
Widow	4	2.0

Characteristics	Number	Percent
Smoking status		
Never	178	86.8
Ex-smoker	5	2.4
Current smoker	22	10.7
BMI (kg/m^2), mean ± SD	26.7 ± 5.0	
Family/household size (number of people), mean ± SD	4 ± 2	

*Currency rate on 1st April 2021: 1 USD = IDR 14,528

Of the total of 205 participants, 57.1% participants had poor glycemic control (HbA1c≥7%). Table 2 shows that glycemic controls and the following: gender (p<0.001), income level (p=0.047), and BMI (p<0.001) had significant association during the COVID-19 outbreaks. Age, education level, employment status, marital status, smoking behaviour, and family/household size had no association with glycemic control during COVID-19 outbreaks (p>0.05)

Table 2 Bivariate analysis between general characteristics and glycemic control (n=205)

Characteristics	Good Glycemic Control (HbA1c <7%) (n=88)	Poor Glycemic Control (HbA1c ≥7%) (n=117)	Total	P-value
Age				
<49 years	48 (48.0)	52 (52.0)	100 (100.0)	0.152
≥49 years	40 (38.1)	65 (61.9)	105 (100.0)	
Gender				
Male	54 (56.3)	42 (43.8)	96 (100.0)	**<0.001***
Female	34 (31.2)	75 (68.8)	109 (100.0)	
Education level				
Below senior high school	42 (41.6)	59 (58.4)	101 (100.0)	0.702
Bachelor's degree or higher	46 (44.2)	58 (55.8)	104 (100.0)	
Employment status				
Unemployed	30 (44.1)	38 (55.9)	68 (100.0)	0.808
Employed	58 (42.3)	79 (57.7)	137 (100.0)	
Income level				
No changed	79 (45.9)	93 (54.1)	172 (100.0)	**0.047***
Decrease	9 (27.3)	24 (72.7)	33 (100.0)	
Marital status				
Married	82 (43.9)	105 (56.1)	187 (100.0)	0.389
Others	6 (33.3)	12 (66.7)	18 (100.0)	
Smoking status				
No	76 (41.5)	107 (58.5)	183 (100.0)	0.244
Yes	12 (54.5)	10 (45.5)	22 (100.0)	
BMI				
Normal or lower	48 (61.5)	30 (38.5)	78 (100.0)	**<0.001***
Overweight or higher	40 (31.5)	87 (68.5)	127 (100.0)	
Family/household size				
<4 people	28 (45.9)	33 (54.1)	61 (100.0)	0.575
≥4 people	60 (41.7)	84 (58.3)	144 (100.0)	

*Chi-square test, p-value <0.05; BMI, Body Mass Index

Table 3 shows that medication type (p<0.001) had significant association towards glycemic control during COVID-19 pandemic. Diabetes duration, length of medication, and comorbidity had no association with glycemic control (p>0.05).

Table 3 Bivariate analysis between diabetes conditions and glycemic control (n=205)

Characteristics	Good Glycemic Control (HbA1c <7%) (n=88)	Poor Glycemic Control (HbA1c ≥7%) (n=117)	Total	P-value
Diabetes duration				
<5 years	40 (50.6)	39 (49.4)	79 (100.0)	0.078
≥5 years	48 (38.1)	78 (61.9)	126 (100.0)	
Medication type				
Oral medicine	72 (51.1)	69 (48.9)	141 (100.0)	**<0.001***
Others	16 (25.0)	48 (75.0)	64 (100.0)	
Comorbidity				
No	78 (42.4)	106 (57.6)	184 (100.0)	0.647
Yes	10 (47.6)	11 (52.4)	21 (100.0)	

*Chi-square test, p-value <0.05

Characteristics of consultation factors among participants describe in Table 4. Type-2 DM with poor glycemic control (HbA1c≥7%) mostly had no experience (60.5%) and no family support in using telemedicine (65.8%) during the pandemic. Further, type-2 DM who used telemedicine to consult a doctor tends to have good glycemic control (63.2%) compared to those who never did any consultation (91.7%).

Table 4 Bivariate analysis between consultation factors and glycemic control (n=205)

Characteristics	Good Glycemic Control (HbA1c <7%) (n=88)	Poor Glycemic Control (HbA1c ≥7%) (n=117)	Total	P-value
Telemedicine experience				
Never	66 (39.5)	101 (60.5)	167 (100.0)	**0.039***
Ever	22 (57.9)	16 (42.1)	38 (100.0)	
Consultation type				
No consultation	4 (8.3)	44 (91.7)	48 (100.0)	**<0.001***
Telemedicine	24 (63.2)	14 (36.8)	38 (100.0)	
In-person visit only	60 (50.4)	59 (49.6)	119 (100.0)	
Family support in telemedicine				
No	40 (34.2)	77 (65.8)	117 (100.0)	**0.004***
Yes	48 (54.5)	40 (45.5)	88 (100.0)	

*Chi-square test, p-value <0.05; SMBG, Self-Monitoring Blood Glucose

Table 5 shows that meal plan compliance (p=0.041) and regular exercise at least 3 times per week (p=0.002) had significant association towards glycemic control. Diet restriction compliance, frequency of eating, snacking, self-monitoring blood glucose (SMBG), and medication adherence had no association with glycemic control (p>0.05).

Table 5 Bivariate analysis between self-care and glycemic control (n=205)

Characteristics	Good Glycemic Control (HbA1c <7%) (n=88)	Poor Glycemic Control (HbA1c ≥7%) (n=117)	Total	P-value
Meal plan compliance				
No	70 (40.0)	105 (60.0)	175 (100.0)	**0.041***
Yes	18 (60.0)	12 (40.0)	30 (100.0)	
Restriction compliance				
No	44 (40.0)	66 (60.0)	110 (100.0)	0.362
Yes	44 (46.3)	51 (53.7)	95 (100.0)	
Frequency of eating				
<3 times per day	26 (38.2)	42 (61.8)	68 (100.0)	0.339
≥3 times per day	62 (45.3)	75 (54.7)	137 (100.0)	
Snacking habit				
No	18 (40.9)	26 (59.1)	44 (100.0)	0.760
Yes	70 (43.5)	91 (56.5)	161 (100.0)	
Regular exercise				
<3 times a week	30 (31.3)	66 (68.8)	96 (100.0)	**0.002***
≥3 times per day	58 (53.2)	51 (46.8)	109 (100.0)	
Medication compliance				
Sometimes forget	10 (52.6)	9 (47.4)	19 (100.0)	0.370
Never forget	78 (41.9)	108 (58.1)	186 (100.0)	
SMBG				
No	54 (48.6)	57 (51.4)	111 (100.0)	0.072
Yes	34 (36.2)	60 (63.8)	94 (100.0)	

*Chi-square test, p-value <0.05; SMBG, Self-Monitoring Blood Glucose

DISCUSSION

Tight glucose control is required for type-2 DM patients to prevent worsen prognosis and risk of any infection. Unfortunately, lockdown measurement amid the COVID-19 outbreaks has been proven to negatively affect diabetes management (11, 14, 15). A study from Ghosal et al have predicted that the longer duration of lockdown may worsen glycemic control and diabetes related-complication due to difficulties in managing the disease (8). Our study found that many of type-2 DM patients have poor glycemic control (HbA1c ≥7%) during the pandemic. The result is not much different

if compared to normal situation as Cholil et al found that glycemic control among type-2 DM in Indonesia tend to be suboptimal (16). However, out finding is understandable because many of type-2 DM patients experienced difficulties in managing their condition (7).

Women tend to have poor glycemic control compared to men in this study. The possible causes are the difference in metabolic process, regulation of glucose homeostasis, treatment response and psychological factors (17-19). Yan et al also found that women reported to have more psychological stress during the pandemic than men and this could affect their well-being(20). Other sociodemographic factor which affect glycemic control in this study is income level. This indicated that level of income could limit patients ability to manage their diabetes condition.

Although this study did not measure lifestyle changes before and after the pandemic, our study found that many of type-2 DM patients had meal plan to maintain their diet compliance with regular meals (at least 3 times per day) although not focusing on diabetic diet. This is understandable because in the current situation, ensuring good nutrition with regular meals is more important than diet optimization.21 Diet optimization (e.g., carbohydrate or calories restriction) might be useful in overweight or obese diabetic patients (22, 23). This is because being overweight or obese leads to poor glycemic control or higher HbA1c level due to insulin resistance and secretion (24).

We observed that PSBB was not an obstacle for the type-2 DM outpatients to exercise regularly at home. Physical activity during COVID-19

lockdown for 30 minutes daily21 is needed to help people with diabetes in improving glycemic control (25), enhance metabolic health(26), and immune defence (27). Additionally, type-2 DM outpatients keep continuing their treatment (28) with oral medicine as the most medication used. Evidence has supported the effectiveness of monotherapy and in combination with other therapeutic agents for lowering HbA1c (29).

Monitoring blood sugar levels is also recommended during COVID-19 oubreaks28, but our study found SMBG have no effect on HbA1c. It may because, unlike the HbA1c measurement, SMBG is episodic and only measures glucose at 1 point time which should be set correctly to enable proper interpretation of the result (30). This is contrary with previous study which found the efficacy of SMBG for glycemic control in type-2 DM patients (31). However, SMBG strategy could play its proper role if its effectively combined with diabetes self-management education.

Despite the potential benefits of telemedicine in glycemic control (32, 33), we found only 18.5% participants took initiative to use telemedicine to consult a doctor. The possible reason is patients' unfamiliarity with telemedicine platform, or they may feel more comfortable doing in-person visits. This finding is below expectation that there will be an increase in the teleconsultation used during COVID-19 outbreaks. However, doctor consultation is advised for controlling diabetes during the pandemic either directly or remotely using telemedicine. Support from family in telemedicine use can help diabetic patients to stay connected with a doctor during the pandemic. Further, this remote consultation will give positive contribution on lifestyle modification during COVID-19 outbreaks which leads to better glycemic control and therapy adherence (34).

To our knowledge, this is the first in Indonesia to have assessed factors contributing to glycemic control in adults with type-2 DM during COVID-19 outbreaks. However, this study had some limitations. First, data were self-reported which subject to information and recall bias. Second, all the participants were type-2 DM patients who visited healthcare facility in the past 1-year (April 2020–March 2021), and this may lead to selection bias. Third, the data was not measure before and after COVID-19 pandemic, and therefore, it cannot draw conclusions on the impact of PSBB based on our study. Further studies in other areas in Indonesia are required to establish the national compliance values regarding the impact of COVID-19 on glycemic control among patients with diabetes.

CONCLUSION

The status of glycemic control in type-2 DM patients in Jakarta, Indonesia remains unsatisfactory during COVID-19 outbreaks. The modifiable associated factors include BMI, medication type, consultation with a doctor, meal plan compliance, regular exercise (minimal 3 times per week) and family support in telemedicine use.

RECOMMENDATION

Our findings highlight the need for diabetic patients to comply with healthy lifestyle and keep consulting with a doctor through in-person visit or telemedicine to ensure good glycemic control and prevent complication during the pandemic. Physician endorsement might need to boost telemedicine use among diabetic patients. Further studies in other areas in Indonesia are required to establish the national compliance values.

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IDENTIFY THE RELATIONSHIP BETWEEN WASTEWATER TEMPERATURE AND AMBIENT AIR TEMPERATURE USING ARTIFICIAL NEURAL NETWORKS

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ABSTRACT.

Today, municipal wastewater management is of great importance in the context of public health in megacities and towns. The fact is that temperature plays a vital role in biological wastewater treatment, determining the wastewater temperature is particularly important in the design and operation of wastewater treatment plants. The aim of this study is to identify the relationship between ambient air temperature and community wastewater temperature with emphasis on Hamadan community wastewater in Iran. In order to measure municipal wastewater temperature, a sampling station was set up. Raw sewage temperature was measured in the sampling station. Then, the municipal wastewater temperature had measured three times a day. Ambient air temperature at the station was obtained from hourly air temperature recorded at the weather station placed in the immediate area. In this research, the artificial neural network (ANN) model having three layers was developed to precisely estimate municipal wastewater temperature. MATLAB program of neural networks toolbox was used for this study. The neural network model was developed, trained, and tested for predicting the sewage temperature. Based on the results, the annual average (SD) ambient air temperature and wastewater temperature was 10.52 (15.25) and 15.32 (7.10) degrees centigrade (C^{o}), respectively. Based on the results, the correlation coefficient between ambient air temperature and municipal wastewater temperature in Hamadan city was quite significant, and the comparison of calculated and observed data indicated a negligible error. The study revealed that computer engineering includes hardware, software, and ANN models that give more accurate results than those based on previously used methods. It is clear from the results that this method can be used in the analysis of other issues related to public health.

Keywords: Air temperature, artificial neural network, public health, wastewater

INTRODUCTION

Biological wastewater treatment is one of the main issues of wastewater treatment processes and identifying their bacteria and sensitivity to temperature changes is very important. The mentioned factor affects the bacterial metabolism and the rate of biochemical reactions in the wastewater and result in increasing the substrate removal rate. It should be noted that, at high temperatures, the solubility of oxygen and other gases in liquid decreases. The fact is that wastewater temperature plays an important role in the biological wastewater treatment. In the other word, wastewater treatment has many problems in cold cities and determining the wastewater temperature is particularly noticeable in the design and operation of wastewater treatment plants.

So far, practical studies have been conducted on the effect of temperature on various wastewater treatment processes such as conventional wastewater treatment (1), stabilization pond (2), anaerobic wastewater treatment (3,4,6,7), biological wastewater treatment (5,12), community wastewater treatment (8,9,10), activated sludge (11) and any other fields (13). For example, Augelletti et al. Studied the influencing microbial factors of wastewater treatment processes in Belgium. Based on the results, Psychrophiles or cryophiles are the species of bacteria that are capable of growth at temperatures close to the freezing point of wastewater with an optimum growth temperature below 15 degrees. They have the potential to exhibit high metabolic activities at low and moderate temperatures using cold-adaptive characteristics that offset the adverse impact of low temperatures on biochemical reaction rates (7).

Today's many environmental health researchers and engineers have started to use Machine Learning (ML) and Artificial Intelligence (AI) mthods in modelling, prediction and optimization of complex

system. Among mentioned methods Artificial Neural Networks (ANNs) algorithm have become the most frequently used in the field of energy (14), water and wastewater (15, 16, 18, 19,20, 21) solid waste (17) and any related fields.

ANN algorithms are an important effort to creat a model which works similar to the human brain and is analogous to the biological function of memorizing and learning, comprising a dense network of connections between input data, neurons in different hidden layers, and output data (21). on the other word, ANN algorithms are information processing systems that can be trained to solve complex linear and nonlinear functions with variable parameters. These methods are highly accepted because they require less data for forecasting and are more preferred than deterministic models; also, unlike other mathematical models, they do not require a complex and explicit description (22).

In the presented study, a model based on ANN algorithm was developed to identifying the relationship between ambient air temperature and community wastewater temperature with emphasis on Hamadan community wastewater in Iran. In the other word, the aim of this study is to predicate the Hamadan community wastewater temperature using ANN model.

METHODS

Study Area

This research was conducted in Hamadan city during summer and winter season. Hamadan is one of the cold cities with an altitude of 1749 meters above sea level, is located at the foot of Alvand mountain area in the west of Iran. Based on information in the statistical yearbook of Hamadan province, edition 2019, Statistical Center of Iran, the average annual temperature and the average annual precipitation during 1975-2019 was 12°C and 314 mm respectively. Today, Hamadan city is equipped with a modern wastewater treatment system, but the wastewater collection network still has shortcomings.

Data Collection

data needed in this research were raw sewage temperature and ambient air temperature. In order to measure the sewage temperature, a sampling station was set up at the end of sewerage network. A pretest was performed to check the applicability and estimate the minimum sample size required to achieve the research objectives. Based on the pretest

results, the minimum sample size was estimated at 100 cases. sampling and analysis methods were based on standard methods (23). Raw sewage temperature was measured by an alcohol thermometer that was provided in the sampling station. Simple random sampling was performed to select 17 days in each season of summer and winter. Then, the temperature of the sewage was measured three times a day, in the morning (between 7:00 am and 8:00 am), afternoon (between 1:00 pm and 2:00 pm), and evening (between 10:00 pm and 11:00 pm). Based on this, the total number of measurements that had performed was equal to 102 cases. Ambient air temperatures at the station were obtained from hourly air temperature recorded at Hamadan- Airport weather station that is near the sampling station.

Design of Neural Network

In this research, Perceptron model was applied and ANN algorithm was built using ambient air temperature as input and wastewater temperature as output. The proposed research was architected on fitnet, feed-forward net and cascade forward net neural network using MATLAB R2019a software. In this situation, the ANN algorithm used here is consists of three layers: input layer, one hidden layer, and output one. Scheme of used network is shown in Figure1. Also, details and parameters such as the best number of neurons that was selected in this research are presented in Table1.

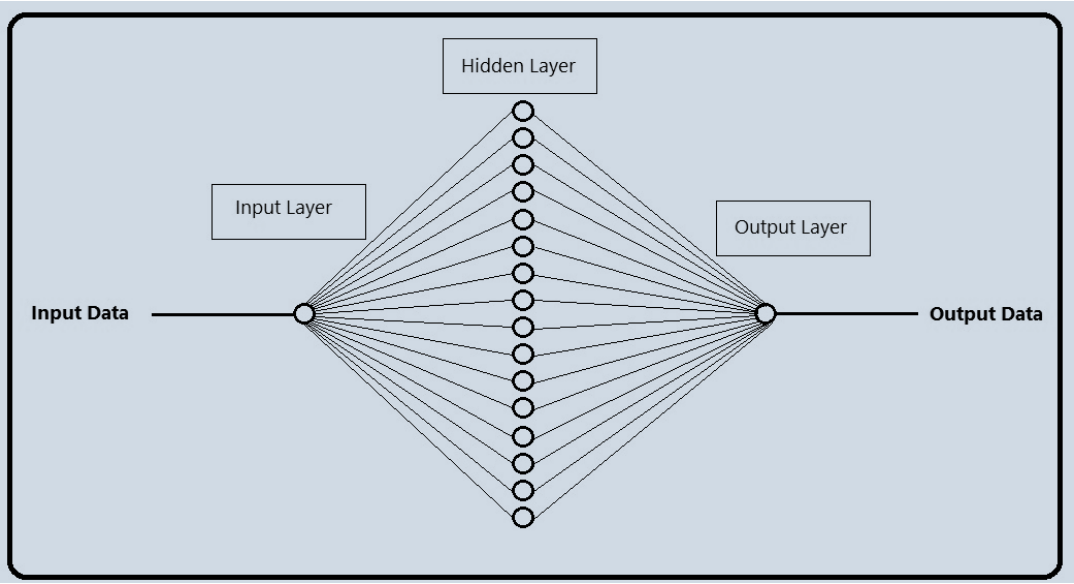

Figure 1 Schematic diagram of artificial neural network (ANN) algorithm

Table 1 The parameters that was selected in this research

No. of hidden layers	**1**
No. of neurons in the hidden layer	10-20
No. of neurons in the output layer	1
Learning rate	0.5
Number of epochs	10 Iterations
Learning algorithm	Levenberg-Marquardt
Transfer function for Hidden layer	Linear (Purelin)
Transfer function for output layer	Tansig

Training Neural Network

Before training, the prepared data was divided into training, testing and validation dataset in the ratio of 70%, 15% and 15% respectively to avoid overfitting and to obtain a generally applicable ANN model works. Training neural networks entail the adjustment of weights in order to make the predicted output close to the target output. To achieve these, during the training process, different types of learning algorithm and activation function were investigated. Finally, Levenberg-Marquardt method, linear (purelin) and tangent sigmoid (tansig) were selected as learning algorithm, Transfer function for Hidden layer and Transfer function for output layer, respectively.

Evaluation criteria

For evaluating the prediction, accuracy of the studied models, Root Mean Squared Error (RMSE), Mean Squared Error (MSE), and correlation coefficient(R) was utilized as presented in equations 1, 2 and 3.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(p_i - O_i)^2)}{n}} \quad (1)$$

$$MSE = \frac{\sum_{i=1}^{n}(P_i - O_i)^2}{n} \quad (2)$$

$$R = \frac{\sum_{i}^{n}(o_i - \bar{o})(p_i - \bar{p})}{\sqrt{\sum_{i=1}^{n}(o_i - \bar{o})^2 \sum_{i=1}^{n}(p_i - \bar{p})^2}} \quad (3)$$

Where pi is the ith predicted value by models, oi is the ith observed value and n is the total number of sample data (23).

RESULTS

The obtained results are presented in three sections: the results of field & laboratory analysis, the results of the ANN processing and correlations, and the results of training Performance.

The results of field & laboratory analysis

As mentioned in the previous sections, the field & laboratory analyzes performed in this study include ambient air temperature and community wastewater temperature. The results of the field & laboratory analysis are summarized in Table 2.

Table 2 Results of ambient air and wastewater temperature in studied area as degree centigrade (C°).

Season	parameter	Ave	Max	Min	SD	n
Summer	Ambient air temperature	25.67	37.00	10.00	7.64	45
	wastewater temperature	22.87	31.00	16.00	2.67	45
Winter	Ambient air temperature	-1.44	11.00	-18.00	6.60	57
	wastewater temperature	9.37	13.00	6.00	1.86	57
Total	Ambient air temperature	10.52	37.00	-18.00	15.25	102
	wastewater temperature	15.32	31.00	6.00	7.10	102

Based on the results, the annual average (SD) of ambient air temperature and wastewater temperature was 10.52 (15.25) and 15.32 (7.10) degree centigrade (C°), respectively.

The results of the ANN processing and correlations

In this research, the ANN algorithm concerned prediction of wastewater temperature in the studied area. Table 3 displays some ANN topology results for the mentioned goal. This research was accomplished, with different ANN networks such as fitnet, feedforwardnet and cascadeforwardnet and different number of neurons in each hidden layer. The R and MSE values were analyzed to select the best topology. Based on the results that are resented in table 3 the best choice is related to third topology and it was select as the best topology. Means, nine ANN topology for prediction of wastewater temperature was developed.

The model performance with 16 hidden neurons along with Linear (Purelin) transfer function for Hidden layer is shown in Figure 2. When data

points sit on the straight line, it confirms the exact correlation between the predicted obtained results and the wastewater temperature from experimental results. Based on the results, all four-scatter plots yielded R-values greater than 0.8, which meant a close relationship existed between the predicted obtained results and wastewater temperature from experimental results. The ANN model with the selected neurons and the algorithm had a MSE value of 1.97, closest to zero, confirming there was almost no error present in this predictive model.

Table 3. Comparison of different neural networks with varied number of neurons.

Topology	Net	Neurons	trainRatio/ valRatio/ testRatio	R	MSE
1	fitnet	10	70/15/15	0.96	4.36
2	fitnet	16	70/15/15	0.96	1.97
3	fitnet	20	65/15/20	0.96	2.57
4	feedforwardnet	10	70/15/15	0.95	3.36
5	feedforwardnet	15	70/15/15	0.96	4.29
6	feedforwardnet	15	65/15/20	0.94	8.06
7	cascadeforwardnet	10	70/15/15	0.96	5.54
8	cascadeforwardnet	20	70/15/15	0.96	2.05
9	cascadeforwardnet	20	65/15/20	0.96	2.37

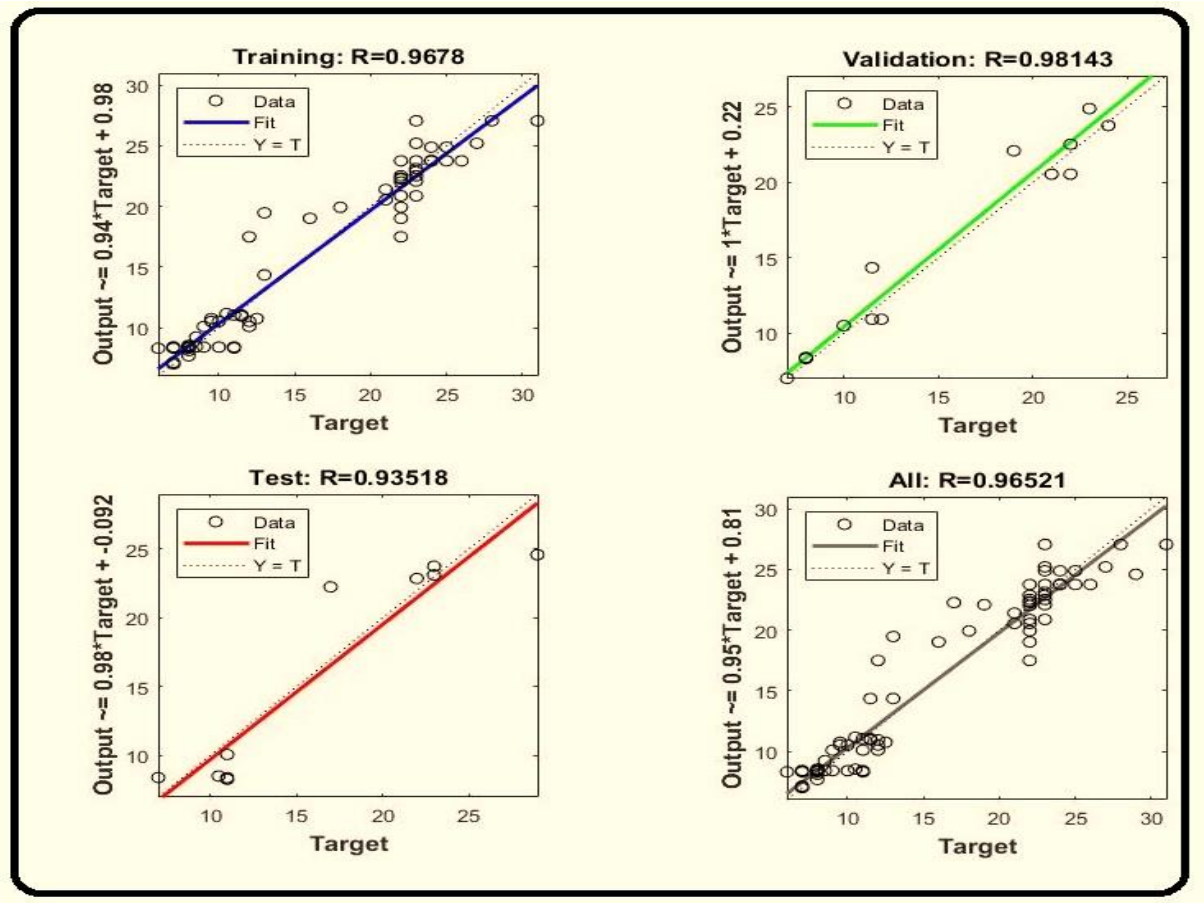

Figure 2 Performance of the artificial neural network (ANN) model based on the training dataset, test dataset, validation dataset and all datasets for 16 hidden neurons in the present research

The results of Training Performance

The networks were fully trained and the performances of the training functions are shown in Table 3. It was found that fitnet method with 16 neurons is highly effective and practical (R=0.96 & MSE=1.57). Figure 3. Shows the mentioned plot of the observed and predicted value, where the y- axis is the wastewater temperature and the x-axis is the ambient air temperature. The other topology showed weak correlation between the observed and the predicted values.

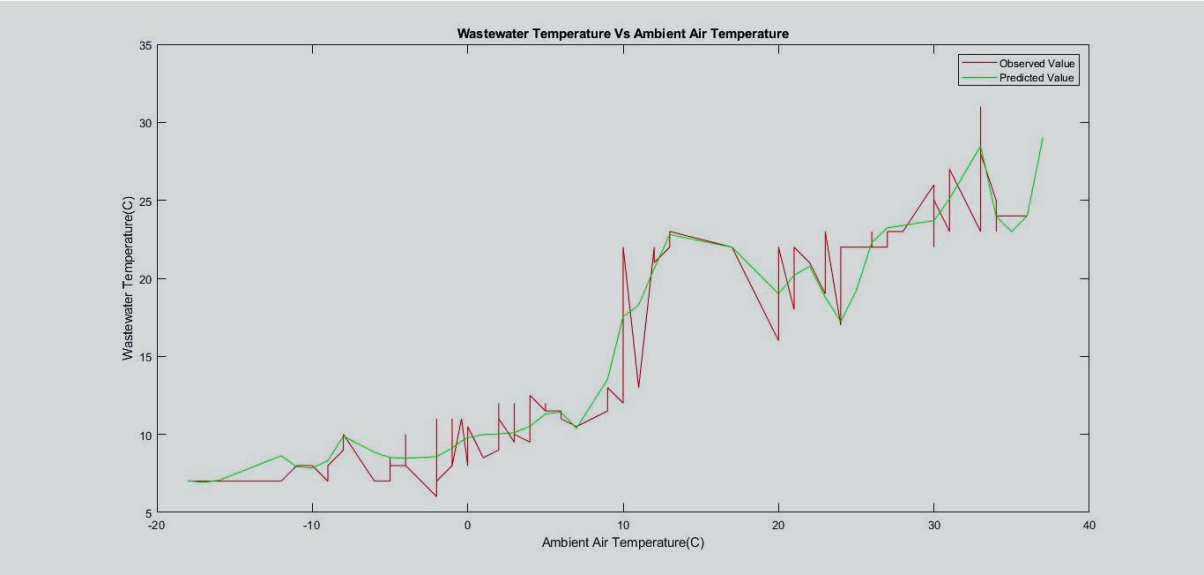

Figure 3 Relationship between wastewater temperature and ambient air temperature.

In this research, the MSE is versus the number of epochs. From the plots, the best validation performance occurred at the fifth epoch with a performance value of 1.97 (Figure 4). These serve as a stopping protocol that can spot a change in the course of the learning algorithm to avoid overfitting of the model. This error minimum signals transition between under fitting and over fitting of the model. The three curves were found to decrease in error as the epochs increase. At 5 to 11 epochs, the error became stable and started to increase after 10, which calls for the selection of the stopping protocol. Epoch 5 is seen as the best point as it represents the event where the three curves are together or closer to each other.

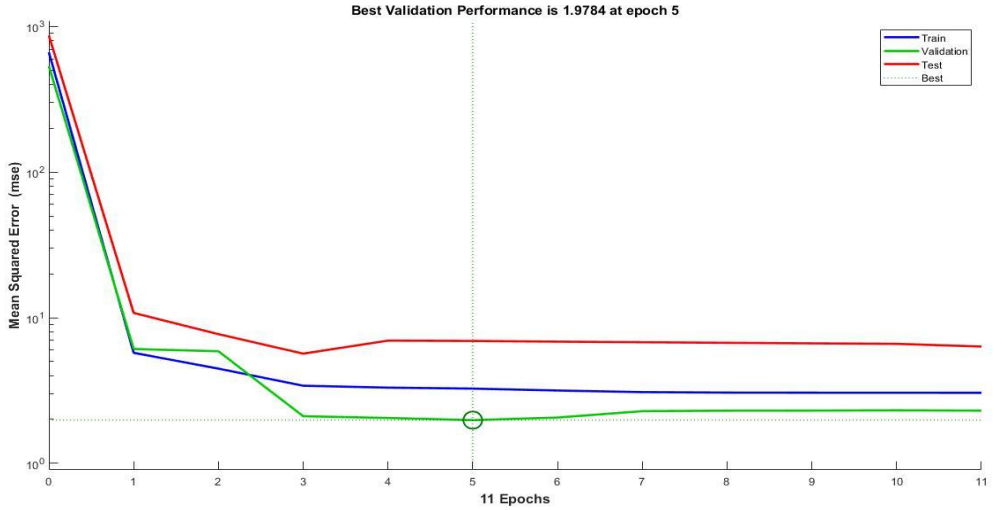

Figure 4. MSE values for training, validation and testing steps

DISCUSSION

In this research ANN algorithm was used to develop a prediction model that can predict wastewater temperature. The results of this study demonstrate the applicability of mentioned algorithm to monitor wastewater temperature. Numerous scientific works have been done in the field of using ANN algorithm for water temperature(24), reservoir Sediment Management(25), odour measurement(26) and other environmental health issues(19).

For example, Kote and Wadkar studied for the prediction of chlorine and coagulant dose in a water treatment plant. The model was developed so that added chlorine was determined as input and residual chlorine as output. It was found that training functions Levenberg-Marquardt and Bayesian regularization are highly effective (R=0.943 and R=0.947 respectively) for feed-forward neural network and cascade feed forward neural network. The other training functions showed very poor correlation between the observed and the predicted values (19).

The study revealed that computer engineering includes hardware; software and ANN algorithm give more accurate results than the ones based on previously used methods. Therefore, it is predicted that this method can be used in the analysis of other issues related to public health.

CONCLUSION

The task selected for the study was modeled to generate the actual wastewater temperature of Hamadan community wastewater. The ANN model designed and trained for prediction of wastewater temperature for the study area showed that ANN modelling have good capability for spatial prediction of wastewater temperature. ANN had R-value of 0.96 at its best topology. The results of the mentioned model prediction compared to the actual wastewater temperature were plotted and analyzed to observe the areas of overestimation and underestimation. The model was elective and can be used to predict a wide variety of experimental designs.

RECOMMENDATIONS

Because of the importance of municipal wastewater treatment in cold weather and due to the necessity of implementing a public health perspective to maintain and support population, it is recommended that the ANN algorithm be used in public health studies. In addition, scientists have to conduct further research to find reliable

and valid ways to develop and use ANN algorithm in different areas of public health on a variety of different topics. Because very few studies and researches have been done in these fields. Finally, due to the existing limitations, it is recommended that more research be done in these areas in order to overcome the barriers and produce change towards technologies adoption such as the mentioned algorithm in the health sciences be expanded.

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THE PREVENTIVE MEASURE AGAINST COVID-19 AMONG BANGKOK RESIDENTS DURING THE OUTBREAK

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ABSTRACT

COVID-19 is a new respiratory infection that is a global public health problem**.** The purpose of this study is to assess the preventive measures among Bangkok residents during the COVID-19 outbreak**.** The preventative measures means activities related to preventing COVID-19 disease such as avoiding crowded areas, wearing a mask, washing hands, eating freshly cooked food, separating and cleaning personal items, and observing symptoms**.** This study was a cross-sectional study of Bangkok residents and collected data by online self-administered questionnaires by convenient sample**.** This preliminary study from 100 subjects showed average age was 32±7.71 years (ranged 20-60 years) with about half having an education level of postgraduate (48%), and a third with the occupation of government officer/state enterprise (33%). The majority were female (76%). The source of COVID-19 information found most of the participants (93%) received information through the internet via social media. The result was; 1) the participants went to high-risk areas or any crowded place because most of the participants (75%) were a working-age had to go to work or study; 2) they took antibiotics by their own (71%); and 3) the participants always urgently sought medical care when they had symptoms only (43%). This study concluded that the participants had inappropriate preventive measures of COVID-19**,** such as being in crowded places, improper hand washing, and incorrect wearing a mask**.** In addition, the public health staff should recommend the correct preventive measures and keep social distancing measures during the COVID-19 outbreak**.**

Keywords: COVID-19, preventive measure, Bangkok

INTRODUCTION

Coronavirus disease 2019 (Covid-19) was a global health and societal emergency respiratory disease that is caused by a novel coronavirus and was first detected in December 2019 in Wuhan, China. On March 11, 2020, the World Health Organization (1) declared the coronavirus disease-19 (Covid-19) a public health emergency with a pandemic spread. As of September 27, 2020, Covid-19 have been reported in 215 Countries across the world more than 33,199,121 confirmed cases and 1,000,556 deaths case. The first infected case in Thailand on January 14, 2020, The first patient is a Chinese woman traveling from Wuhan to Bangkok (2). After that, there is a growing number of Covid-19 case in Thailand.

Covid-19 is characterized by rapid transmission and can occur by close contact with an infected person. Covid-19 can spread through human-to-human transmission and indirect contact with contaminated objects. Covid-19 can be transmitted through body fluid droplets from the mouth or nose, which can spread when a person with Covid-19 coughs, sneezes, and talks. Droplets typically cannot transverse more than six feet. The details on the disease are evolving. The main symptoms of Covid-19 have been identified as fever, dry cough, fatigue, myalgia, shortness of breath, and dyspnea.

At present, the Covid-19 pandemic is getting worse, especially in Thailand. There is no specific antiviral treatment whose safety and effectiveness for treat Covid-19(3) The coronavirus infectious cases are still increasing and continued to cause an adverse health effects and economic tragedy to millions of people. So far, the disease is characterized by high morbidity and mortality rates. The shutting down of social activities throughout the world to mitigate the spread of the pandemic has led to a lockdown, causing a downturn and economic fall due to a break in the supply chain. Making people in society must adapt to survive and prevent disease.

As a result of the Covid-19 epidemic affected all over the world including Thailand, the first Covid-19 case in Thailand was found in Bangkok. Currently, Bangkok has the highest number of Covid-19 cases. Therefore, the researcher wanted to know the preventive measure of Covid-19 among Bangkok residents. by the survey also and researcher hope this result can better prepare the government to address future health crises involving infectious diseases. The results of this study are important to focus on societal enthusiasm to comply with pandemic control measures.

METHODS

This preliminary study design was a cross-sectional study. The study area was conducted in Bangkok because the first Covid-19 case in Thailand was found in Bangkok. And currently, Bangkok has the highest number of Covid-19 cases. The participants of this study were focused on both Thai male and female who live in Bangkok and had inclusion criteria; aged 20 – 60 years old, live in in Bangkok at least 6 months (since Covid-19 spread to Thailand), can read/write/communicate in Thai. On the other hand, the exclusion criteria were people who have neurological and memory loss problem was excluded because it affected memory and thought processing for answered questionnaires. The is a preliminary research and survey for 100 subjects of Bangkok residents by convenience sampling method in September to October 2020.

The self-administered questionnaire consisted of two parts: part 1 general characteristics and part 2 prevention measure of Covid-19. The detail of preventive measure toward Covid-19 virus disease means activities and actions related to prevention Covid-19 disease such as avoid crowded areas, wearing mask, wash hand, eat freshly cooked food, separate and clean personal items, and observe symptoms. The prevention measure of Covid-19 part was developed based on review literature about Covid-19 from World health organization, World health organization in Thailand, Centers for Disease Control and Prevention, Centers for Disease Control and Prevention in Thailand, and European Centre for Disease Prevention and Control.

For data collection, due to the situation of Covid-19 outbreak, some participants inconvenient to responded in a documented way due to exposure concerns. Then the researcher created an online questionnaire.

1. The researcher created the self-administered questionnaire by google form online platform and the first page explained about research objectives, ethics for respondents, screened criteria for respondents, and informed consent. The people had criteria seem inclusion criteria and consented to prove information able to do the self-administered questionnaire. But people who had characteristics same exclusion criteria could not answer the questionnaire, they were received a thank you message and finished the questionnaire.

2. The researcher taught the rules for distributing questionnaires to choose the respondents according to inclusion and exclusion criteria for 6 researcher assistants and sent the link of online self-administered questionnaire 100 subjects.

3. This study had screening questionnaire before sampling the subjects. Research assistants screened the respondent for inclusion and exclusion criteria before gave the link of questions.

4. When the respondents pressed the button to send questionnaires that completed. The next page gave information documents about Covid-19 and the hotline or website to help when the respondents had stress and mental health problems.

For data analysis, SPSS program was used to analyzed descriptive data, focused on frequencies and percentages. Internal consistency of the prevention measures was tested using a reliability test where the Cronbach alpha coefficient aided in determining the reliability of the variables. The results showed that the Cronbach alpha was 0.92. The result added credence where according, the range of Cronbach alpha more than 07 is considered adequate and reliable (4).

RESULTS

The characteristics of preliminary results 100 subjects found that, their average age was 32+7.71 years (ranged 20-60 years). Most of them were female (76%). The education found 48% of subjects was post graduate level. The major of subjects showed their occupation was government officer/state enterprise (33%). The result of study showed that 57% of them had daily life transportation by private car. 76% of the participants did not had symptoms during the Covid- 19 epidemic. And 78% of participants used medical masks during the Covid-19 outbreak. The most of participants around 69% did not isolation from their family during the Covid-19 outbreak (Table 1).

Table 1 General information, total participants **(**N**)** = 100

General information	**Number** (**n**), (%)
Gender	
Male	24 (24%)
Female	76 (76%)
Age	
20 – 30	38 (38%)
31- 40	50 (50%)
41-50	8 (8%)
51-60	4 (4%)
Level of education	
High school	4 (4%)
Certificate level	1 (1%)
Bachelor's degree	47 (47%)
Post Graduate level	48 (48%)

General information	Number (n), (%)
Occupation	
Student	19 (19%)
Government officer / State enterprise	33 (33%)
Merchant	6 (6%)
Employee labor	15 (15%)
Other	27 (27%)
Income / month (during the Covid-19 outbreak)	
No income	39 (39%)
Same normal income.	49 (49%)
Decrease income	1 (1%)
Increased income	11 (11%)
The source of Covid-19 information that you receive.	
Television	70 (70%)
Radio	16 (16%)
Internet / social media	93 (93%)
newspaper	8 (8%)
Health workers	18 (18%)
Family members	30 (30%)
Friends	32 (32%)
Daily life transportation. (Can answer more than 1 question)	
Private car	57 (57%)
Private motorbike	12 (12%)
Motorbike taxi	19 (19%)
Taxi	21 (21%)
Public van	8 (8%)
Mass rapid transit systems (BTS/MRT/ARL)	47 (47%)
Other	3 (3%)
During the Covid-19 outbreak, what kind of mask did you use? (Can answer more than 1 question)	
medical masks	78 (78%)
N 95	18 (18%)
Cloth mask	62 (62%)
Cloth mask, add filters	18 (18%)
Plastic mark	7 (7%)
During the COVID- 19 epidemic, did you have any of the following symptoms (more than one answer)	
No symptoms	76 (76%)
Fever	6 (6%)
dry cough	11 (11%)
Runny nose	12 (12%)
Sore throat	12 (12%)
Headache	13 (13%)
muscle aches	10 (10%)
nausea or vomiting	1 (1%)
Diarrhea	3 (3%)
Are you stop working / taking a break of work during the Covid-19 outbreak?	
Stop	29 (29%)
Do not stop	60 (60%)
Not working	11 (11%)
You isolate yourself from the family during the Covid-19 outbreak.	
Yes	31 (31%)

No	69 (69%)

According to the preventive measure of Covid-19 in Table 2, it was shown that the results of preventive measure of Covid-19. The most of participants (75%) must go to risk areas or any crowded place example the place that have a Covid-19 infected case, the participants live in a crowded area such as a lift, public transportation (BTS, public bus). Most of the participants 71% took antibiotics on their own if they feel sick. 43% of participants always urgently sought medical care when they had symptoms. This study found only 46% of participants cleaned personal appliances such as mobile phones, portable computers, bags, etc. immediately upon return from outside

Health behavior frequency related to the used of masks, the results found that most of the participants (58%) wore a medical mask when going outside and discarded the surgical mask in a closed bin immediately after use (48%). Frequency of health behaviors associated with hand washing, found that most of participants (49%) washed their hands with soap and water at least 20 seconds every time and 45% rubbed their hands with alcohol 70% at least 20 seconds every time. The frequency of healthy behaviors related to eating, found that 49% of subjects ate freshly cooked food regularly, also 45% always used a private spoon (Table 2).

Table 2 Preventive measure level of Covid-19, total participants **(**N**) =** 100

Question	**Number** (**total subject** = 100)			
	Never,	**Sometimes,**	**Often,**	**Always**
1. You go to risk areas or any crowded place.	25 (25%)	56 (56%)	12 (12%)	7 (7%)
2. When you have a fever, you take antibiotics by your own.	29 (29%)	34 (34%)	22 (22%)	15 (15%)
3. You urgently seek a medical care when you have fever, cough and difficulty breathing	8 (8%)	23 (23%)	26 (26%)	43 (43%)
4. You clean your personal appliances such as mobile phones, portable computers, bags, etc. immediately upon returning from outside.	4 (4%)	20 (20%)	30 (30%)	46 (46%)
5. You wear a medical mask when go outside.	11 (11%)	13 (13%)	18 (18%)	58 (58%)
6. You discard the medical mask in a closed bin immediately after use.	10 (10%)	17 (17%)	25 (25%)	48 (48%)
7. You wash your hands with soap and water at least 20 seconds every time.	4 (4%)	15 (15%)	32 (32%)	49 (49%)
8. You rub your hands with alcohol 70% at least 20 seconds every time.	8 (8%)	18 (18%)	29 (29%)	45 (45%)
9. You eat freshly cooked food	5 (5%)	23 (23%)	23 (23%)	49 (49%)
10. You use a private spoon.	5 (5%)	16 (16%)	34 (34%)	45 (45%)

DISCUSSION

The result found that the major of subjects (93%) received the information about Covid-19 through the internet (social media), similarly with the study in China (5) presented that social media was the popular channel for receiving Covid-19 news. At present, there exists a vast array of information including, unverified malicious information on social media and these can spread quickly and can misinform many people (6). The majority reported visit crowded places 70% contrasts with the advice from CDC to avoid crowds and poorly ventilated spaces (7). the result shown respondents wore medical masks every time only 58%. This contrasts with the study of Chen Y shown the Chinese put on a mask when went out 97.4%(8) and contrary to another study, 76% did not wear face masks when they left their home (9)

may be most of the participants in this study were a working-age had to go to work or study then made they must live in the crowded area. And the result of this study washed hands with soap and water at least 20 seconds every time only 49% and rub your hands with alcohol 70% at least 20 seconds every time only 45% contrasts with other studies, most of the participants washed their hands 73.08%(10), 49.5% sanitized their hands with alcohol-based sanitizers(11) the results of this study do not follow the advice from CDC to scrub your hands for at least 20 seconds for prevent the spread of germs during the Covid19 pandemic (12). This may be caused by people's lack of knowledge or awareness of having to wash their hands properly every time. The result of this study showed the respondent took antibiotics by own 71% contrasts with the WHO recommends against antibiotic therapy and widespread use of antibiotics should be discouraged, as their use may lead to higher bacterial resistance rates, which will impact the burden of disease and deaths in a population during the Covid-19 pandemic and beyond (13). Most of the participants in this study always urgently seek medical care when they had symptoms only 43 % contrasts with other studies, 96% seek medical advice if they experience any symptoms of Covid-19 disease (14) and do not follow the advice from CDC to seek healthcare provider and local health department immediately when you had any sign of Covid-19 (15). The strengths of this study were a new topic and updated research. The limitation of this study was the epidemic situation made it difficult to collect data then made this study had the least sample and use convenient random.

CONCLUSION

In summary, the finding of this study was found: 1) the participants went to risk areas or any crowded place 75% because most of participants were a working age had to go to work or study. 2) they took antibiotics by own 71% 3) the participants always urgently sought a medical care when they had symptoms only 43%. 4) Most of the participants wear mask when they went outside 58 percent and washed hands with soap and water at least 20 seconds every time 49%. 5)Most participants ate freshly cooked food regularly 49% and 45% used a private spoon. This study concluded that the participants had inappropriate preventive measure of Covid-19, such as being in crowded places, improper hands washing, and incorrect wearing a mask.

RECOMMENDATIONS

1. The further study should be larger-scale surveys to represent the population.
2. The public health staff should give a recommendation for the correct preventive measures and keep social distancing measures during the Covid-19 outbreak.

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ASSESSMENT OF KNOWLEDGE, ATTITUDE AND USAGE ON PERSONAL PROTECTIVE EQUIPMENT AMONG MECHANICAL MAINTENANCE WORKERS OF A POWER GENERATION UNIT IN THAILAND

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ABSTRACT

A Power Generation Unit has duty of electric power supply to the people by producing and distributing electric power. The mechanical maintenance department is one part of their responsibility to achieve the target. However, 207 accident cases were reported during 2012 to 2019. The main causes were found to be unsafe act and unsafe condition including improper usage and lack of personal protective equipment (PPEs). Thus, knowledge, attitude regarding to PPEs, its usage, and factors related to PPEs usage of mechanical maintenance workers need to be assessed. This survey study collected data through self-response questionnaire from 379 mechanical maintenance workers of a power generation unit in Thailand. The average age of the workers is 42 years. Most of workers are man and 80.7% have a position as technician. Most of them have ever passed safety training before starting working which wearing PPEs was a part of safety training. Half of workers got injury from accident while working. The results reveal that 43.3%, 54.6%, and 2.1% of the workers possess level of knowledge at high, moderate, and low respectively. Only 20.8% showed high level of attitude on PPE usage. Moreover, 77% of them did not regularly use recommended PPEs while working, among these, 60% of them did not use regular PPEs and a few used particular PPEs. The association between attitude and practice was significantly low positive correlation. Besides, attitude also associated with knowledge. No association between knowledge and practice was found. Related factors can effect to usage PPEs (p-value<0.05); i.e., position, department, education, times of safety training, injury's history, and attitude. The results of the study suggested that policy and program is necessary enhance the awareness of the benefit of wearing PPEs and training should be introduced for workers in Thailand. The further study should be conducted to investigate the reason behind cause of non-use PPEs during working.

Keywords: Personal Protective Equipment (PPE), knowledge, attitude, PPEs usage, mechanical maintenance workers, accident

INTRODUCTION

Hazards exist in every workplace in different forms such as sharp edges, falling objects, sparking up, and a lot of other possibility dangerous situations. The Occupational Safety and Health Administration (OSHA) requires that employers protect their employees from workplace hazards that can cause injury. The best way to control hazard should be control its source to protect employees. It depends on working's hazard or workplace condition, OSHA recommends the use of engineering or work practice controls to manage or eliminate hazards to the greatest extent possible (1). Personal protective equipment, commonly referred to "PPE", is equipment worn to minimize exposure to a variety of hazards. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (earplugs, muffs) hard hats, respirators and full body suits (1).

An employer shall provide for and control an employee to wear standard personal protective equipment as stipulated by the Director-General. The employee is obligated to wear personal protective equipment, in good condition as working condition and nature throughout the working period. Whereas the employee does not wear such equipment, the employer shall order the employee to cease working until the employee wears such equipment (2).

A Power Generation Unit has duty of electric power supply to the people by producing and distributing electric power. The mechanical maintenance department is one part of their responsibility to achieve the target of electricity generating. Its workforce has to work under hazardous environment into incidents that are divided to accident and near miss following Occupational Safety and Health Administration.

Although there are regulations to control accident such local safety rule, safety policy including providing appropriate personal protective equipment to fit their work, their working still occur accident that leads to direct losing (medical fee, life insurance or compensation) and indirect losing (wasting time for working, repairing expenses for machinery, tools and equipment that have been damaged, losing of reputation and image of organization or any welfare any of the injured workers) (3). The total of cumulative accidents from 2012 to 2019 were 207 cases, that data was presented as accidents into loss of personnel and loss of property. Even though there were less accident cases over half from 2012 to 2019, the number of accidents is still stable.

All reported incidents were investigated by the investigation team to find corrective and preventive action of working and prevent the occurring the same case of accident. The incident report will be in accident analysis process and the main causes of accident were found to be unsafe act and unsafe condition including working on wrong procedure, improper usage of PPE, lack of personal protective equipment, and lack of attention during working. Many studies showed that decision of PPE usage depend on individual determinants such as hazard perception (4), attitude about using PPEs while working (5), and perception on benefit of using PPEs (4,6).

Most of KAP data are collected by using questionnaire. KAP study can identify knowledge gap, cultural beliefs or behavior pattern that may facilitate understanding and action. They can identify information that is common known and common attitude. Also can identify factors influencing practicing that are not known in most of people, reasons for their attitude and why and how people practice PPEs. According to there are few studies about PPEs usage and the relationship of knowledge, attitude including individual determinants that affecting on PPEs usage in Thailand, especially in industry as a power plant. Thus, this research aims to study about knowledge regarding to PPEs, attitude and usage of PPEs among mechanical maintenance of a power generation unit in Thailand. The results will be used to develop safety working awareness for workers and to improve mechanical maintenance working to become an effective work without accident in the future.

METHODS

Study design

A cross-sectional design was used to determine the levels of mechanical maintenance workers' knowledge, attitude and their usage of PPEs and also find out associations between them.

Target population

The mechanical maintenance workers in a power generation unit, Nonthaburi province, Thailand were study population. These workers are in the duty of analysis, planning of problems, maintenance, improvement, demolition and mechanical equipment installation of all types of power plants i.e., thermal, combined thermal, renewable energy, and diesel power plant.

A manpower of mechanical maintenance workers are 624 working in four departments and one central agency performing administrative work of this power generation unit.

Sample size

The sample size was calculated from Wayne's formula for finite population (7) where the absolute precision required at 5% to get sample size with a 95% confidence interval (CI). The standard deviation set at 0.76 according to the knowledge, attitude, and practice among workers in small scale industries (8). Thus sample size of the mechanical maintenance workers was 367.

Sampling techniques

Due to no accident reported from the central agency and planning department, participants were selected by simple random sampling from three departments i.e., boiler maintenance, gas turbine and diesel, and steam turbine department. Participants who have been working at maintenance plant, are not on leave, and willing to participate the study were enrolled to the study.

Measurement

The data were collected by a structured questionnaire. There were five parts of questionnaire ;

Part 1 was socio-demographic factors including age, gender, education level, marital status, department and working's years.

Part 2 was about safety training, time average of safety training, type of work, length of working, incident and accident's history including social support factors.

Part 3 was the knowledge of understanding of PPEs usage and understanding in accidents term including matching type of PPEs and hazard and also concern effect occupational health and safety. Each item was prepared as part of a standard answer (Yes, No, or Don't Know) and score ranged from 0–15. Knowledge level had was classified into 3 levels as Bloom cut-off point (9). The 12-15 scores between 12-15 were classified as high level, 9-11 scores were classified as moderate level and 0-8 scores were classified as low level.

Part 4 was the attitude of usage personal protective equipment and hazardous in work condition, which included both positive (the score ranged from 0 (strongly disagree) to 4 (strongly agree) and negative statements (ranged from 0 (strongly agree) to 4 (strongly disagree) (10). The total scores variesd from 0 to 60. The scores has been classified into 3 levels, as high, moderate, and low when the scores were ≥58, 45-57, and ≤44, respectively.

Part 5 was related to the frequency of personal protective equipment usage while working mechanical maintenance. There were 11 items based on 3 scale ranging from 3 (Always), 2 (Sometimes), 1 (Never). The score varied from 3 to 33. The score was classified into 3 levels, scores ≥31 were classified as high usage, 25-30 scores as moderate usage and ≤24 scores as low usage.

Validity and reliability test of instruments

The Index of Item-Objective Congruence (IOC) was conductetd to test the content validity of the questionnaire. The reliability testing of questionnaire was carried out with 40 workers and tested the internal consistency reliability of knowledge part using Kuder-Richardson 20 and Cronbach's Alpha was used to test for attitude part. The reliability testing of questionnaire was 0.68.

Data collection

The data was collected through self-response questionnaire during February to March 2021. The eligible workers were approached and informed all processes of the study including the objectives, risks and benefits,

confidentiality of the data. Finally, the workers were asked for their consent. The participation was voluntary basis. The respondents were allowed to answer the questionnaire at their home. The completed questionnaires were sent back in a sealed envelope after 1-2 days. The completeness and correctness of the questionnaires were checked.

Ethical considerations

The study protocol was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University. The certificate of ethical approval number is 008/2564.

Data analysis

The data were analyzed with computer software SPSS version 22. The descriptive statistic used to describe for frequency, percentage, mean and standard deviation. Pearson chi-square used to describe association between socio-demographic, level of knowledge, attitude and usage. Spearman also used to find the correlation between knowledge, attitude, and practice score.

RESULTS

The complete questionnaires were responded by 379 workers. The respondents were from boiler department (153 workers, 38.4%), steam turbine (110 workers, 27.6%) and gas turbine and diesel department (116 workers, 29.1%).

The most gender of respondents was male (95.8%). The average age was 42.5 years with standard deviation 10.6. The majority of age range was 51-60 years (32.5%). The majority of respondent's position was technician (80.7%) and only 8.2% was engineer. For working's duration of respondent, the average was 14.9 years. Nearly half of workers (49.3%) work in their position less than or equal 10 years. The majority of respondents graduated from higher vocational certificate (63.6%) and only 1.1% graduated from Master Degree and higher. For marital status, majority of them were married (66.5%) (Table 1)

Table 1 Socio-demographic characteristics of the participants (n = 379)

Characteristics	Number	Percent
Gender		
male	363	95.8
female	16	4.2
Age (years)		
20-30	69	18.2
31-40	121	31.9
41-50	66	17.4
51-60	123	32.5
Mean ± SD = 42.5±10.6, Range = 23-60		
Position		
Technician	306	80.7
Expert Technician	42	11.1
Engineer	31	8.2
Duration of working (years)		
≤10	187	49.3
11-20	69	18.2
21-30	92	24.3
31-40	31	8.2
Mean ± SD = 14.9 ± 11, Range = 1-40		

Characteristics	Number	Percent
Education level		
Vocational Certificate	60	15.8
Higher Vocational Certificate	241	63.6
Bachelor Degree	74	19.5
Master Degree and higher	4	1.1
Marital status		
Single	108	28.5
Married	252	66.5
Divorced	16	4.2
Widowed	3	0.8

The majority of respondents (99.5%) in this study passed safety training before starting work. The result showed that safety training course consists of wearing PPEs information (97.1%). The workers attended the safety training at average 6 times. The average working hours per day was 8.62. For type of jobs that the respondents worked for last 6 months, most of them worked with tools, equipment and machinery (83.4%). Over half of the respondents had injured because of accident. However, they had not been in serious condition, thus majority of them did not get any medical treatment (48.0%) or got only first aid (34.0%) (Table 2). The respondents got encouragement from their co-worker for usage PPEs (77.6%). Most of respondent had seen their co-workers use PPEs while working (97.1%) as shown in Table 2.

Table 2 Work experience and social support of the participants (n = 379)

Characteristics	Number	Percent
You have ever passed safety training	377	99.5
Time average of safety training that you pass per year (times)		
≤5	183	48.3
6-10	177	46.7
≥11	19	5.0
Mean ± SD = 6 ± 3.2, Range = 0-20		
Personal protective equipment training	368	97.1
Type of works done (multiple response)		
Working with tools, equipment and machinery	316	83.4
Working in confined spaces	283	74.7
Working at high altitude and scaffolding	301	79.4
Working manual material handling	283	74.7
Working with mobile cranes and cranes	210	55.4
Working sparking operations or hot work	279	73.6
Working in workshop	289	76.3
Others	13	3.4
Length of working hour(s) per day		
≤10	363	95.8
11-20	16	4.2
Mean ± SD = 8.62 ± 1.76, Range = 1-18		
Experience in getting injured from accidents	196	51.7
You have ever been involved incidents during work	192	50.7

Characteristics	Number	Percent
Treatment after getting injured		
Got first aid at the workplace	129	34.0
Went to the hospital	45	11.9
Got first aid then went to the hospital	23	6.1
None	182	48.0
Encouragement from co-workers in using PPEs	294	77.6
You have ever seen your co-worker wearing PPEs while working	368	97.1

Table 3 showed the knowledge and attitude level regarding PPEs and its usage. In term of knowledge, more than half of the workers possessed moderate level of knowledge, 43.3% were at high level, while only few possessed knowledge at low level. For attitude, 61.8% of the workers had a moderate attitude and nearly the same percentage of them had high (20.8%) and low (17.4%) level. Majority of workers (64.1%) use the PPEs at the moderate level.

Table 3 The levels of knowledge and attitude regarding PPEs and its usage of workers (n=379)

Variables	Number	Percent
Knowledge level		
High	164	43.3
Moderate	207	54.6
Low	8	2.1
Minimum = 6 Maximum = 15 Median = 11 Mean ± SD = 11.23 ± 1.24		
Attitude level		
High	79	20.8
Moderate	234	61.8
Low	66	17.4
Minimum =30 Maximum = 60 Median = 53 Mean ± SD = 51.4 ± 6.5		
Usage level		
High	86	22.7
Moderate	243	64.1
Low	50	13.2
Minimum = 12 Maximum = 33 Median = 28 Mean ± SD = 27.7 ± 3.3		

Pearson chi-square analysis was used to determine the association between worker's socio-demographic characteristics, work experience and social support and usage. The high usage group was defined as "use" while the moderate usage and low usage group were combined and defined as "non-use" before analysis. The analysis revealed that position, department, education level, times of safety training attending and experiences in getting injured from accidents were found significantly associated with PPEs usage (Table 4 and 5).

Table 4 Association among worker's socio-demographic characteristics with PPEs usage (n = 379)

Factors	PPEs Usage			
	Use n **(%)**	Non-used n **(%)**	χ^2	p-value
Socio-demographic				
Gender			0.148**	1.000*
Male	83(22.9)	280(77.1)		
Female	3(18.8)	13 (81.2)		
Age (years)			3.040	0.386
20-30	15(21.7)	54(78.3)		
31-40	31(25.6)	90(74.4)		
41-50	18(27.3)	48(72.7)		
51-60	22(17.9)	101(82.1)		
Position			9.940	0.007*
Technician	60(19.6)	246(80.4)		
Expert Technician	17(40.5)	25 (59.5)		
Engineer	9(2.0)	22(71.0)		
Duration of working				
≤10	36(19.3)	151(80.7)		
11-20	20(29.0)	49(71)		
Department			14.080	*
Boiler	48(31.4)	105(68.6)		
Steam Turbine	24(21.8)	86(78.2)		
Gas Turbine and Diesel	14(12.1)	102(87.9)		
Education level			8.970	*
Vocational Certificate	21(35.0)	39(65.0)		
Higher Vocational Certificate	51(21.2)	190(78.8)		
Bachelor Degree	12(16.2)	62(83.8)		
Master Degree and higher	2(50.0)	2(50.0)		
Marital status			2.530	0.471
Single	20(18.5)	88(81.5)		
Married	62(24.6)	190(75.4)		
Divorced	4(25.0)	12(75.0)		
Widowed	0(0)	3(100)		

‡Fisher' exact test , p-value based on Chi-square test; *p- value < 0.05

Table 5 Association among worker's work experience and social support with PPEs usage (n = 379)

Factors	**PPEs Usage**			
	Use n (%)	**Non-used n** (%)	χ^2	**p-value**
Work Experience				
You have ever passed safety training			0.590**	1.000*
Yes	86(22.8)	291(77.2)		
No	0(0)	2(100)		
Time average of safety training that you pass per year (times)			6.320	0.040*
≤5	34(18.6)	149(81.4)		
6-10	44(24.9)	133(75.1)		
≥11	8(42.1)	11(57.9)		

Factors	PPEs Usage			
	Use n (%)	Non-used n (%)	χ^2	p-value
Personal protective equipment training			**3.325****	**0.078**
Yes	86(22.8)	291(77.2)		
No	0(0)	2(100)		
Length of working hour(s) per day			0.051**	0.766
≤10	82(22.6)	281(77.4)		
11-20	4(25.0)	12(75.0)		
Experiences in getting injured from accidents			4.330	0.038*
Yes	36(18.4)	160(81.6)		
No	50(27.3)	133(72.7)		
You have ever been involved incidents during work			2.595	0.107
Yes	37(19.3)	155(80.7)		
No	49(26.2)	138(73.8)		
Treatment after getting injured			4.970	0.174
Got first aid at the workplace	21(16.3)	108(83.7)		
Went to the hospital	11(24.4)	34(75.6)		
Got first aid then went to the hospital	5(21.7)	18(78.3)		
None	49(26.9)	133(73.1)		
Social support				
Encouragement from co-workers in using PPEs			0.934	0.334
Yes	70(23.8)	224(76.2)		
No	16(18.8)	69(81.2)		
You have ever seen your co-worker wearing PPEs while working			0.136**	0.718
Yes	83(22.6)	285(77.4)		
No	3(27.3)	8(72.7)		

‡Fisher' exact test , p-value based on Chi-square test, *p- value < 0.05

Knowledge regarding on PPEs was not significantly correlated with usage personal protective equipment. In contrast, attitude towards on PPEs showed little significant correlation with usage personal protective equipment. Knowledge also had a statistically significant correlation with attitude on usage PPEs (Spearman's rho, p-value <0.01) (Table 6).

Table 6 Correlation between knowledge, attitude scores, and usage PPEs

Variable	Usage PPEs		Knowledge	
	Spearman's rho	*p*-value	Spearman's rho	*p*-value
Knowledge	0.089	0.083	-	-
Attitude	0.184	<0.001*	0.185	<0.001*

*Correlation was significant at $p < 0.01$

DISCUSSION

Out of 379 participants, 207 (54.6 %) had moderate knowledge level, 164 (43.3%) had high knowledge level and only 8 (2.1%) had low level knowledge level. Around 62% of workers (234) had moderate attitude level, 79 (20.8%) had high attitude and 66 (17.4%) had low attitude on understanding of mechanical maintenance workers on the hazard in mechanical maintenance work and their health effects, types of personal protective equipment used in different conditions of maintenance work and the importance of using PPEs. Nearly 65% (243, 64.1% had moderate totally usage on personal protective equipment, 86 (22.7%) had high usage level and 50 (13.2%) had low usage. The high usage group was defined as "use" while the moderate usage and low usage group were combined and defined as "non-use."

Many factors including gender, age, marital status, level of education and work experience related to assess occupational hazards and usage of PPEs(11).This was inconsistent with the findings of this study only education level associated with usage of PPEs. Previous study in many countries showed that workers (>70%) had never been trained on PPE's training and any safety training (12) and only 42% received safety training in installation/repair/maintenance industry (13). This was not in line with this study. Almost all of the workers received safety training which the personal protective equipment was included in the training and an average training time of worker received was 6 times, these could not promote the properly use of PPEs among the mechanical maintenance workers and raise their awareness of protecting the hazardous event from work by using PPEs. The findings also reveal the knowledge and attitude level of the workers which majority were at moderate level. Moreover, the training cannot persuade worker to wear PPEs even they attended more than 11 times. Thus, the training course should be evaluated or revised by the authority to make it effective. It may involve training process, matter presentation or efficiency of each training. Training sessions regarding the use of PPE should be arranged on a regular basis and add example of serious accident case to point out various losses as consequence of accidents. Besides, many barriers that important in terms of whether or not the PPEs would stay on properly and provide the appropriate protection such as style of PPEs including proper and fit style, availability and accessibility(13) should be explored.

This study also showed the relationships between work position, department of the workers and PPEs usage. Among three positions; technician, expert technician, and engineer, the technician had lowest rate of PPEs usage. This may be caused by improvidence because technician was group who work most in the power plant so they have deftness on own job then they may work without own hazard prevention. In term of the department the worker working for, the workers working maintenance for the gas turbine and diesel use PPEs in the lowest rate when comparing with boiler and steam turbine departments. This may result from difference of job description, administration of each department and personal safety mind. For experience in getting injured, more than 80% who had experiences that categorized to non-used PPEs group. However, only 18% of injured cases referred to the hospital which may imply that low incidence of serious injured occurred so that the workers overlook the necessity of using PPEs.

There is no correlation between knowledge of PPEs and practice of using PPEs. This contrast with another study in Thailand(14), a little positive correlation with practice PPEs was reported. Other previous studies found that respondents who had poor knowledge, they cannot effectively use PPEs during working (8,15). Even no correlation has been found between knowledge and usage of PPEs but it has a little positive correlation with attitude and the attitude then links to the practice of using PPEs

among the workers. The main barrier of decision on wearing protection was their perception of risk of an injury at workplace(13). Appropriate attitude was related to prevalence of using PPE(14,15). Around one-fifth (20.8%) of the workers had high attitude on using PPEs. It seems that worker did not recognize proper of PPEs as expected. Attitude of the workers on using PPEs needs to be improved. Although decision of an individual is one of the main determinants of PPEs usage, many others can still affect usage as well such as unclear hazard identification and risk assessment, insufficient communication between workers, incomplete work instruction following job description or poor risk control measure. To build a good safety conscience, strong monitoring and evaluation need to be introduced to ensure the proper practice of PPE. Appropriate measures should be taken at the policy level to ensure adequate prevention and increased control measures.

CONCLUSION

Usage of PPEs is helpful to improve occupational health and safety among of workers. Even the workers knew about type, importance and hazard perception and effect to health and safety from usage PPEs well but they decide to not use it. In addition, based on personal opinion, they do not realize the hazard then they work without wearing PPEs. Worker' perform on PPEs use only gathered from the self-administrative questionnaire but they were not observed their performing at the work place, it might not be true practice. The bias of answered should also be recognized because the workers may not answer the truth.

RECOMMENDATIONS

This study is only considered as the first step to explore the knowledge, attitudes and practices of workers on occupational safety in an electricity supply unit. From there, further studies are needed to find out the actual causes of omission PPEs use, so that appropriate adjustments and policies will be made to reduce occupational accidents of workers.

Policy and program are necessary to enhance the awareness of the benefit of wearing PPEs and promote positive attitude of the workers especially targeted on workers who have to work on site. Organization should revise hazard identification, risk assessment and preventive control measures, increase communication tool box meeting activity between foreman for recognize risk or hazardous before starting work , adjust work instruction to cover each step of working and increase clearly safety quality checklist in work instruction and provide proper tool and PPEs to fit work condition and nature of work.

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HEAVY METALS EXPOSURE FROM CASSAVA FARMS LOCATED IN ABANDONED TIN MINES AT ONG PHRA SUB-DISTRICT, THAILAND

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ABSTRACT

Heavy metal contamination is one of the major environmental concerns as its toxicity can cause significant adverse health effects to humans. Abandoned tin mines are considered contaminated sites. Eating crops cultivated in these areas can cause heavy metals exposure. This study investigated the heavy metal contamination in soil and cassava cultivated in the abandoned tin mine in Ong Phra Sub-district, Dan Chang District, Suphan Buri Province, Thailand. This study measured the concentration of As, Mn, Pb, Fe, Cu, Cd, Ni, Zn Cr, and Hg in cassavas as well as in surface soil located in cassava farms. The total 10 sample points, five soils and five cassavas, were distributed in different zones, including upstream, old mining, and downstream zones. The soil samples were analyzed using the X-ray fluorescence (XRF) technique, while the cassava samples were digested and then analyzed using an inductively coupled plasma spectrometer. The results revealed that the average arsenic contamination in soil was 48.64 ±66.06 mg/kg (ranged ND to 151.78 mg/kg), and cassava was74.622±90.300 µg/kg (ranged ND to 229.637µg/kg), the maximum was found in excess of the recommended levels in both soil and cassava. The average concentration in mg/kg of Mn, Pb, Fe, Cu, Cd, Ni, Zn Cr and Hg in soil were 464.04±253.72 (159.98-847.53), 1.35±2.80 (ND-18.92), 19,498.07±24,926.10 (4,572.71-62,631.00), 49.62±8.96 (40.80-62.66), ND, 5.03±7.00 (ND-17.16), 22.46±15.03 (7.09-38.94), 31.49±19.32 (1.00-51.95) and ND, respectively. The heavy metals in soil and cassava samples exceeded the safety values. Heavy metal exposure from cassava can cause adverse health effects to humans in the future by bioaccumulation. This study can be the guideline for health risk assessment related to heavy metals contamination in cassava farms, to prevent risk related to crops consumption from abandoned mine areas.

Keywords: Heavy metal, Tin mine, Soil, Cassava, Arsenic

INTRODUCTION

Heavy metal contamination spreading worldwide is a major environmental problem which can cause serious health risks to human (1, 2). Heavy metals are not only naturally occurring elements (3) but also originate from anthropogenic sources, such as mining and smelting operations. The release of heavy metals from mining occurs from the exploration stage to the closure stage of mine's operation (4). In Thailand, Ong Phra Sub-district, Dan Chang District, Suphanburi province is one of the contaminated sites affected from abandoned tin mines reported from many researchers. In 2009, water samples were collected to determine the As concentration. The results shown that As concentration varied from 0.023 – 0.748 mg/L and 80% of the water samples exceeded the WHO's drinking water standards (50 µg/L) (5). In 2011, the study on identification of distribution, sources and health effect related with arsenic contamination in these areas was conducted. The As concentration in water ranging from 0.019 to 9.965 mg/L shown that the source of As in river basins might cause from the mining sludge depositing in many mine tailing ponds located in upstream area, which might dissolve and disperse through downstream area (6). The results from other study revealed that the As contamination in soil ranged from 4.80 to 1,070.40 mg/kg, while the detected highest concentrations of As in groundwater were 14 µg/L in dry season and 9 µg/L in wet season (7). The range of As concentrations of the mentioned studies in different environmental medium are in Table 1.

Table 1 As contamination in environment related to the abandoned tin mines, Thailand.

Environmental medium	The lowest As concentration	The highest As concentration	Environmental standard for As content
Soil*	4.8 mg/kg	1,070.4 mg/kg	3.9 mg/kg (8)
Groundwater*	< 1 µg/L	14 µg/L	10 µg/L (9)
Surface water**	0.019 mg/L	9.965 mg/L	0.01 mg/L (10)
Surface water***	0.023 µg/L	0.748 µg/L	0.01 mg/L (10)

*: Tiankao and Chotpantarat (7), **: Charernsri (6), ***: Pansamut and Wattayakorn (5)

Even though the tin mines in Ong Phra Sub-district were closed and abandoned in the last 20-30 years, these areas are still contaminated with As in various environmental media including soil, groundwater and surface water as reported in many studies. Thai regulation regarding types and specifications of projects or businesses, which require an environment impact assessment (EIA) including principles, procedures, practices and guidelines of making an EIA report under the Notification of Natural Resources and Environment Ministry, announced in 2012. The notification states that the EIA report is required for mining defined by the Mineral Act. Since the tin mines were closed prior 2012, it can be anticipated that the waste residues from the abandoned tin mines in this area were leaved without any control measures complying with EIA. Since bioaccumulation of heavy metals can cause any adverse effects to human health, heavy metal transferring in food chain to human is other concerning point. For this reason, risk assessment related with heavy metal concentration in edible crops in this area should be carried out in order to evaluate the bioaccumulation levels. Because of the limited information regarding the study on accumulation of metals in foodstuffs effected from abandoned tin mines and potential health risk to humans through consumption, this study was therefore conducted to investigate the heavy metal contamination in soil and cassava cultivated in the contaminated soil. In addition, it should be further evaluated the potential human health risks of toxic metal exposure through consumption of cassava. Based on the results of health risk assessment from this study, it could provide support for policy makers to carry out a further risk reduction plan and an effective management in the contaminated areas.

METHODS

This study was carried out in the areas surrounding the abandoned tin mines covering the area around 3, 500 Rai or 5,600,000 m2 in Ong Phra Sub-district ,which

is one of the seven sub-districts in Dan Chang District of Suphan Buri Province located at a latitude of 14o 0' 30" N and longitude of 99o 41' 50" W as shown in Figure 1 (5). The old tin mines are approximately 80 km west of Dan Chang District (7), and are surrounded with many communities, such as Ban Ngong Ma Khua Keun, Ban Kok Chang, Ban Nam Tok Sai Thong, and Ban Thung Makok (6).

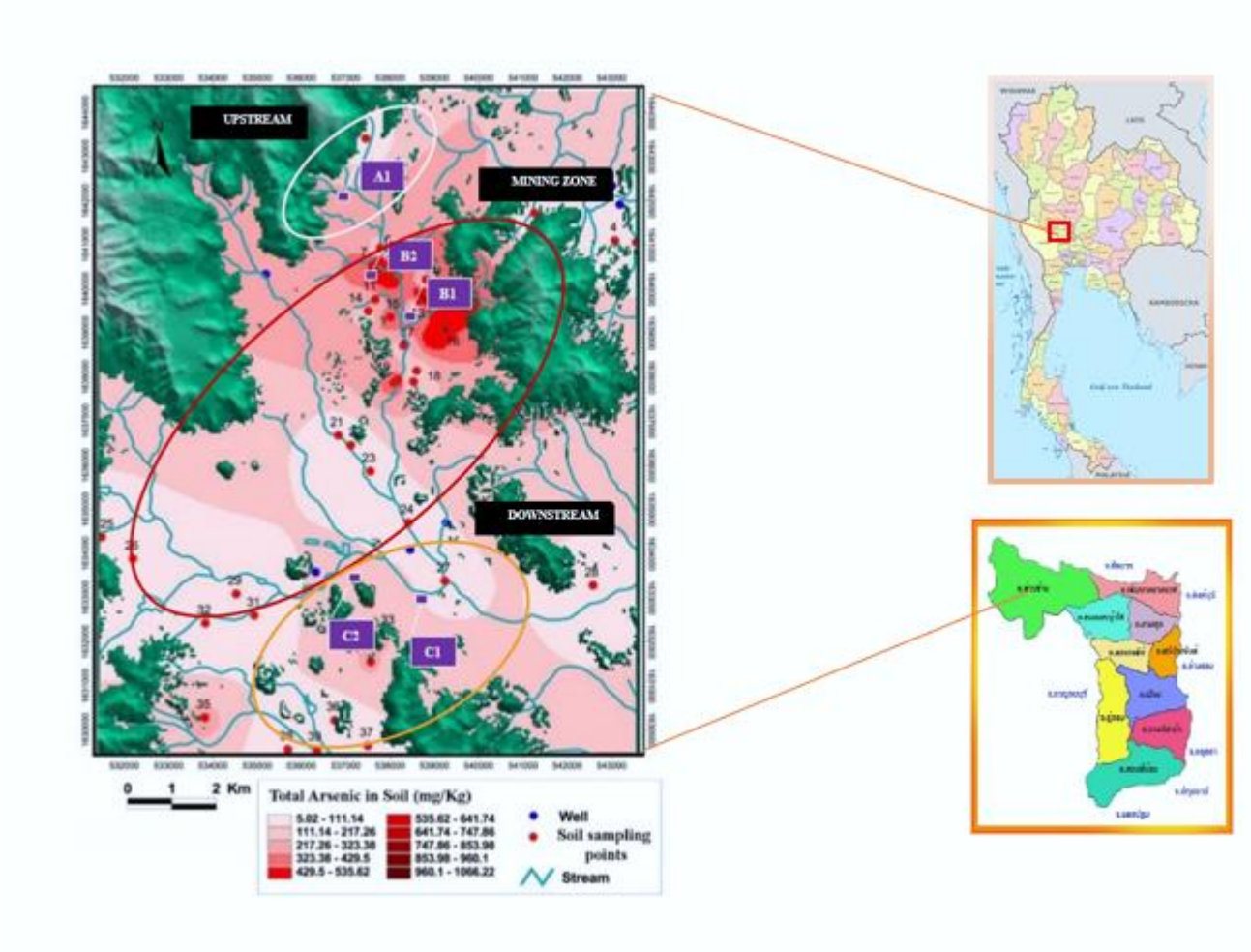

Figure 1 Sampling points of soil and cassava of this preliminary study related with the distribution of As concentration in soil adapted from Tiankao (11) .

The total ten sample points of soil and cassava were distributed in different zones as illustrated in Figure 1 including 1) one sample of soil and one sample of cassava in upstream zone, which has low- impact from former mining activities (A1: 536984 E, 1642026N), 2) two samples of soil and two samples of cassava in old mining zone, which has high impacts from former mining activities (B1: 538447.E, 1639396N; B2: 537540E, 1640285N), and 3) two samples of soil and two samples of cassava in downstream zone, which may affect from heavy metal migration (C1 : 538948E, 1633003N; C2 : 537229E, 1632389N). Soil and cassava were collected in the same sampling point for each sample and analyzed the concentration of ten interested heavy metals (As, Mn, Pb, Fe, Cu, Cd, Ni, Zn, Cr and Hg). The zigzag pattern was used for collecting one composite sample of around 1 kg of soil (12). Then, the around 500 g of homogenized samples by using the coning and quartering procedure (13) were kept in plastic bag before analysis by applying the ex-situ X-ray fluorescence (XRF) technique. The open-air sun dried soil samples were homogenized and sieved at 125 μm particle size. The around 10 g of each prepared sample was put on the cell container covered its bottom with film and analyzed at the Pollution Control Department (PCD) by using EDX-7000/8000 energy dispersive X-ray fluorescence spectrometer having as excitation source of a maximum 50 kV X-ray tube. The collected cassava tubers were washed with clean water to remove soil and dirt. The grinded cassava samples were weighted for 1 g and put in microwave digestion vessels. The 70% concentrated nitric acid (HNO3) solution and

70% concentrated hydrogen peroxide (H2O2) were added in each vessel for the simultaneous extraction of a large. The digested solution samples were transported into 50 ml volumetric flasks and cooled down to room temperature. They were brought to volume with deionized water and mixed fully prior analysis by using ICP-MS/ICP-OES depending on their concentration. The heavy metals in soils and cassavas showing high concentration above the environmental standards were considered as the concerned heavy metals for the further study focusing on health risk assessment affected from heavy metal contamination in the areas surrounding the abandoned tin mines.

RESULTS

The concentration of the ten heavy metals from the triplicate soil samples and cassava samples analyzed by XRF and ICP-MS/ICP-OES, respectively are shown in Table 2. The results revealed that the As concentration in soil located in old mining and downstream areas were above the Thailand Soil Quality Standard and Canadian Soil Quality Guideline of 3.9 and 12 mg/kg, respectively, while the concentration of the other heavy metals didn't exceed the recommended levels. In connection with the investigation of heavy metal in cassava, the exceeding concentration levels of Pb and As compared with permissible limit of metal in cassava of 0.1 µg/g for both metals were found in upstream and old mining areas, respectively.

In order to identify the pollution level of heavy metal contaminations in the study area, the single pollution index (PIi) was calculated as the ratio between the metal concentration (Ci) in a soil sample and its reference value (Si) as shown in Equation 1 (14).

$$PI_i = C_i/S_i \quad (1)$$

Ci = metal concentration in soil

Si = Soil quality standards as shown in Table 2

The overall pollution status of heavy metal contamination of the surface soil was determined by the Nemerow pollution index (PIN) as shown in Equation 2 (14).

$$PI_N = \sqrt[2]{\frac{PI_{ave}^2 + PI_{i\,max}^2}{2}} \quad (2)$$

Where PIave and PIimax are the mean and maximum of the single pollution indices for individual heavy metals, respectively.

The five pollution levels of heavy metals in surface soils were classified based on the corresponding PIN values (Table 3). Following the categorization of the PIN of As, Zn and Cu represented the seriously polluted, moderately polluted and slightly polluted levels, respectively, while that of other heavy metals were considered as clean zone displayed in Table 4.

The results of cassava analysis shown in Table 2 indicated that As and Pb concentration levels in cassava exceeded the permissible limit. Arsenic exceeding permissible limit (0.1 µg/g) in food stuff could cause in the short term (nausea, vomiting, diarrhea, cough and headache) and long term (cardiovascular diseases, diabetes and vascular disease) human health effects (15, 16). On the part of Pb toxicity in humans, gastrointestinal tract, kidneys, and the central nervous system could affect (17, 18). The bioaccumulation factor (BAF) of each heavy metals was calculated as shown in Equation 3.

$$BAF = C_{plant}/C_{soil} \quad (3)$$

Where, C plant and C soil represent the heavy metal concentrations in edible part of vegetables and soils, respectively (16).

For all sampling points, the BAF value of Zn was the highest value representing the highest accumulation amount of Zn in cassava (Figure 2). The calculated result of mean BAF values was of the order Zn>Ni>Cu>Mn>>As≈Pb≈Cr≈ Fe>Hg≈Cd.

Table 2 Heavy metal concentration in soil and cassava varying in different zones

Sampling points	pH	As	Pb	Cr	Cu	Hg	Cd	Fe	Mn	Ni	Zn
Heavy metals concentration in soil (ppm)											
Upstream: A1	7.05	ND	18.92	ND	40.08	ND	ND	4,572.71	491.48	ND	10.58
Mining zone: B1	6.77	77.91	ND	29.44	45.72	ND	ND	5,776.04	334.75	ND	17.84
Mining zone: B2	7.06	13.31	ND	31.71	44.09	ND	ND	4,879.10	159.98	ND	10.9
Downstream: C1	8.04	ND	ND	43.34	54.85	ND	ND	15,964.33	486.48	12.94	38.94
Downstream: C2	7.09	151.78	ND	51.95	62.66	ND	ND	19,631.50	847.53	25.24	37.88
Average	7.20	48.64	1.35	31.49	49.62	ND	ND	19,498.07	464.04	5.03	22.46
Standard deviation	0.49	66.06	2.80	19.32	8.96	ND	ND	24,926.10	253.72	7.00	15.03
Minimum	6.77	ND	ND	1.00	40.80	ND	ND	4,572.71	159.98	ND	7.09
Maximum	8.04	151.78	18.92	51.95	62.66	ND	ND	62,631.00	847.53	17.16	38.94
Soil Quality Standard for agricultural purpose (mg/kg)		3.9[a], 12[b]	400 [a], 70 [b]	300 [a], 64 [b]	64[b]	6.6 [b]	37[a], 1.4[b]	50000[c]	1800[a]	50[b]	20[b]
Heavy metals concentration in cassava (ppb)											
Upstream: A1	-	ND	111.872	ND	449.431	ND	ND	7,241.280	3,797.487	334.921	2,000.831
Mining zone: B1	-	229.637	81.974	83.317	729.137	ND	ND	6,042.646	1455.743	367.479	2,967.435
Mining zone: B2	-	ND	191.350	96.261	661.584	ND	ND	4,850.660	1316.262	438.505	1,814.333
Downstream: C1	-	23.702	ND	98.321	642.065	ND	ND	4,428.261	733.609	267.786	2,112.192
Downstream: C2	-	79.772	ND	79.103	577.154	ND	ND	6,632.841	818.047	195.364	1,117.337
Average		74.622	93.039	81.400	611.874	ND	ND	5,839.138	1624.230	320.811	2,002.426
Standard deviation		90.300	62.786	19.378	105.743	ND	ND	1,183.749	1253.935	93.244	663.712
Minimum		ND	ND	ND	449.431	0.000	0.000	4,428.261	733.609	195.364	1,117.337
Maximum		229.637	191.350	98.321	729.137	0.000	0.000	7,241.280	3797.487	438.505	2,967.435
Permissible limit of metal in cassava (µg/kg)		100[d]	100[e],1,000[f]	50[g]	20,000[f]	100[f]	100[e, f]	22,000[f]	2,000-5,000[g]	500[h]	50,000[f]

a: Soil Standard, PCD, Thailand (8), b: CSQGs (Agricultural), Canada (19), c: WHO (20), d: WHO/FAO, 1999 (16) , e: Joint FAO/WHO Food Standards Programme CODEX Committee on Contaminants in Foods (21) , f : Nigerian industrial standards for cassava and cassava products for cassava and cassava products (22), g : WHO (23) , h: National Food Safety Standard Maximum Levels of Contaminants in Foods, China (24)

Table 3 Classification criterions for PI_N (25)

Grade	Class	Pollution level
1	< 0.7	Clean
2	0.7-1.0	Warning limit
3	1.0-2.0	Slightly polluted
4	2.0-3.0	Moderately polluted
5	>3.0	Seriously polluted

Table 4 Calculation of PIi and the PI_N values

PIi										
Soil sampling point	As	Pb	Cr	Cu	Hg	Cd	Fe	Mn	Ni	Zn
Upstream: A1	0.026	0.047	0.003	0.626	0.015	0.003	0.091	0.273	0.020	0.529
Mining zone: B1	19.977	0.000	0.098	0.714	0.015	0.003	0.116	0.186	0.020	0.892
Mining zone: B2	3.413	0.000	0.106	0.689	0.015	0.003	0.098	0.089	0.020	0.545
Downstream: C1	0.026	0.000	0.144	0.857	0.015	0.003	0.319	0.270	0.259	1.947
Downstream: C2	38.918	0.000	0.173	0.979	0.015	0.003	0.393	0.471	0.505	1.894
Soil quality standard	3.9[a]	400[a]	300[a]	64[b]	6.6[b]	37[a]	50000[c]	1800[a]	50[b]	20[b]
PI_N										
$PI_N = \sqrt{\frac{PI_{ave}^2 + PI_{i\,max}^2}{2}}$	28.898	0.034	0.143	0.882	0.015	0.003	0.313	0.380	0.376	1.603

a: Soil Standard, PCD, Thailand (8), b: CSQGs (Agricultural), Canada (19) c: WHO (20)

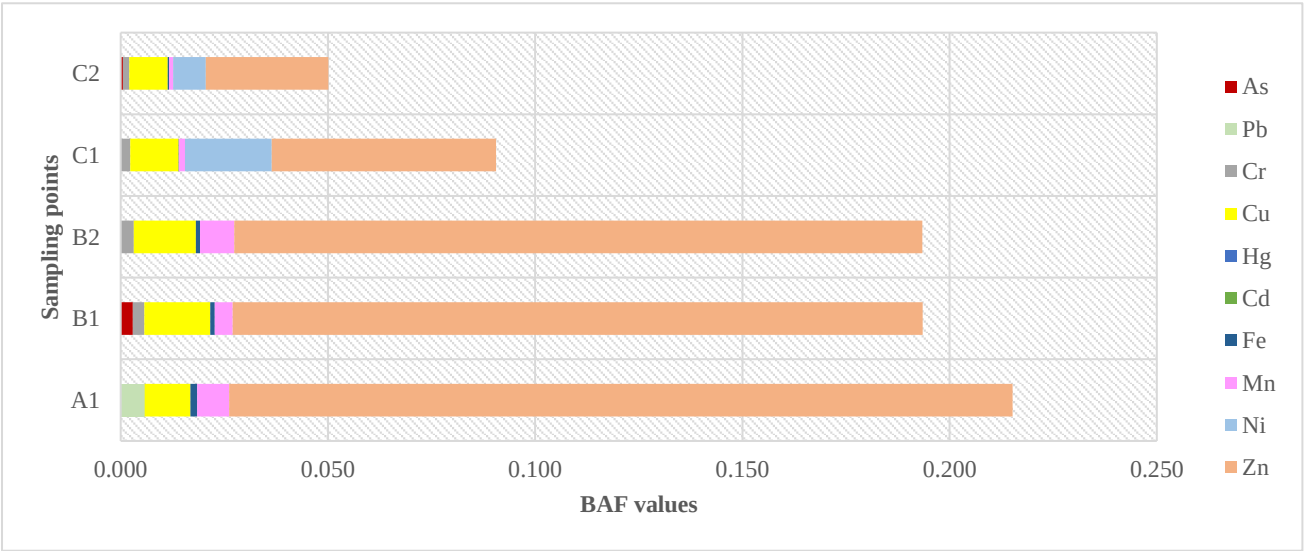

Figure 2 BAF Values in different zone of areas

DISCUSSION

According to the preliminary sampling in this present study, the total As concentrations range 13.31-77.91 and ND- 151.78 in mining and downstream zones, which were higher than the Thailand Soil Quality Standard for agricultural and residential purposes approximately 20 and 40 times, respectively. The results are as expected and correspond with the previous study conducted by Tiankao (11), which represented the high concentration of As in mining and downstream zones. Arsenic occurs mainly as inorganic species in natural systems. Although, the more toxic arsenite [As (III)] is more soluble and then more moblile than arsenate [As (V)] (26), arsenite and arsenate are the main forms of arsenic in the soil (27). In addition, As (III) and As (V) are easily taken up by the cells of the plant root. Then, this present study focuses on the investigation of total As in soil and cassava. The level of heavy metals and As concentration in soil reflect the level of soil contamination or soil pollution in the study area. Following the categorization Nemerow pollution index (PIN) of As, Zn and Cu represent the seriously polluted, moderately polluted and slightly polluted zones, respectively, while that of other heavy metals are considered as clean zone. In consideration of moving of investigated metals into cassava cultivated in the contaminated soil, the highest BAF values of all sampling points express by Zn. Although the BAF value of As corresponds to the moderate level in comparison with that of other heavy metals, the transfer of As from soil to plant is of concern based on the indicated excessive pollution caused from arsenic contaminated soil in this study area. Due to the restriction of entering to the study areas during pandemic of COVID-19, time for environmental sampling was very limited, especially for cassava sampling before its harvesting. For this reason, the available sampling points for both soil and cassava were also limited. However, the preliminary results provided a trend of significant contamination of heavy metals.

CONCLUSION

The conducted preliminary study indicates that arsenic contamination is a major problem in the study area due to the exceeding of the recommended level in both soil and cassava. However, other heavy metals are still of concern. In connection with the preliminary results, the comprehensive study with focusing on health risk assessment through contaminated cassava consumption will be carried out.

RECOMMENDATIONS

Based on the results of health risk assessment from this study, the further risk reduction plan and effective management in this contaminated areas effected from the abandoned tin mines should be developed. In a similar way, the health risk assessment and investigation of heavy metal concentration levels in the surrounding areas of other abandoned metal mines, which lack of any long-term control measures regarding the release of heavy metal that may pose adverse effects to human and environment, should be conducted.

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THE *IN VITRO* CELL STUDY OF SMALL INTERFERING RNA LOADED POLYMERIC NANOPARTICLES FOR REDUCTION OF TYR GENE EXPRESSIONS IN MELANOGENESIS

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ABSTRACT

Hyperpigmentation is a skin disorder caused by the over-production of melanin and leading to darker patches of skin. However, the current treatment by using the depigmenting agents has adverse effects. To overcome this problem, gene therapy and nanotechnology are used in this study. RNA interference by using small interfering RNA (siRNA) is an effective method for post-transcriptional gene silencing that can be used for the development of new drugs. Therefore, we use the siRNA that targets the *TYR* (Tyrosinase) gene, which encodes the crucial enzyme in melanogenesis to decrease melanin production. The polymeric nanoparticles (NPs) are used as carriers to protect siRNA from cellular barriers. Therefore, this study aims to evaluate the knockdown efficiency of siTYR and the characteristics, cytotoxicity, and cellular internalization of siTYR-loaded polymeric nanoparticles (siTYR-NPs) in melanoma cells. The results show that siTYR could reduce the expression of *TYR* mRNA to be 0.8 times lower than untreated cells. The average size of siTYR-NPs is about 196 ± 1.4 nm, and the zeta potential is -21. 7 ± 2.9 mV. The cell viability assay is used to investigate the toxic effect of siTYR-NPs. The results reveal that there is no difference in cytotoxic effect up to the highest concentration, which is 4 mg/mL. To study the cellular internalization of siTYR-NPs using flow cytometry, the melanoma cells are treated with the NPs that load Alexa Fluor555-labelled siRNA. The increased fluorescence intensity and percentage of Alexa Fluor 555 positive cells are detected from the cell-treated NPs compared with untreated cells. This study shows that polymeric NPs can provide the proper characteristics to be the siTYR carrier. The further development of the siTYR-NPs might lead to the silencing of *TYR* gene expression in melanogenesis and the reduction of melanin production in the melanoma cell line.

Keywords: Small interfering RNA, Drug delivery system, Polymeric nanoparticles, Hyperpigmentation, Melanin production

INTRODUCTION

The skin color of humans is regulated by the amount of melanin, which is the pigment in the skin. Melanin is a mixture of biopolymers produced in a complex process called melanogenesis. Although one of the important roles of melanin is a photoprotective factor, which protects skin against harmful effects of UV radiation, the overproduction of melanin causes darkly pigmented skin and disfigurement with subsequent emotional impact (1, 2). Hyperpigmentation leads to a large number of dermatological problems such as freckles, melasma, malignant melanoma, and post-inflammatory melanoderma (3). The accumulation of melanin can be induced by ultraviolet light, abnormal hormone-releasing, and increasing the activity of enzymes in melanogenesis (4). In melanogenesis, melanin is synthesized within melanosomes of melanocytes by many specific melanogenic enzymes. The synthesis pathway begins with the hydroxylation of the tyrosine to L-3,4-dihydroxyphenylalanine (DOPA) in a reaction catalyzed by tyrosinase. After that, the conversion of DOPA to dopaquinone is also catalyzed by tyrosinase. Therefore, tyrosinase is one of the main rate-limiting step enzymes encoded by the TYR gene. This enzyme also controls the rate of melanin biosynthesis by affect the quantity and quality of melanin (5, 6). From its major role in melanogenesis, tyrosinase is recognized as a therapeutic target for regulating the activity of melanin synthesis. The current treatment for hyperpigmentation is using tyrosinase inhibitors including hydroquinone, arbutin, and azelaic acid as the depigmenting agents (5, 7). However, the main problem of hyperpigmentation treatment is adverse effects from these agents such as irritation, contact dermatitis, and high toxicity (8, 9). To overcome these problems, gene therapy and nanoparticle technology are being used in this study.

Nowadays, gene therapy through RNA interference (RNAi) is one of the most potent approaches to treat many diseases by regulating the expression of the gene of interest. RNAi is a post-transcriptional gene silencing process triggered by the introduction of double-stranded RNA (dsRNA) which leads to gene silencing in a specific sequence. After reaching the target cell, dsRNA is shortened to be interfering RNA (siRNA). These siRNAs are then combined into a multi-nuclease complex, RNA-induced silencing complex (RISC), and degrades the complementary mRNA by the Argonaute protein. Therefore, gene silencing is a result of translational inhibition (10, 11). For many skin disorders, the siRNA method is used as a promising therapeutic due to providing more effective treatments and an attractive nontoxicity route (12, 13). However, the delivery approaches of siRNA into the skin still be the main challenges due to the interaction between a skin barrier and siRNA, which are highly effective defensive skin barrier function and negatively charged and hydrophilicity characteristics of siRNA. Based on its characteristics, the naked siRNA is unable to cross the membrane. Therefore, the assistance of a siRNA delivery carrier is required (13). There are numerous carriers to deliver siRNA into cells including viral carriers and nonviral carriers (14, 15). Recently, nanoparticles are increasingly used as non-viral siRNA carriers because they can protect the degradation of siRNA, promote interaction with the opposite-charged cell membrane, and enhance endosomal escape during the endocytic pathway (13). There are many types of NPs categorized by their size, morphology, and chemical properties. It includes carbon-based, metal, lipid, and polymeric NPs (8, 16). The polymeric NPs is used in the siRNA transfection because it has been reported as a potential carrier for gene delivery with the advantages of low toxicity, biocompatibility, and biodegradability (17, 18). In this study, we use gene therapy and nanoparticle technology to synthesize the polymeric NPs that load siTYR to silence the expression of the TYR gene. This work studies the cytotoxicity, cellular uptake, and knockdown efficiency of siTYR-NPs. We expect that siTYR can be loaded into NPs and siTYR-NPs will be optimized to improve cellular uptake and endosomal escape for the efficient delivering siRNA into the cell with less toxicity and silencing the expression of genes in melanogenesis.

METHODS

The sequences of siTYR and measurement of gene silencing using qRT-PCR analysis

The siTYR was purchased from GenePharma, China. The sequences of siTYR were:

siTYR sense: 5'-GUCCCUGUGGCCAGUUUUUAGGC-3'
siTYR antisense: 5'-GCCUGAAAGCUGGCCACAGGGACUC-3'

The expression of TYR mRNA in melanoma cells that were treated with siTYR was examined by the qRT-PCR (Quantitative Reverse Transcription Polymerase Chain Reaction) method. First, the melanoma cells were seeded in 96-well contained McCoy's media supplemented with 10% fetal bovine serum (FBS) and cultured overnight in a 37 °C and 5% CO2 incubator. The next day, the cells were transfected with 50 nM

by using lipofectamine, a transfection reagent. At 24 hours post-transfection, the cells were washed with phosphate-buffered saline buffer (PBS) and further incubated in McCoy's media for 24 hours. To measure mRNA expression, RNA from the cells was extracted by using RNeasy Mini Kit (Qiagen, Germany) and its cDNA was synthesized by using SuperScript III Reverse Transcriptase (Invitrogen, USA). The PCR reaction consists of cDNA, Brilliant II SYBR Green QPCR Master Mix (Agilent, USA), and TYR or ACTB (beta-actin; housekeeping gene) primer, and then amplified using qPCR system. The mRNA expression was calculated by the 2–ΔΔCt method, using the Ct difference between each sample and the control cells and normalizing to the ACTB expression and the statistic comparison was analyzed by one-way ANOVA followed by Dunnett's multiple comparisons test.

Preparation of siTYR loaded polymeric nanoparticles

The siTYR-NPs were prepared using the double emulsion/solvent evaporation (W1/O/W2) method. The siTYR was prepared in an annealing buffer, and the siTYR solution was further mixed with chloroform containing poly (lactic-co-glycolic acid) (Sigma-Aldrich, USA). The mixture was emulsified by using a probe sonicator to produce a primary W1/O emulsion. To stabilize polymeric NPs, the primary emulsion solution was dropped into surfactant and further emulsified by a probe sonicator to form a W1/O/W2 double emulsion. To completely evaporate chloroform, the resulting emulsion was stirred in a fume hood at room temperature overnight. The siTYR-NPs were then collected by centrifugation and freeze-dried process.

Characterization of siTYR loaded polymeric nanoparticles

To determine the size and zeta potential of siTYR-NPs, a dynamic light scattering method and a zeta potential method using Zetasizer (Malvern Instrument, USA) were used. To measure the siRNA encapsulation efficiency of siTYR-NPs, the following procedure of the indirect method was used. The supernatant of siTYR-NPs that was collected after centrifugation, was used as the sample to quantify the siTYR content by using the Quant-iT RiboGreen RNA Assay Kit (Thermofisher, USA). The major component of this kit containing fluorescent dyes which can be quantified RNA content by using a microplate reader (Biotek, USA). The encapsulation efficiency was calculated by using the following equation:

siTYR encapsulation efficiency (%) = ((Total amount of siTYR input - amount of siTYR in the supernatant) / Total amount of siTYR input) x 100

Cytotoxicity study of siTYR loaded polymeric nanoparticles to melanoma cell line

To examine the cytotoxicity of siTYR-NPs, siTYR-NPs were used to transfect with human melanoma cells line. The melanoma cells were seeded in 96-well plates and cultured overnight in a 37 °C and 5% CO2 incubator. Next day, the cells were transfected with 125-4,000 µg/mL of siTYR-NPs per well and further incubated for 24 hrs. Then, the cytotoxicity was analyzed by MTS cell viability assay (Promega, USA) (19). The results were analyzed by one-way ANOVA followed by Dunnett's multiple comparisons test.

Cellular uptake study using flow cytometry

To study the cellular uptake of siTYR-NPs, the Alexa Fluor 555-labelled siRNA, which was purchased from Thermofisher, USA, was used as representative of siRNA and loaded into polymeric NPs. To transfect the fluorescently labelled siRNA-NPs, the melanoma cells were seeded in 96-well plates and further transfected with the fluorescently labelled siRNA-NPs for 24 hours. After the transfection, the cells in each well were detached from plates by using 0.25% trypsin/ethylenediaminetetraacetic acid and feather collected and resuspended in PBS. Then, the cells were examined the fluorescent intensity that refers to cellular uptake by flow cytometer. The results were analyzed by one-way ANOVA followed by Dunnett's multiple comparisons test.

RESULTS

Knockdown efficiency of siTYR on melanoma cells

To study the knockdown efficiency of siTYR, the melanoma cells were transfected with 50nM of siTYR by using a lipofectamine reagent. After 24 hours, the mRNA expression of TYR was quantitatively measured by qRT-PCR method. The relative level of TYR mRNA in the cells treated with siTYR was decreased to be 0.8 times lower than untreated cells (Fig. 1). Whereas, the scrambled siRNA, a negative

control siRNA, could not reduce the mRNA expression of TYR on melanoma cells.

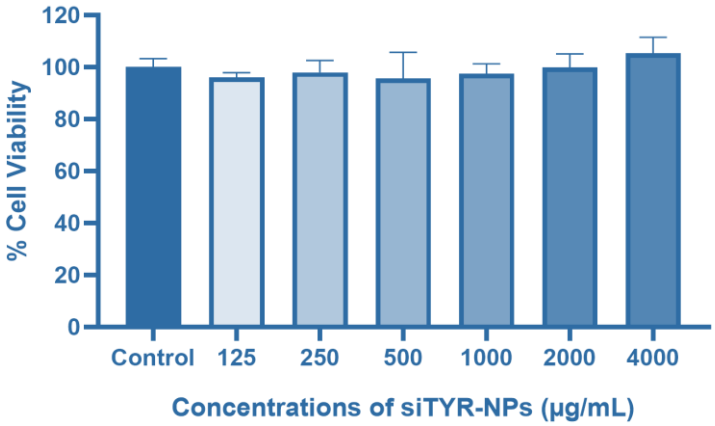


Figure 1 The measurement of *TYR* mRNA expression on melanoma cells treated with siTYR. The relative expression of *TYR* was determined by qRT-PCR method and calculated by the $2^{-\Delta\Delta Ct}$ method, using the Ct difference between each group and the untreated cell. Data are presented as the mean ± SD.

Characteristics of siTYR-NPs

The polymeric NPs loading siTYR were successfully prepared by the double emulsion/solvent evaporation method. The siTYR-NPs were characterized in terms of size, zeta potential, and encapsulation efficiency. The results are summarized in Table 1. The size of siTYR-NPs was 196 ± 1.4 nm with a narrow size distribution shown in the low polydispersity index on dynamic light scattering (DLS) analysis. Zeta potential analysis showed that the siTYR-NPs had a negative charge (-21.7±2.9mV). The siTYR were efficiently loaded into NPs showed in 46.7% of initial siRNA loading.

Table 1 Characteristics of the siTYR-loaded polymeric NPs.

NPs	Average particle size (nm)	Polydispersity index (PI)	Zeta potential (mV)	Encapsulation efficiency (%)
siTYR-NPs	196 ± 1.4	0.02 ± 0.01	-21.7 ± 2.9	46.7

Cytotoxicity effects of siTYR-NPs on melanoma cells

The melanoma cells were treated with various concentrations of siTYR-NPs (125 to 4,000 µg/mL). After 24 hours of incubation, the cytotoxicity effects of siTYR-NPs were examined using the MTS cell viability assay. The number of viable cells was compared with the control group, untreated cells. Up to the highest concentrations, 4,000 µg/mL, there was no significant cytotoxic effects of siTYR-NPs on melanoma cells (Fig. 2). This result refers that siTYR-NPs do not cause toxic effect on the melanoma cells.

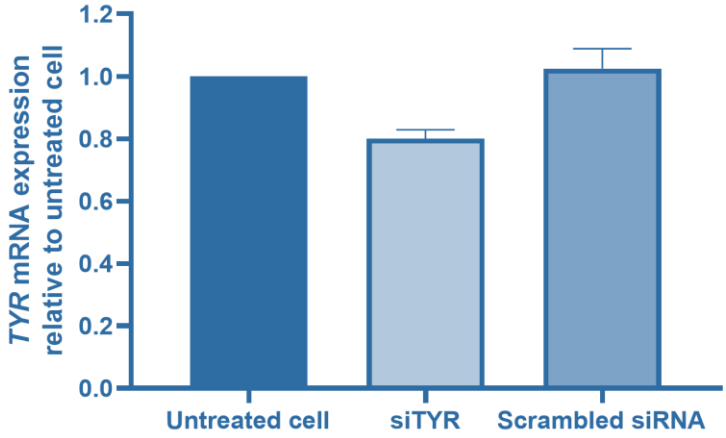
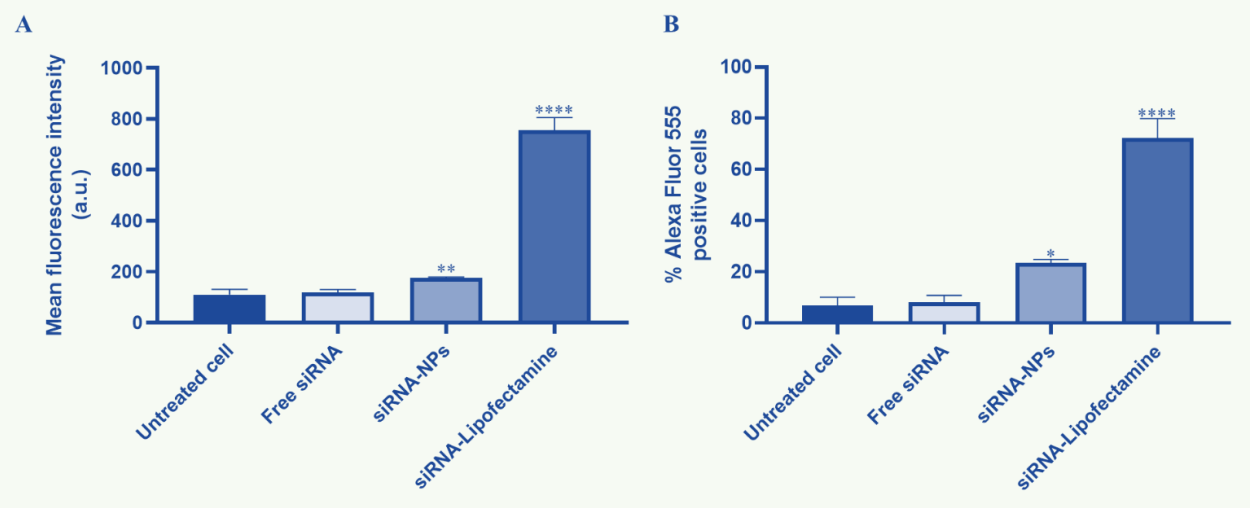


Figure 2 Cytotoxicity effects of siTYR-NPs on the melanoma cells. Cell viability of cells treated with siTYR-NPs was determined by MTS assay. The results are presented as the mean ± SD (n=3).

Cellular uptake of the Alexa Fluor 555-labelled siRNA loaded NPs

The Alexa Fluor 555-labelled siRNA was loaded into NPs and used as a representative of siTYR-NPs. The fluorescence intensity and the percentage of Alexa Fluor 555 positive cells from the cell treated with NPs were detected by flow cytometry. The results showed that the cell treated with the polymeric NPs had significantly increased intensity to be 176.7 a.u., while the fluorescence intensity of the untreated cells was only 109.7 a.u. The fluorescence intensity of the free siRNA group, the cells treated with the Alexa Fluor 555-labelled siRNA without a carrier, was only 117.7 a.u. (Fig. 3A). Correspond to the fluorescence intensity, the percentage of Alexa Fluor 555 positive cells of the cell treated with siRNA-NPs is a significant increase, which is 16.6% compared with an untreated cell (Fig. 3B). Moreover, The flow cytometric histogram showed that the Alexa Fluor 555 signal, which refers to the percentage of cellular uptake, is different in the cell treated Alexa Fluor 555-labelled siRNA with and without NPs (Fig. 3C).



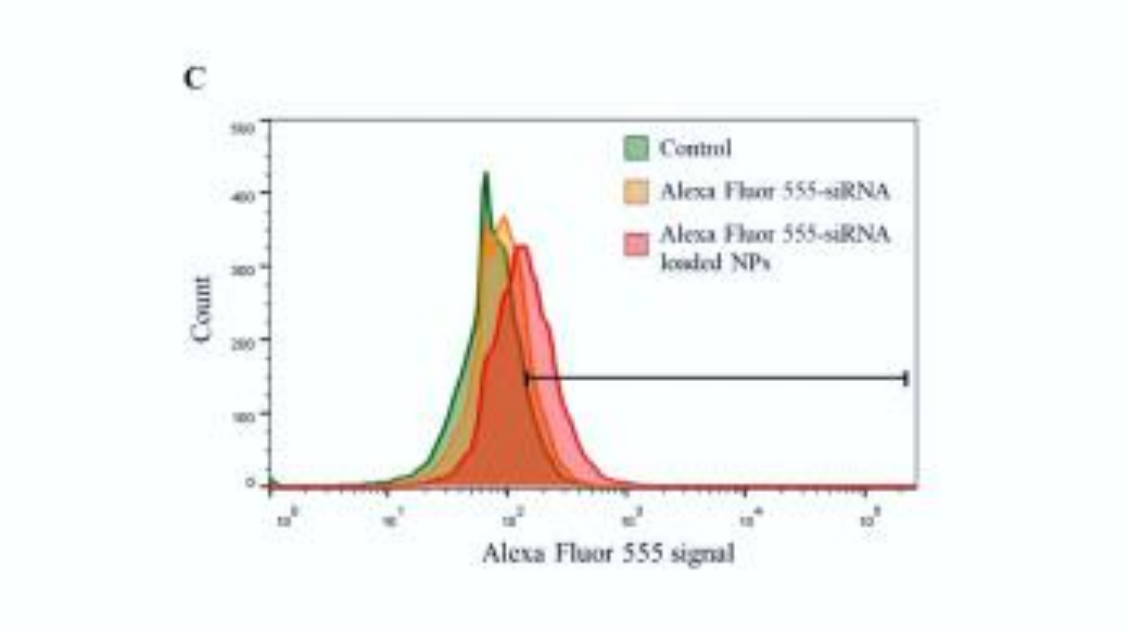


Figure 3 The cellular uptake of the Alexa Fluor 555-labelled siRNA-loaded NPs on the melanoma cells. (A) Mean fluorescence intensity, in an arbitrary unit (a.u.), of Alexa Fluor 555 detected by flow cytometer. The untreated cells are indicated as a control. The free Alexa Fluor 555-labelled siRNA group is indicated as a negative control and the Alexa Fluor 555-labelled siRNA transfected by lipofectamine is indicated as a positive control. (B) the percentage of Alexa Fluor 555 positive cells from flow cytometric histogram of each group compared with a control. (C) The histogram from flow cytometer showing cellular internalization of fluorescent siRNA-NPs compared with untreated cells. Data are presented as the mean ± SD (n=3). (*p<0.05, **p<0.01, ****p<0.0001)

DISCUSSION

In melanogenesis, TYR gene encodes for the tyrosinase enzyme which is one of the main rate-limiting step enzymes. Therefore, if the expression of TYR gene is downregulated, the production of melanin is reduced (20). The previous study reported that using TYR-small interfering RNA to control melanogenesis in the human melanocytes can significantly decrease the mRNA and protein levels of TYR and subsequently result in the suppressed melanin synthesis 21. A similar result showed in our study that siTYR can significantly reduce the mRNA expression of TYR on melanoma cells, the cell that expresses TYR gene.

However, the knockdown efficiency of our siTYR is lower than the previous result that showed 50% of knockdown efficiency (21). The factors that affect the knockdown efficiency can be the amount, sequence, and incubation time of transfection siRNA.

In this study, we synthesized the NPs with the proper characteristic for delivering the siTYR into the cells. The average size of siTYR-NPs is around 196 nm which is in the range of 100 to 250 nm that has been reported as the size of siRNA-loaded in polymeric NPs (13, 22). And the previous study also showed that the siRNA-NPs with 200 nm size could be uptake to the cell (23). Therefore, our siTYR-NPs should be uptake to the cell. For zeta potential of NPs, the siTYR-NPs in this study has a negative surface charge because of the carboxyl groups on the particles from a polymeric substance used in NPs synthesis (24). This negative charge of NPs can affect the cellular internalization by the repulsed effect of negative charge with cell membrane. Many studies used cationic reagents to overcome this problem for increasing the cellular internalization and the siRNA payload in NPs (23). Despite this, the limitation of using the cationic reagents to increase the charge of NPs is the toxic effect on the cells. The positive charge of cationic reagents can cause plasma-membrane disruption and result in the cytotoxic effect (25). Based on this evidence, siTYR-NPs that have negative charge showed a lower encapsulation efficiency and the percentage of cellular uptake. Moreover, the siTYR-NPs in this study were no significant cytotoxic

effect on the cell due to their negative charge and small size. To confirm that polymeric NPs in this study can deliver siRNA into the cells, the cellular uptake study using flow cytometry is performed under specific conditions. The increasing fluorescence intensity in the cell- treated siRNA-NPs refers to the uptake of Alexa Fluor 555-labelled siRNA into the cell by using NPs as a carrier. Furthermore, the percentage of Alexa Fluor 555 positive cells from the cell treated with NPs also indicates a higher percentage compared to untreated cells and the cells treated with the Alexa Fluor 555-labelled siRNA without NPs. These results confirm that NPs can be used as siTYR carriers to deliver siTYR into melanoma cells. However, the study of knockdown efficiency of siTYR-NPs and the determination of intracellular melanin content on melanoma cells should further study to prove that siTYR-NPs can lead to the silencing of TYR gene expression in melanogenesis and the reduction of melanin production in the melanoma cell line.

CONCLUSION

In conclusion, the polymeric NPs can load siTYR and provide the proper characteristics to efficiently deliver siRNA into the human melanoma cells without the toxic effect. The further optimization and development of the siTYR-loaded NPs could lead to the silencing of TYR gene expression in melanogenesis and the reduction of melanin production in the melanoma cell line.

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DEOXYARBUTIN-LOADED TRANSETHOSOMES DECREASE MELANIN PRODUCTION IN AN *IN VITRO* MODEL OF HYPERPIGMENTATION DISORDER

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ABSTRACT

Melasma is one type of hyperpigmentation disorder, which is caused by an accumulation of melanin in the epidermis. Tyrosinase is a rate-limiting step enzyme of melanin production. Deoxyarbutin is a tyrosinase inhibitor to inhibit melanin production, but it is inefficient for anti-melanogenesis because it easily degrades in aqueous conditions. This study aims to synthesize deoxyarbutin loaded transethosomes to improve the therapeutic efficiency of deoxyarbutin, which decreases melanin production. Transethosomes formulation was prepared by thin-film hydration method, which consists of 85% (w/w) phospholipid, 15% (w/w) tween 20 and ethanol. Transethosomes preparation conditions were optimized by varying ethanol concentration (v/v) at 30%, 40%, and 50%. The average size of transethosomes with various ethanol concentrations increased from 88.3 to 632.8 nm, and zeta potential from -9.8 to -15.7 mV. Melanin content assay was performed by treating G361 human melanoma cells with 0.127 µg/ml, 1.27 µg/ml, and 12.7 µg/ml of deoxyarbutin loaded transethosomes comparison to free deoxyarbutin. The 1.27 µg/ml and 12.7 µg/ml of deoxyarbutin loaded transethosomes have less melanin content in G361 human melanoma than free deoxyarbutin treatment. This study successfully synthesized transethosomes and deoxyarbutin loaded transethosomes using various methods. Deoxyarbutin loaded transethosomes are more effective in decreasing melanin production compared to free deoxyarbutin. Therefore, deoxyarbutin loaded transethosomes may enhance efficiency for hyperpigmentation disorder treatment.

Keywords: hyperpigmentation disorder, melanin production, transethosomes, deoxyarbutin

INTRODUCTION

Hyperpigmentation is a common disorder of the skin, which is caused by an increase of melanin accumulation in the epidermis leading to darkening of the human skin color. This disorder does not harmful but can cause concern to the patient and affect the quality of life (1). Hyperpigmentation disorder can divide into several types, but the hyperpigmentation disorder that affects millions of people around the world is melasma (2). Melasma is a common hyperpigmentation disorder that presents as a gray or brown patch on the face, which cause by melanin deposition in the epidermis. The major cause of melasma is UV radiation because it stimulates tyrosinase, a rate-limiting step enzyme to convert tyrosine to L-3, 4-dihydroxyphenylalanine (DOPA) by hydroxylation and converts DOPA to DOPA quinone, a precursor of eumelanin and pheomelanin production by oxidation reaction. Therefore, tyrosinase inhibitors play an important role to inhibit tyrosinase activity, which leads to reduced melanin production (3). The topical tyrosinase inhibitor includes hydroquinone, kojic acid, arbutin but these agents have side effects such as ochronotic for long-term use, contact dermatitis (4, 5). Arbutin is less toxic but ineffective to inhibit tyrosinase (4). In the previous study, researchers developed an effective and safe tyrosinase inhibitor called deoxyarbutin. They studied the effect of deoxyarbutin comparison with hydroquinone, kojic acid and arbutin to inhibit tyrosinase in vitro, skin lightening in a guinea pig model. The results showed that deoxyarbutin is the most effective in inhibiting tyrosinase in vitro and increase the skin lightening of a guinea pig model. (6).

Deoxyarbutin is a hydrophobic drug because the structure is composed of deoxy sugars (Figure 1), which enhance skin penetration and increase the binding affinity of tyrosinase, leading to excellent inhibit tyrosinase activity and reduction of melanin production In addition, deoxyarbutin can increase skin lightening and nontoxic in humans (7). Deoxyarbutin has the potential to use as a topical drug to reduce melanin production. However, deoxyarbutin degraded to hydroquinone and other molecules such as tetrahydro-2H-pyran-2-ol in an aqueous solution. Hydroquinone will be oxidized to benzoquinone (8). The instable of deoxyarbutin leads to limit the therapeutic use (9).

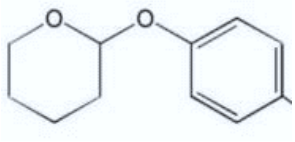

Figure 1. Structure of deoxyarbutin (8)

Lipid-based nanoparticles are usually used to deliver drugs because they have biocompatible, less toxic to human cells, control the release of encapsulating drugs and protect drug degradation (10). Lipid-based nanoparticles for transdermal drug delivery have several types included conventional liposomes, ethosomes, transfersomes and transethosomes. Conventional liposomes formulation consists of phospholipid. These vesicles are used to deliver a drug into the skin, but it is limited to penetrate the deeper layer of the skin because the human skin has a stratum corneum which is the outer layer of the epidermis that acts as a barrier for inward and outward movement of substance and act as a barrier of transdermal drug delivery (11, 12). Transfersomes formulation consists of phospholipid and single chain surfactant or edge activator, which increase the flexibility of transfersomes leading to passing through intercellular space, narrow space of stratum corneum by deformable itself and reformable when passing of stratum corneum (12). However, these vesicles limit to loaded hydrophobic drugs because they compromise deformability and elastic properties (13). Ethosomes formulation consists of ethanol and phospholipid. Ethanol can disrupt the phospholipid of the stratum corneum and fluidizes lipid bilayer but the major

disadvantage of thesis vesicle is a cause of skin dehydration (14). Transethosomes are a combination of transfersomes and ethosomes, which consist of phospholipid, ethanol and single chain surfactant or edge activator (12). In the previous study, researchers formulated epigallocatechin gallate (EGCG) loaded transethosomes and incorporated them into transethosomes gel. They have compared the skin penetration and stability test between EGCG loaded transethosomes gel and EGCG gel. The results showed that transethosomes improve skin penetration of EGCG and protect EGCG from oxidation (15). According to a previous study, transethosomes is outstanding to enhance transdermal drug delivery because the formulation of transethosomes consists of permeation enhancers such as ethanol to disrupt the skin barrier and single chain surfactant or edge activator to increase the flexibility of transethosomes which can help transethosomes to pass through the

intercellular space of the stratum corneum to deliver the drug to the skin. In addition to being outstanding in improving transdermal drug delivery, transethosomes also can protect the encapsulated substance (12).

In this study, we aim to optimize the fabrication of deoxyarbutin loaded transethosomes for the improvement of the therapeutic efficiency of deoxyarbutin which decreases melanin production in G361 human melanoma, an in vitro model of hyperpigmentation disorder.

METHODS

Materials

Phospholipon 90G was purchased from Lipoid GmbH (Ludwigshafen, Germany). Tween 20, molecular biology grade and NaOH, analytical grade were purchased from Merck Millipore (Massachusetts, USA). Absolute ethanol and diethyl ether, analytical grade were purchased from RCI Labscan (Bangkok, Thailand). Deoxyarbutin, analytical grade was purchased from Cayman Chemical (Michigan, USA). Phosphate buffer saline pH 7.4 (PBS), ultra pure grade was purchased from Vivantis Technologies (Selangor Darul Ehsan, Malaysia). Triton X-100, laboratory grade was purchased from Sigma-Aldrich (Saint Louis, MO, USA). McCoy's 5A Medium and G361 human melanoma were purchased from American Type Culture Collection (ATCC) (Manassas, Virginia). The 0.25% trypsin-EDTA, fetal bovine serum and Penicillin-Streptomycin were purchased from Gibco™ (New York, USA). Lysis buffer was purchased form Cell Signaling Technology (Massachusetts, USA).

Fabrication and optimization of transethosomes formulation

Transethosomes were prepared by a conventional thin film hydration method, which was optimized to determine the suitable transethosomes formulation for encapsulated drugs. Transethosomes preparation were performed according to the previous study, which has been modified (16). Briefly, the proportion of transethosomes formulation components were represented in Table 1. Phospholipon 90G and tween 20 were dissolved by diethyl ether. The solvent was removed by a rotary evaporator overnight. The thin film was rehydrated by distilled water containing 30, 40 and 50% of ethanol, then shaking at room temperature for 1 hour. Transethosomes size were decreased by extruder at 200 bars with 200 nm of polypropylene membrane for 10 cycles. The particle size, polydispersity index (PDI) and zeta potential of each transethosomes formulation were analyzed by dynamic light scattering (Zetasizer ultra, Malvern Instruments, Malvern, UK)

Table 1: Component to optimized transethosomes formulation

Formulation	Phospholipon 90G (% w/w)	Tween 20 (% w/w)	Ethanol (% v/v)
1(control)	85	15	-
2	85	15	30
3	85	15	40
4	85	15	50

Deoxyarbutin loaded transethosomes were prepared by thin film hydration method as described above, which modification in decrease transethosomes size process. Briefly, transethosomes were rehydrated with 1X PBS, pH 7.4 containing ethanol and 10% w/w of deoxyarbutin. Transethosomes size were decreased by sonication as a 40% amplitude for 5 minutes. Transethosomes were purified by ultracentrifuge at 80,000 rpm 4°C for 90 minutes and resuspended with 1X PBS, pH 7.4. Control transethosomes were prepared similar process with deoxyarbutin loaded transethosomes .

Physicochemical characterization

Physicochemical characterization was perform performed according to the previous study, which has been modified (16). Ten microliters from a stock

solution of transethosomes were diluted by 990 µl of distilled water. The particle size, zeta potential and PDI were analyzed by dynamic light scattering for triplicate at 25°C. The refractive index of transethosomes and water were set at 1.45 and 1.33, respectively.

The entrapment efficiency (EE) of deoxyarbutin was investigated by mix the purified transethosomes with 10% Triton-X 100, then vortex for 5 minutes (17). The content of deoxyarbutin was determined using absorption at 280 nm using a microplate reader and calculated by comparison to a standard curve of deoxyarbutin. The %EE was determined by the equation as follows.

$$\%EE = \frac{\text{Total amount of determine drug x 100}}{\text{initial amount of drug loading}}$$

Melanin content assay

To investigate efficacy in melanin content reduction of deoxyarbutin loaded transethosomes comparison with free deoxyarbutin. The method for melanin content assay was performed according to the previous study, which has been modified (18). Briefly, 3x105 cells of G361 human melanoma were seeded into 6 well plate, then incubate at 37°C under 5% CO2 for 24 hours. Cells were treated with 0.127 µg/ml, 1.27 µg/ml and 12.7 µg/ml deoxyarbutin loaded transethosomes with free deoxyarbutin as an equal concentration of deoxyarbutin in transethosomes included 0.127 µg/ml, 1.27 µg/ml and 12.7 µg/ml, then incubated at 37°C under 5% CO2 for 72 hours. Cells were harvested by 0.25% trypsin-EDTA. The lysis buffer was used to extract cells, then centrifuge at 14,000 g at 4°C for 10 min. The 1N NaOH was used to extract melanin from pellets, then incubated at 70°C for 2 hours. The melanin content was measured by a microplate reader at 405 nm. The concentration of melanin content was calculated by a standard curve of synthetic melanin and normalized melanin content by the total cells number.

Statistical analysis

All the data were presented as mean ± standard error of the mean. An independent t-test was used to determine significant differences of free deoxyarbutin comparison to deoxyarbutin loaded transethosomes. The p-values ($p < 0.05$) are the level of statistical significance.

RESULTS

Fabrication and optimization of transethosomes formulation

The size, PDI and zeta potential of transethosomes were obtained from 100 folds dilution of stock solution. Transethosomes containing 30% and 50% ethanol have the smallest size and largest size, respectively. The PDI of transethosomes containing 30% and 40% ethanol was equal, whereas transethosomes containing 50% ethanol have the highest PDI. The zeta potential of transethosomes containing 30% has a lower negative charge than transethosomes containing 50% ethanol but higher than transethosomes containing 40% ethanol as represented in Table 2.

Table 2: Size, Zeta potential and PDI of optimization transethosomes formulation. Data represented as mean±SD (n=3)

Formulation	Size (nm)	PDI	Zeta potential (mV)
1 (control)	146.0 ±3.5	0.1 ± 0.01	-13.5 ± 1.9
2	88.3 ± 3.6	0.1 ± 0.01	-15.0 ± 1.6
3	112.7 ± 3.2	0.1 ± 0.01	-9.8 ± 0.9
4	632.8 ± 190.0	0.5 ± 0.20	-15.7 ± 0.2

Control transethosomes and deoxyarbutin loaded transethosomes were prepared with 30% ethanol and decreased the size by sonication. Deoxyarbutin loaded transethosomes have a larger size than control transethosomes. PDI of deoxyarbutin loaded transethosomes and control transethosomes was equal. The zeta potential of deoxyarbutin loaded transethosomes has a lower negative charge than control transethosomes as represented in Table 3.

Table 3 Size, PDI and zeta potential of control transethosomes and deoxyarbutin loaded transethosomes. Data represented as mean±SD (n=3)

Sample	Size (nm)	PDI	Zeta potential (mV)
Control transethosomes	46.6 ± 1.3	0.2 ± 0.01	-11.5 ± 1.5
Deoxyarbutin loaded transethosomes	59.1 ± 1.0	0.2 ± 0.02	-8.7 ± 0.9

Measurement of melanin content

The melanin content of G361 human melanoma, that treated with 0.127 µg/ml, 1.27 µg/ml and 12.7 µg/ml of deoxyarbutin loaded transethosomes were 6.2±1.4 pg/cell, 5.9±1.0 pg/cell and 4.1±0.9 pg/cell, respectively. Free deoxyarbutin at concentration 0.127 µg/ml, 1.27 µg/ml and 12.7 µg/ml were represented melanin content in G361 human melanoma at 8.4±0.7 pg/cell, 6.7±1.4 pg/cell and 5.5±1.5 pg/cell, respectively. There were no significant differences between free deoxyarbutin and deoxyarbutin loaded transethosomes (Figure 2).

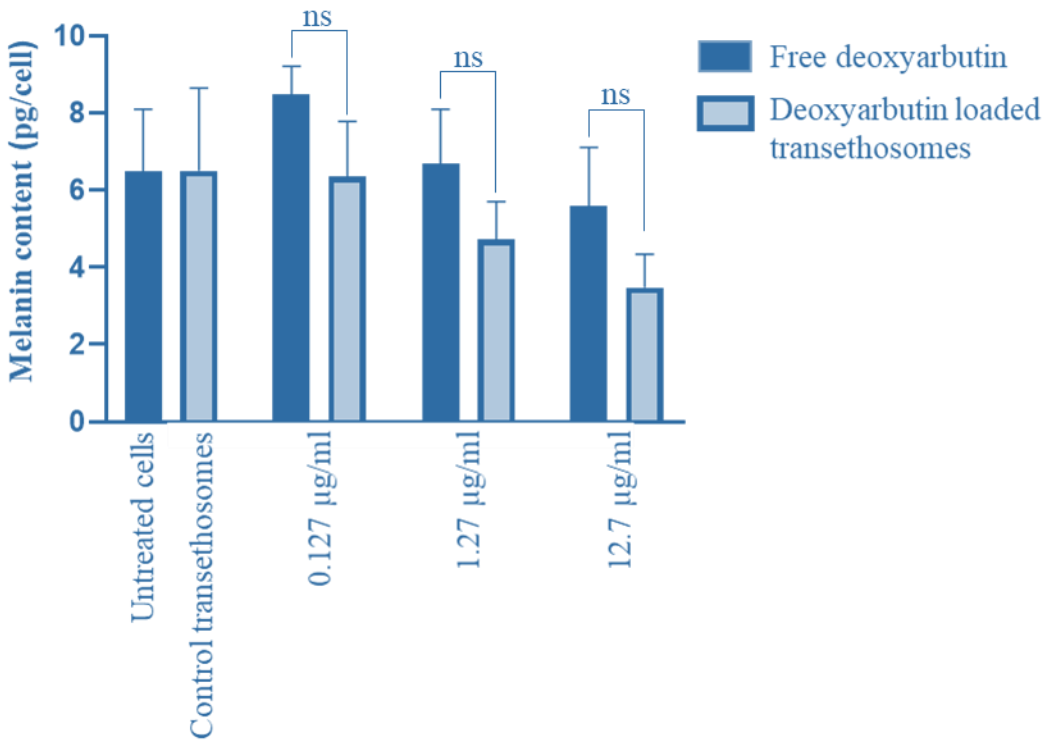

Figure 2. Effect of deoxyarbutin loaded transethosomes and free deoxyarbutin on melanin content. G361 human melanoma cells were treated with 0.127 µg/ml, 1.27 µg/ml and 12.7 µg/ml comparison with free deoxyarbutin and controls (untreated cells and control transethosomes).
Data represented mean ± SD (n=3).
ns: not significant

DISCUSSION

Ethanol concentration was optimized for transethosomes synthesis. Transethosomes containing 30% and 40% ethanol concentration have a smaller size than control, which similarity to the previous study because interpenetration of the ethanol hydrocarbon chain leads to reduce particles size (19). In the previous study, particles size was decreased when increasing the ethanol concentration, which was contrary to this research (20). We found that transethosomes size were an increase when increasing ethanol concentration. Transethosomes containing 40% and 50% ethanol have a larger size than transethosomes containing 30% ethanol because increasing ethanol concentration probably makes the vesicle membrane more leaky, thus leading to larger particle size (19). PDI of transethosomes containing 30% and 40% ethanol were 0.1±0.01, which indicated that transethosomes containing 30% and 40% ethanol have homogeneous and narrow size distribution, whereas transethosomes containing 50% ethanol have the highest PDI, which indicated that transethosomes containing 50% ethanol have nonhomogeneous and broad size distribution. Zeta potential is a parameter that indicates the stability of transethosomes. Transethosomes formulation have a negative charge because phospholipid and ethanol have a negative charge. The negative charge of nanoparticles plays an important role in increasing the stabilizing of transethosomes by avoiding the aggregation of nanoparticles due to electrostatic repulsion (19). The higher negatively charge of zeta potential of nanoparticles (NPs) indicating the high stability of NPs as well (21). Transethosomes containing 30% ethanol have more negative charge than transethosomes containing 40% ethanol, so transethosomes containing 30% ethanol have more stable than transethosomes containing 40% ethanol. Therefore, transethosomes containing 30% ethanol were able to synthesize deoxyarbutin loaded transethosomes.

Control transethosomes and deoxyarbutin loaded transethosomes were prepared by 30% ethanol concentration and decreased size by sonication because extrusion has disadvantages such as time-consuming, possible contamination by handling, high cost of material (22) which was not able to pharmaceutical and cosmetic industry. Control transethosomes and had a smaller size than deoxyarbutin loaded transethosomes. Zeta potential of both transethosomes have a negative charge. PDI of control transethosomes and deoxyarbutin loaded transethosomes were 0.2±0.01 and 0.2±0.02, respectively, which indicated that control transethosomes and deoxyarbutin loaded transethosomes synthesized with 30% ethanol and decreased size by sonication have stable and homogeneous size. In the previous study, researchers studied characteristic comparison of transfersomes, ethosomes, and transethosomes encapsulated actives of distinct polarities include vitamin E and caffeine on skin penetration. They found that transethosomes were more deformable than transfersomes and ethosomes, which leading to more penetration to the deeper skin layer than transfersomes and ethosomes. Transethosomes formulation of the previous study consists of soybean phosphatidylcholine, the different surfactant includes sodium cholate and sorbitan laurate and 30% ethanol. vitamin E loaded transethosomes and caffeine loaded transethosomes had a larger size than control transethosomes, which corresponds to the different sizes of deoxyarbutin loaded transethosomes and control transethosomes in this study (13). In the previous study, researchers investigated deoxyarbutin and its derivatives include deoxyfuran, thiodeoxyarbutin and fluorodeoxyarbutin for depigmentation. The results show that nontoxic concentrations of deoxyarbutin and its derivatives includes deoxyfuran and fluorodeoxyarbutin can inhibit tyrosinase activity and reduce melanin production. Darkly pigmented melanocytes were treated with a nontoxic concentration of deoxyarbutin, deoxyfuran and fluorodeoxyarbutin. Darkly, pigmented melanocytes have 66%, 68% and 74% of melanin content at day 3 after removing these substances, which can indicate that deoxyarbutin and its derivatives have the potential to reduce melanin production (23). In this study, the highest concentration of deoxyarbutin was 12.7 µg/ml had 4.1±0.9 pg/cell of melanin, whereas untreated cell had 6.3±1.6

µg/ml. Therefore 12.7 µg/ml of deoxyarbutin has approximately 65% of melanin content which was consistent with previous research that deoxyarbutin has properties to reduce melanin production. The comparison efficiency in reducing melanin content between free deoxyarbutin and deoxyarbutin loaded transethosomes in this study, there were no significant differences, which indicate that deoxyarbutin loaded transethosomes not effective to reduce melanin production than free deoxyarbutin. If analyzed quantitatively, free deoxyarbutin at 0.127 µg/ml and 1.27 µg/ml were not effective for reducing melanin production whereas 12.7 µg/ml was reduced melanin production in G361 human melanoma cells. In addition, the concentration at 1.27 µg/ml and 12.7 µg/ml of deoxyarbutin loaded transethosomes were effective in reducing melanin production than free deoxyarbutin because free deoxyarbutin was degraded in aqueous conditions and transethosomes protect the encapsulated deoxyarbutin. In the previous study, researchers investigated the inhibitory effect of anthocyanin, which is an unstable substance loaded liposome, a lipid-based nanoparticle on A375 human melanoma cells. Therefore, they used liposomes to extend the half-life of anthocyanin. The result shows that anthocyanin in liposomes effective to reduces melanin content in A375 human melanoma cells than free anthocyanin, which corresponds to this study (24).

Our research was performed only in the G361 human melanoma cell, an in vitro model for hyperpigmentation disorder. However, this result indicated that deoxyarbutin loaded transethosomes have more effective in reducing melanin production than free deoxyarbutin in an in vitro model.

CONCLUSION

The deoxyarbutin loaded transethosomes containing 30% ethanol (v/v) were successfully fabricated. Physicochemical characteristic analysis showed the narrow size distribution and stability of the obtained transethosomes. In vitro study in G36l cell lines was investigated and confirmed the effectiveness of deoxyarbutin loaded transethosomes in reduction of melanin production. Our finding indicates that deoxyarbutin loaded transethosomes have the potential to be used as a nanocarrier for therapeutic of hyperpigmentation disease.

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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

PREVALENCE AND FACTORS ASSOCIATED WITH PSYCHOLOGICAL AGGRESSION AGAINST THE CHILDREN IN MYANMAR

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ABSTRACT

Psychological aggression toward children is one of the most challenging public health problems. It is against the children's rights, affecting negative impacts on their life-long health. However, those violent acts are still widely used across countries. So, it is required to clearly understand the country-specific information for prevention and control. This study aimed to investigate the prevalence and factors associated with psychological aggression against children in Myanmar. This study is a secondary data analysis of the 2015-2016 Myanmar Demographic and Health Survey (MDHS). Psychological aggression of caregivers was assessed using two different questions with the child disciplinary module of UNICEF. A Chi-square test was done to determine the associated factors. This study included 7,335 children aged 2-14 years. Results showed that nearly three-fourth of the children (74.0%, 95% CI: 73, 75) were the recipients of psychological aggression in which the more common form is "shouting, yelling, or screaming at the child" (72.0%, 95% CI: 70.59, 73.38). Chi-square results suggested that age, sex, and education level of the children were significantly associated with psychological aggression against children (p <0.05). The family characteristics, i.e., parental survivorship, age, sex, the relationship of primary caregiver to children, and attitude of primary caregiver towards physical punishment, were also significantly associated with psychological aggression regarding children (p <0.05). Psychological aggression towards children is high in Myanmar. Therefore, sustainable actions should be immediately implemented to educate the community about the harmful effects of psychological aggression and how to communicate with children in optimistic ways, primarily focusing on children, caregivers, and household heads.

Keywords: child health; violence against children; violent discipline; psychological aggression

INTRODUCTION

Psychological aggression toward the children is "the acts that harm the emotional health and development of a child, including but not limited to restricting a child's movements,

ridicule, threats and intimidation, rejection and other nonphysical forms of hostile treatment" (1). It is a form of emotional violence against the children, and one of the challenging public

health problems affecting negative impacts on life-long health of the children (2, 3). Survivor children have greater potential of involvement in bullying, high blaming to others and might have antisocial behaviors in their adolescent life (4, 5) and depression, anxiety, and risky behaviors in their adulthood life (6). Those violent acts are against the children's rights of the UN Convention (7). Therefore, "2030 Agenda for Sustainable Development", target 16.2 emphasized to "end abuse, exploitation, trafficking and all forms of violence against, and torture of, children" (8).

However, it is estimated that 70% of children are exposed to psychological aggression as a form of violent discipline globally (9). In ASEAN countries, the prevalence is estimated that 58.2% in Vietnam, 65.9% in Laos, and 40.4% in Thailand (10-12). The prevalence of psychological aggression in Myanmar is estimated to be higher than that of those countries (7). Previous studies had identified associations between use of psychological aggression against children and certain sociodemographic characteristics. Those factors include individual characteristics of the child such as sex (13-15), age (15, 16), education level of child (16); and characteristics of family such as parental survivorship (15, 16), education of caregivers (14), attitude of caregivers on physical punishment (13, 15), and number of people in the family (13).

Since the results of previous studies have identified that violence towards children is preventable (3), we need to clearly understand the reason for the use of psychological aggression against children. Despite the estimated higher prevalence in Myanmar, there are very few studies focusing on this area and no published study has been available yet except 2015-2016 Myanmar DHS. Hence, it is required to clearly understand the country-specific information to elaborate strong evidence-based data, which consequently support the initiation of effective policies for prevention and control. Therefore, this study aimed to investigate the prevalence and factors associated with psychological aggression against the children in Myanmar using the data of the Myanmar Demographic and Health Survey (MDHS) 2015 - 2016. The psychological aggression against children were interviewed to the caregivers in the child discipline module of DHS which was adapted from Multiple Indicator Cluster Surveys 4 (MICS-4), in which the standard age to study child discipline is 2 to 14 years. Since the survey is nationally representative, this study could provide the information on the correlates of psychological aggression so that, strategies and plans could be established accordingly.

METHODS

Study Design

This study was a secondary data analysis of 2015-2016 MDHS carried out by the Ministry of Health and Sports, Myanmar with technical assistance from the DHS Program (17).

Study Population

The study population were the children aged 2-14 years in the households, who were selected for the child discipline module. One adult respondent from each household were interviewed about the outcome.

Data Collection of DHS

The sampling design of the DHS was two-staged cluster sampling which provided representative estimates for the whole country, for urban and rural areas, and for 15 regions of the country. The survey was successfully interviewed in 12,500 households.

Assessment Tool

The child discipline module included in the household questionnaire of DHS was adapted from the Parent to Child Conflict Tactics Scale (18), in which, the standard age to study child discipline is 2 to 14 years. Face to face interview with oral consent was conducted to one adult respondent of age 15 years or older in each household asking about disciplinary practices towards the children and their attitude on physical punishment. Psychological aggression of all adult household members towards the children during the month before the survey were accessed with

2 different questions: "Shouted, yelled or screamed at the child in the past month" and "Called him/her dumb, lazy, or a similar name in the past month". In this study, a dichotomous variable "any psychological aggression" was created in which use of any of the two practices was recoded "Yes" and not using any of those methods was considered "No".

Sample size of this study

Due to the selection of one child per household in child discipline module, the surveyed child population was equal to the number of respondents (7893, unweighted). But 242 children who were not usual resident are excluded in this study resulting in 7,651 observations. The response rates of both questions were nearly 100%. After exclusion of cases with missing variables, this study included 7,335 (weighted) children aged 2-14 years (unweighted number of children = 7,556).

Statistical analysis

Stata version 16.0 was used, and the prevalence of psychological aggression and sociodemographic characteristics were described by proportion with 95% Confident Interval (CI). Chi-square test was used to investigate the associated factors of psychological aggression with the dependent variable "any psychological aggression". The independent variables included age, sex, and education level of children; parental survivorship; age, sex, and education level of primary caregiver; attitude of caregiver on physical punishment; relationship of primary caregiver to children; and number of family members. Sampling weights and cluster survey design were accounted in data analysis to be representative to the population. Variables with p – value <0.05 were considered statistically significant.

Ethical Consideration

Ethical review was approved by Chulalongkorn University with COA No. 079/2021.

RESULTS

Sociodemographic characteristics of the children

Table 1 shows the summary of sociodemographic characteristics of the children. The total number of children is 7,335 (weighted). The average age of children was 8.18 ± 3.76 years, most children were males (50.8%), and most children had had primary education level (40.7%). More than 90% of the primary caregivers were female (93.0%). Most of primary caregivers had age 30 – 49 years (65.1%). Nearly three-fourth of primary caregivers had education level non or primary (70.2%). About the attitude of primary caregivers on physical punishment, most of them did not believe on it being necessary (64.8%). The detailed sociodemographic characteristics are mentioned in the Table 1.

Table 1 Sociodemographic characteristics of the children (N=7,335) (weighted)

Sociodemographic characteristics of the children	Percent	95% CI
Individual Characteristics		
Age of children		
2-5	29.8	28.45 – 31.14
6-14	70.2	68.86 – 71.55
Sex		
Male	50.8	49.37 – 52.12
Female	49.3	47.88 – 50.63
Education level		
No education, preschool	37.9	36.29 – 39.58
Primary	40.7	39.25 – 42.11
Secondary	21.4	20.10 – 22.77
Family Characteristics		
Number of family members		
2 – 5	66.2	64.36 – 67.89
More than 5	33.9	32.11 – 35.64
Sociodemographic characteristics of the children	**Percent**	**95% CI**

Parental survivorship		
a child with both biological parents	92.5	91.71 – 93.30
a child with one or both parents deceased	7.5	6.70 – 8.29
Sex of primary caregiver		
Male	7.0	6.11 – 7.97
Female	93.0	92.03 – 93.89
Age of primary caregiver		
< 30 years	17.0	15.85 – 18.28
30 – 49 years	65.1	63.71 – 66.38
50 and above years	17.9	16.82 – 19.05
Education level of primary caregiver		
none or primary	70.2	68.17 – 72.13
secondary or higher	29.8	27.87 – 31.83
Relationship of primary caregiver to children		
Mother	82.5	81.26 – 83.60
Father	5.5	4.73 – 6.41
Another adult in household	12.0	11.15 – 12.97
The attitude of primary caregiver towards physical punishment		
Believe physical punishment is necessary	29.7	28.32 – 31.11
Not believe physical punishment is necessary	64.8	63 – 66.38
Do not know	5.5	4.48 – 6.80

Prevalence of psychological aggression against the children

Table 2 shows prevalence of psychological aggression against the children. Nearly three-fourth of the children (74.2%) were committed by any type of psychological aggression. The more common form was "shouting, yelling, or screaming at the child" (72.0%).

Table 2 Prevalence of psychological aggression against children (N=7,335) (weighted)

Psychological aggression	(%)	95% CI
Any of psychological aggression	74.2	72.77 – 75.54
"Call the child lazy, damp, or a similar item"	22.5	21.14 – 23.89
"Shouting, yelling, or screaming at the child"	72.0	70.59 – 73.38

Associated factors of psychological aggression against the children

Table 3 shows the associated factors of psychological aggression against the children by the chi-square results. The findings show that individual characteristics of the children: age ($p < 0.01$), sex ($p < 0.001$) and education level ($p < 0.001$) were significantly associated with psychological aggression. The caregiver characteristics i.e., age, sex, attitude of primary caregiver towards physical punishment and relationship of primary caregiver to children were also significantly associated with the psychological aggression ($p < 0.001$). The results also shows that parental survivorship was also the significant associated factor of psychological aggression against children ($p=0.041$).

Table 3 Association between psychological aggression against children and sociodemographic characteristics (N=7,335) (weighted)

Sociodemographic characteristics	Psychological aggression (%)		$\chi 2$	*p*-value [a]
	No	Yes		
Age of the child			10.1	<0.01**
2 – 5	23.4	76.6		
6 – 14	26.9	73.1		

Sociodemographic characteristics	Psychological aggression (%)		χ2	*p*-value [a]
	No	Yes		
Sex of the child			31.5	<0.001***
Male	23.0	77.0		
Female	28.7	71.3		
Education level of the child			42.6	<0.001***
No education, preschool	23.1	76.9		
Primary	25.2	74.8		
Secondary	31.9	68.1		
Number of family members			0.2	0.659
2 – 5	26.0	74.0		
More than 5	25.5	74.5		
Parental survivorship			5.6	0.041*
a child with both biological parents	25.5	74.5		
a child with one or both parents deceased	30.0	70.0		
Sex of primary caregiver			40.1	<0.001***
Male	37.5	62.5		
Female	25.0	75.0		
Age of primary caregiver			23.4	<0.001***
< 30 years	21.2	78.8		
30 – 49 years	26.1	73.9		
50 and above years	29.3	70.7		
Education level of primary caregiver			4.5	0.065
none or primary	25.1	74.9		
secondary or higher	27.5	72.5		
Relationship of primary caregiver to children			51.5	<0.001***
Mother	24.3	75.6		
Father	37.7	62.3		
Another adult in household	31.0	69.9		
The attitude of primary caregiver towards physical punishment			128.7	<0.001***
Believe physical punishment is necessary	29.7	70.3		
Not believe physical punishment is necessary	17.1	82.9		
Do not know	27.2	72.8		

a. Bivariate Analysis (Chi square test), *p*-value <0.05 are in bold.
* p-value < 0.05, if statistically significant at α = 0.05
** p-value < 0.01, if statistically significant at α = 0.01
*** p-value < 0.001 if statistically significant at α = 0.001

DISCUSSION

This study elaborates important findings on psychological aggression against children in Myanmar. The results shows that nearly three-fourth of children in Myanmar experienced one or more forms of psychological aggression. Compared to other nationally representative surveys, it is lower than a neighboring country: Bangladesh (86.3%) (19); but much higher than in Thailand (40.4%) (10), Vietnam (58.2%) (12). Moreover, this study also identifies that nearly one-third of caregivers considered physical punishment being necessary (29.6%). Comparing to other ASEAN countries, it is higher than that in Vietnam (14.6%) (12) and Lao People's Democratic Republic (PDR) (25.4%) (11), but lower than that in Thailand (52.8%) (10) and a neighboring country: Bangladesh (35%) (19). This higher prevalence of psychological aggression and bad attitude of caregivers can be explained by sociocultural believes in Myanmar. Parents and caregivers in Myanmar generally perceive that they are entitled to verbal aggression to correct the wrong behavior of children, especially within the family. As a social norm, adults using verbal

aggression against children is considered as nothing wrong and they consider that using psychological aggression is appropriate and effective for child discipline. Since there was no legally prohibition on caregivers' use of psychological aggression or physical punishment in Myanmar until new Child Rights Law 2019 (20), this fact may also contribute as an important explanation.

This study also finds out the significant factors associated with psychological aggression against children. Our study revealed that individual associated factors include age, sex, and education level of children. Similar findings are observed in various studies worldwide such as boys (13, 15), or girls (14) are more likely to experience psychological aggression. It is unclear to explain gender difference, but the higher risk of boys may be due to higher expectation of caregivers on boys (21). Previous studies also found the significant association with age (16) and psychological aggression increased with age (15) which may be due to "body-mind development from pre-school to early adolescent age" (15). Similarly, a study of violence against children in Zimbabwe found that female children not attending school are more likely to be treated by emotional violence (16). So, the higher education level of children may have protective effect on them from violence. This study also identified that age and sex of caregivers and relationship of primary caregiver to children were also significant associated factors. Similarly, in Vietnam, violent disciplinary practices were more common in families with adults of average age less than 30 years (22). A study in Ghana also found that male primary caregiver was negatively predictive of psychological aggression (23). However, further studies should focus on caregivers' characteristics in detail and their relationship with uses of different types of violence against children. Moreover, parental survivorship was identified as an associated factor in this study. This finding is similar to those from studies in Vietnam (22) and Yemeni (24) which reported significant associations between parental survivorship and violent child disciplines. The study found that the attitude of primary caregiver towards physical punishment is significantly associated with psychological aggression against children. It is similar to previous studies worldwide (13, 15) which showed that children were more likely to be treated by psychological aggression of the caregivers if they believed physical punishment being necessary. Such results reveal that caregivers who agree to use physical punishment may also tend to use psychological aggression more commonly. However, additional in-depth and detailed studies should be conducted to clarify the important association between attitude of caregivers on physical punishment and practices of emotional violence against children.

This is the first nationally representative study in Myanmar that investigated psychological aggression against children as a form of disciplinary practices by caregivers and its associated factors. Although this study reflects the situation of psychological aggression against children in Myanmar, it had some limitations. Firstly, the secondary data analysis of a cross-sectional survey using Chi-square test to investigate the associated factors could not control the confounders, so that, the results could be interpreted as just associations. Secondly, recall bias and reporting bias may also occur because the practices of all caregivers were asked only towards the respondents. Moreover, the selection of independent variables is restricted by the limitation of data. Potential cofounders on uses of psychological aggression against children such as alcohol drinking, alcohol addiction, socio economic stress, genetic of mental problem of the parent or caregivers could not be included in this study. Since the prevalence of psychological aggression was determined based on 2 questions, it may be different from actual practices which are out of assessment. Lastly, since the data were collected in 2015 – 2016 when there was no enactment of New Child's Right Law (2019) in Myanmar, the practices may be different with the current situations.

CONCLUSION

The prevalence of psychological aggression towards the children is 74.2% in Myanmar. It is significantly associated with individual characteristics: age, sex and education level of the children, and characteristics of the family: parental survivorship, age and sex of primary caregiver, relationship of primary caregiver to children and attitude of primary caregiver towards physical punishment.

RECOMMENDATIONS

Since the psychological aggression against children is very common in Myanmar, it is important to focus on reducing its prevalence and promoting nonviolent disciplinary practices. Based on findings of this study, additional studies are recommended to conduct for planning and implementation of child protection policies and for the response on violence against children. Further research and interventions such as

focus group discussions and health education programs should address and emphasize on understanding attitude of caregivers on physical punishment in relation to their actual practices of psychological aggression against children.

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ASSESSMENT OF INFECTION PREVENTION AND CONTROL MEASURES AGAINST COVID-19 ADOPTED BY UNDERGRADUATE STUDENTS WITHIN THE BANGKOK METROPOLITAN REGION

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ABSTRACT

The acute respiratory viral disease, COVID-19, spread intensely and rapidly across countries, including Thailand. Despite preventive guidelines set by the Thailand government for the public to follow, all three COVID-19 waves were reported to have majorly started from nightlife settings. To effectively contain the pandemic, both strictly following preventive measures and quickly reaching herd immunity via vaccinations are two critical factors. The study objective is to identify infection prevention and control measures against COVID-19 among Thai undergraduate students of two provinces in the Bangkok Metropolitan Region. A preliminary online survey was conducted at the three universities in the Bangkok Metropolitan areas in May 2021. The measurements included socio-demographics, perceptions towards COVID-19 vaccines, and self-assessment of national COVID-19 guidelines adherence. Approximately one-quarter of the participants (26.5%) strictly took minimal precautions to protect themselves from COVID-19 infection. Only 48.5% followed strict social distancing guidelines, and 50.0% practiced frequent handwashing. Chi-square test showed a significant association between perceptions towards COVID-19 vaccines and strict adherence to national COVID-19 guidelines, X^2 (2, N = 68) = 7.655, p = 0.022. Undergraduate students who reported not strictly following COVID-19 preventive measures mostly have neutral views towards COVID-19 vaccines (47.1%). The findings suggested that Thai undergraduate students have conflicted feelings towards the current COVID protection scheme in Thailand. Enforcing to practice safe social distancing and frequent handwashing is compulsory among the undergraduate aged group.

Keywords: COVID-19, undergraduate students, vaccine, prevention, control.

INTRODUCTION

According to WHO, the 2019 novel coronavirus disease, or shortly named as "COVID-19", made its beginning in December 2019(1). The infection started off as clusters of viral pneumonia cases with an unknown cause in a city of China before it has now been considered as a pandemic. This extremely contagious disease spread intensely and quickly across continents, including Thailand which had confirmed more than 578,000 cases with 4679 total deaths as of 30th July 2021(2). This global increased number of cases had put a burden on health workers due to prolonged uses of PPE, insufficient workforce and close contact with high-risk patients, which resulted in health workers' physical and mental illnesses (3). A joint statement was also made by ILO, FAO, IFAD and WHO announcing that the pandemic had affected the food system due to closure of borders and trading (4). Farmers could not buy materials and sell their produce. Not only these agriculture workers faced job loss, but also several other occupations were lost, hence creating a rise in unemployment rates. In the US, the unemployment rate went up from 3.5% in February 2020 to 5.8% in May 2021(5). Economy has been slowed down due to factories and offices being shut down to avoid gatherings. Work and education settings have temporarily changed into online mode. Thus, some activities that require physical presence cannot be conducted, which created a delay in progress. Moreover, the means of transportation, especially airways, have been put under strict guidelines despite the fact that there are now fewer travelers. This lockdown has affected greatly on the tourism industry. In addition, individuals have to take extra steps while going out such as wearing masks, using hand-sanitizer and avoiding crowds, which can mentally stress them. This COVID-19 pandemic, which is occurring recurrently, has created a global turmoil in all sectors. No more losses can be afforded in the fight against this contagious disease.

Thus, with a goal to completely end this pandemic, vaccines were rapidly developed. Protecting the people against COVID-19 is the safest method to stop the community transmission if the total vaccinated rate reaches a certain threshold (6,7). Herd immunity will prevent future outbreaks. Thailand government is also providing COVID-19 vaccines to populations who reside in high-risk provinces since the end of February 2021. Mass public vaccination scheme has already started on 7th June, which inoculated 306,580 people on the first single day (8). It is essential to contain pandemic effectively via reaching herd immunity quickly. In the meantime, taking prevention measures are necessary to reduce cases. WHO guided useful personal prevention measures such as frequent handwashing, social distancing and wearing masks for every citizen of the world to abide by. They published articles such as stating the effectiveness of proper handwashing in eliminating the transfer of COVID-19 and other diseases (9). Moreover, CDC published that staying 6 feet (1.83 meters) from others, avoiding crowds and poorly ventilated areas, and getting vaccinated as standard mechanisms to protect oneself and others from contradicting COVID-19 virus (10).

Similar to other countries, Thailand government also set and informed useful preventive guidelines for the public to follow in order to protect themselves against this highly contagious disease. However, little information is known about how Thai undergraduate student population has responded to the state policy regarding COVID-19. This group of people are exposed to different environments such as culture change, media, peers and university life. Also, they are young adults who act as the influencing medium between their old family members and the outside world. It is important to observe on to what extent they have abided by the guidelines. Thus, the main objective of this study is to conduct a rapid assessment of the infection prevention and control measures against COVID-19 among undergraduate students of two provinces in Bangkok Metropolitan Region (BMR).

METHODS

Study design and area

This rapid assessment was conducted in the areas of Pathum Thani and Nakhon Pathom among six total provinces in BMR. These two provinces were purposely chosen due to the reports of having COVID positive cases which were not very high compared to the other four provinces. The reason behind was that to understand how the undergraduate students have abided by the COVID guidelines to maintain infection-free and to

have a better generalizability using the uninfected target population in a low case area. The universities located in the two selected provinces, were chosen to recruit undergraduate students to participate in this study.

Target Population

Current undergraduate students aged 18 and above, who are Thai citizens with an ability to read and understand Thai language were considered as inclusion criteria for the study population. Also, those participants must be currently enrolled in the chosen three universities, and be able to use electronic forms. Most importantly, the participants must be free of coronavirus disease and must not have received the COVID-19 vaccination during their time of participation within this study. This preliminary data was recruited from the before-mentioned three universities.

Survey measurement

The questionnaire was adopted from existing literature - OCEANS II survey (11), and revised by an expert in the university and translated into Thai language. Then, the extracted questionnaires were transformed to google e-form for online data collection. The final version of the questionnaires included a set of three sections:

1. The first section included multiple choice and short-answer questions about personal demographic factors of the participants such as age, gender, year at university, current travel status to classes, visit history to bars, and their risk perceptions to COVID-19 disease.
2. The second section was about views towards COVID-19 vaccine. So, the participants had to respond to statements such as “Would you take a COVID-19 vaccine if offered?”, Taking a COVID-19 vaccination is:” and etc. They chose among three answers: positive, neutral and negative.
3. The third section asked the participants to self-rate on how much they had adhered to the six statements regarding the national COVID-19 guidelines. It was measured on a five-point Likert scale (all of the time = 1, most of the time = 2, some of the time = 3, occasionally = 4, not at all = 5). Participants who obtained total scoring of 6 were grouped as strictly adhering to guidelines, whereas those who obtained total scoring of 7 to 30 were grouped as not strictly adhering to guidelines.

Procedures

Before data collection, official request letters for permission to collect data with IRB approval certificates were sent to the Deans of universities. Then, one administrative staff from each of three universities were contacted by the principal researcher to kindly collaborate within this study. To decrease contact during the current pandemic, an online survey method via Google Form website was only used. The collaborating administrative staffs used university directories to send a total of 90 official emails with survey link attached. Potential undergraduate students had the right to either participate or not, after reading the introduction informed consent page of the survey. Anonymous preliminary test was completed during May 2021.

Data analysis

Total response rate in this study was 75.6% because there were 68 respondents out of 90 students who were contacted. Hence, the final sample size used for analysis was 68. The analysis was performed using IBM Statistical Packages for the Social Sciences (version 27). Descriptive statistics were calculated to understand the general characteristics of the participants and score the self-assessment sections. Chi-square test of independence was performed to find associations between factors associated with infection prevention and control measures against COVID-19.

Ethical Approval

This research was approved by the Institutional Review Board of Faculty of Social Science and Humanities, Mahidol University in May 2021, with certificate of approval number 2021/064.3105. Informed consent was obtained from participants on the introduction page of the survey.

RESULTS

General characteristics of the participants

The socio-demographic characteristics of participants who responded in the preliminary test were shown in Table 1. Female undergraduate students were dominant participants (82.4%). All participants were aged between 19 and 23, with a mean age of 21.1 years, S.D 1.16. Most of the participants (98.5%) attended online classes only at their universities during this pandemic, hence the self-rated perceived risk toward COVID-19 was generally low among this group of participants. This group of undergraduate participants were dominantly from senior university educational levels (83.8%). Three participants reported to have visited entertainment clubs during April and May 2021.

Table 1 General characteristics of participants (n = 68)

Socio-demographic variables	Number	Percent
Age		
19	9	13.2
20	6	8.8
21	28	41.2
22	17	25.0
23	8	11.8
(*Mean* = 21.13, *S.D* = 1.16, *Min* = 19, *Max* = 23)		
Gender		
Male	12	17.6
Female	56	82.4
University Educational Level		
Year 1 – 2	11	16.2
Year 3 – 4	57	83.8
Travel to Class		
None (Full-time Online)	67	98.5
Sometimes (Online & On-campus)	1	1.5
Self-rate risk of COVID-19		
Low	48	70.6
Moderate	17	25.0
High	3	4.4
Club Visit History (April ~ May 2021)		
0 time	65	95.6
1 - 6 times	2	3.0
≥ 7 times	1	1.5

Assessment of infection prevention and control measures

In this preliminary test, it was found that only 26.5% strictly adhered to all Thai COVID-19 guidelines. Table 2 presented the self-assessment results of how the participants adhered to each of the simple COVID-19 preventive guidelines. Almost all (92.6%) reported that they wore masks strictly at all times when going out in public areas. However, a high number of participants (51.5%) carelessly practiced social distancing which was not staying two meters apart from each other at all times. Also, only half of the participants reported strictly frequent handwashing. When asked to predict their likelihood of adhering to future guidelines, there were 30.9% of participants who responded to carelessly abiding by the rules.

Table 2 Number and percentage of participants related to infection prevention and control measures (n = 68)

Statements	All of the time	Not all of the time
	Number (%)	
1) Not hold or attend gatherings whether it is difficult to maintain social distancing and avoid social interactions.	42(61.8)	26 (38.2)
2) Wear a face covering in public settings.	63(92.6)	5(7.4)
3) Wash the hands with soap and water often, for at least **20** seconds.	34(50.0)	34(50.0)
4) Staying **2** meters apart from other people at all times when going out.	33(48.5)	35(51.5)
5) Overall past experience with following guidance from the government about COVID-19	51(75.0)	17(25.0)
6) Predict and self-rate on following future guidance from the government about COVID-19	47(69.1)	21(30.9)

In Table 3, chi-square test showed that there was a significant association between perceptions towards COVID-19 vaccines and strict adherence to Thailand's national COVID-19 guidelines, X^2 (2, N = 68) = 7.655, p = 0.022 (Table 3). It was found that those 47.1% of those who reported to not have been strictly following COVID-19 preventive measures mostly have neutral views towards COVID-19 vaccines.

Table 3 Association of COVID-19 infection prevention control with independent variables (n = 68)

Independent Variables	National COVID-19 Guidelines Adherence		Pearson Chi-Square	p-value
	Strict n (%)	Not Strict n (%)		
Age Group			2.023	0.732
19 - 21	12 (27.9)	31 (72.1)		
≥ 22	6 (24.0)	19 (76.0)		
Gender			0.720	0.396
Male	2 (16.7)	10 (83.3)		
Female	16 (28.6)	40 (71.4)		
University Educational Level			5.041	0.169
Year 1 - Year 2	2 (18.2)	9 (81.8)		
Year 3 - Year 4	16 (28.1)	41 (71.9)		
Travel to Class			2.819	0.093
None (Full-time Online)	17 (25.4)	50 (74.6)		
Sometimes (Online & On-campus)	1 (100.0)	-		
Self-rate risk of COVID-19			1.064	0.587
Low	11 (22.9)	37 (77.1)		
Moderate	6 (35.3)	11 (64.7)		
High	1 (33.3)	2 (66.7)		
Club Visit History (April ~ May 2021)			3.501	0.321
0 time	17 (26.2)	48 (73.8)		
1 - 6 times	-	2 (100.0)		
≥ 7 times	1 (100.0)	-		
Perceptions toward COVID-19 vaccine			7.655	0.022*
Negative views	6 (50.0)	6 (50.0)		
Neutral views	5 (13.5)	32 (86.5)		
Positive views	7 (36.8)	12 (63.2)		
***p-value* ≤ 0.05**				

DISCUSSION

This rapid assessment has found that undergraduate students were adhering to COVID-19 protection guidelines, which is satisfactory because their behaviors could influence their peers' adherence behaviors (12). Among four main preventive behaviors, mask wearing was prominently practiced at 92.6%. Similar results were also found in literature (12-14). Most people positively viewed masks as the mechanism to stop COVID-19 transmission (13). Especially in Asian countries, studies have found that mask-wearing was significantly practiced at 94.0%, 99.4% and 98.0% in Thailand, Vietnam and China respectively (14,15). The second most followed preventive measure, at 61.8%, was avoiding gatherings. Similarly, there were only three undergraduate students who admitted having visited clubs during April - May 2021.

In addition, our study revealed that only half of the participants practiced frequent handwashing using soap. Those who did not wash hands often might have the difficulty assessing appropriate facility that has water and soap (16). In order to compensate for this, the use of hand sanitizers must be promoted. The least practiced preventive behavior was social distancing. Only 48.5% undergraduate students practiced staying two meters apart at all times in public settings. A similar result was found that about 53% Thai adult public practiced social distancing16. Despite the educational videos shown to this Thai public once every month for two consecutive months, total participants, who practiced strict social distancing, only increased to about 76%. The reason could be that remembering to keep a safe distance while communicating and travelling is difficult. So, some people tend to interact at less than 2 meters unconsciously.

An online survey in the US showed that the people's adherence to preventive behaviors could change depending on the studying timeframe (13). Therefore, it is necessary to continue educating and persuading the public with preventive behaviors because people will forget to take personal precautions as vaccination rates go up. It was suggested in an article about role models and respected individuals creating a new social norm could support the likelihood to adhere to the COVID-19 guidelines (17). Thus, social influencers should be used as mediators to promote the use of preventive behaviors. In our study, a significant association was found between perceptions towards COVID-19 vaccine and guidelines adherence. So, similar populations, like 47.1% participants who viewed COVID-19 vaccine as neutral, must be targeted to increase awareness about effectiveness of vaccinations and strict adherence. A study on Thai public found that healthcare workers, employers, work colleagues, government websites, WHO and television were considered as trustworthy sources to search for COVID-19 related information (16). Therefore, strict laws regarding COVID-19 infection prevention and control measures should be established and announced in the before-mentioned channels to increase the reach to the public.

STUDY LIMITATIONS

One of the main biases within this study was sample selection bias as the participants were recruited from specific selected universities and had the right to deny participation upon invitation. Since responses were collected via self-administered online survey method, self-reporting biases such as social desirability bias and recall bias could be included. Also, further analysis should be done because the results presented above were from a preliminary test. Moreover, due to small sample size, these preliminary results cannot be generalized to a larger undergraduate population of the intended two provinces of BMR yet. These results cannot also be generalized to other populations with diverse socio-demographic characteristics.

CONCLUSION

The results from preliminary test of this study suggested that Thai undergraduate students have conflicted views about COVID-19 vaccines. Hence, it would be beneficial to oblige undergraduate group to strictly adhere to all COVID-19 guidelines, which will not only stop community transmission but also influence others in their environment. Thai public health officials should enforce laws about practicing safe social distancing and frequent handwashing.

RECOMMENDATIONS

The authors recommend performing follow up research after the undergraduate student population get vaccinated against COVID-19 to investigate deeper about their confidence towards infection prevention via vaccinations. In addition, this research recommends Thai policymakers and law enforcers to utilize the findings to encourage the public to strictly follow COVID-19 prevention guidelines. The university committee should constantly remind and educate their students to strictly abide by the infection prevention and control measures. Also, incentives should be given such as free distribution of hand-sanitizers and masks.

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FACTORS ASSOCIATED WITH HIV STATUS DISCLOSURE AMONG MEN WHO HAVE SEX WITH MEN IN BALI, INDONESIA

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ABSTRACT

HIV disclosure as part of the discussion when having sex can be an effective approach for HIV prevention as it can lead to more effective condom use. However, revealing one's HIV status is uneasy, especially among men who have sex with men (MSM) in the context of Indonesia. This study aimed to examine the factors associated with HIV status disclosure among MSM in Bali, Indonesia. There were 370 MSM involved, obtained from *SEKSI* 2019 dataset. This study was a cross-sectional survey using online data collection. A Chi-square test was applied for bivariate analysis, while a binary logistic regression was employed for the multivariate analysis. Only 24.3% of MSM in this study had disclosed their HIV status with their non-permanent partners. The Chi-square test found that duration of stay in Bali ($p = 0.007$), discrimination experience ($p < 0.001$), and engagement in paid sex ($p = 0.046$) were significantly associated with HIV status disclosure among MSM. In multivariate analysis, factors associated with increased likelihood of disclosing HIV status among MSM are engaged in paid sex (AOR=2.11; 95%CI=1.12-3.98). Conversely, factors associated with decreased likelihood to disclose the HIV status among MSM is experienced discrimination (AOR=0.43; 95%CI=0.25-0.75). MSM who engaged in paid sex might be easier to have HIV discussion before sex, or it might be the sex workers who required the clients to reveal their HIV status, as the sex workers do not want to risk themselves. These situations might explain why MSM who engaged in paid sex were more likely to disclose their HIV status. Similar to other studies, discrimination experiences were found significant barriers to HIV disclosure. The intervention can be focused on the individual level (e.g., managing negative consequences of disclosure) and the community level (e.g., public campaign to reduce discrimination).

Keywords: HIV status disclosure, MSM, discrimination, Indonesia

INTRODUCTION

Indonesia is considered as one of the fastest-growing HIV epidemics in the world because AIDS-related deaths have not decreased and the HIV prevalence increased significantly since 2010(1). In 2019, the number of HIV cases in Indonesia was 50,282 cases, which has increased from 46,650 cases in 2018 (2). The AIDS case rate in Indonesia during 2019 was 38.93 cases per 100,000 population. Even though the HIV prevalence is still low in the general population at 0.5%, but it was more than 5% among key populations, which is considered a concentrated epidemic(3). According to the data from UNAIDS (2020), the HIV prevalence among sex workers was decreased from 9% in 2011 to 5.3% in 2015. The prevalence of HIV among people who inject drugs also has decreased from 36.4% in 2011 to 28.8% in 2015. Among prisoners, the HIV prevalence also has decreased from 3% in 2015 to 1% in 2017. While the HIV prevalence among sex workers, people who were injected with drugs, and prisoners relatively decreased, the trends among men who have sex with men (MSM) have increased from 8.5% in 2011 to 25.8% in 2015. Moreover, the last integrated biological and behavioral survey (IBBS) conducted by the Ministry of Health (MoH) of Indonesia in 2018-2019 showed that the HIV prevalence ranging from 17.9% among MSM, 13.6% among people who inject drugs, 11.9% among transgender women, and 2.1% among female sex workers(4).According to this situation, MSM is still a key driver of HIV transmission in Indonesia.

Being an MSM is not socially accepted in the context of Indonesia because the behavior is considered to violate religious values(5). Moreover, prohibitive cultural perspectives and norms against same-sex marriage made MSM conceal their sexual orientation and engage in unprotected sex (6).As a consequence, the MSM tended to hide and was difficult to reach by the HIV program(7). The barriers in accessing adequate HIV services among MSM were not only because of their sexual orientation but also related to being afraid of being stigmatized and discriminated against regarding their HIV status(8-10). A Qualitative study among HIV-positive MSM in three Indonesian cities found that fear of unwanted disclosure inhibited the treatment uptake(11) Even in HIV prevention, being afraid of being rejected by their peers and partners regarding the HIV status reduce the interest and intention of using pre-exposure prophylaxis (PrEP) among MSM in Bali (12) Regarding this situation, the stigma and discrimination related to HIV status and sexual orientation among MSM have detained the progress of the HIV program in Indonesia, especially in promoting people to get HIV tested, engage in treatment services, and also prevent HIV transmission(1, 13).

HIV status disclosure as part of the discussion when having sex can be an effective approach for HIV prevention, as it can lead to more effective condom use. When an individual with HIV-negative knew that their sexual partner is HIV-positive, they tended to use condoms when having sex to prevent HIV transmission(14). On the other side, those who are HIV-positive may want to disclose their HIV status to their partners who are HIV-negative, as the responsibility to protect their partners from HIV transmission(15) However, revealing one's HIV status is uneasy. To date, there are only a few published studies that explore the HIV status disclosure practice that focuses on non-permanent partners. The HIV status disclosure practice to non-permanent partners is associated with risky sexual behavior, sexual negotiation skills, and new treatment optimism(16, 17). Moreover, the communication norm with non-permanent partners is different compared to the permanent partners. There may be little or no verbal communication with a non-permanent partner, which results in no discussion about the private information (18). When this situation happened, individuals tended to rely on the assumptions of their partner's status. A study in China found that when the partner of MSM wants to engage in unprotected sex, 79% of HIV-negative MSM assumed that those partners are HIV-negative, while 32% of the HIV-positive MSM will be assumed that those partners were HIV-positive(19). Faulty assumptions regarding the partner's HIV status could lead to serious implications, such as an increase in the risk of HIV transmission.

Even though HIV status disclosure practices are considered a good strategy in preventing HIV transmission (20), there is limited published research attempted to identify the HIV disclosure practice among MSM in Bali and Indonesia. A study in Batam, Indonesia found that there is a significant correlation between HIV status disclosure with condom use(21). Some qualitative

studies in Medan and Yogyakarta also found that fear of stigma and discrimination related to HIV status and sexual orientation become barriers in accessing HIV services among MSM(6, 11, 22). Therefore, this study aimed to investigate the factors associated with HIV status disclosure with non-permanent partners among MSM in Bali, Indonesia.

METHODS

Data Source

This was a cross-sectional study that uses the dataset from the "Studi Kesehatan Seksual Indonesia (SEKSI) 2019" conducted by the Center for Public Health Innovation (CPHI), Faculty of Medicine, Udayana University from August 2019 to February 2020. SEKSI 2019 uses an online self-administered questionnaire for data collection, which targets the MSM group in Bali Province. The sample size was calculated using the OpenEpi Version 3, by assuming that the proportion of MSM who disclose their HIV status is 43.7% according to a study conducted in Batam, Indonesia.23 Moreover, the sample was recruited using a snowball sampling technique, by sharing the study information through the MSM community (including gay apps and social media) and partner referral. Those who did not know their HIV status and only have sex with permanent sexual partners were excluded from the analysis. For this analysis, there were 370 MSM included.

Variables

The dependent variable of this study was HIV status disclosure to non-permanent partners, defined as the situation when MSM disclosed their HIV status but did not know the partner's HIV status. Meanwhile, the independent variables consisted of HIV Disclosure Model constructs and modifying factors. HIV Disclosure Model comprised of discrimination experience, perception on HIV prevention, finding sexual partners, social engagement, and engaged in paid sex. Modifying factors comprised of age characteristics, level of education, domicile, duration of stay in Bali, length of HIV diagnosed, and HIV status.

Statistical Analysis

A Series of statistical analyses were performed using STATA 15 software. Univariate analysis was applied to describe the proportion of HIV status disclosure to non-permanent partners and other characteristics. The Chi-square test and binary logistic regression were employed to examine factors associated with HIV status disclosure for bivariate and multivariate analysis, respectively. The enter method was used to develop the multivariate model in examining the effect of HIV Disclosure Model constructs by controlling for all modifying factors(18). The association of multivariate analysis was presented in adjusted odds ratio (AOR), 95% confidence interval (CI), and p-value.

Ethical Consideration

Primary data collection of which this study is based on has been approved by the Research Ethics Commission, Faculty of Medicine, Udayana University/ Sanglah General Public Hospital, Denpasar, Bali, Indonesia with No. 1402/UN14.2.2.VII.14/LT/2020. MSM who were involved in this study was voluntary and anonymous and online informed consent was obtained from the survey. In addition, this study also has been approved by the IRB at IPSR, Mahidol University, with COE. No. 2021/06-133.

RESULTS

Based on table 1, the majority of MSM were 25 years old or older (71.9%) and completed senior high school or higher (89.2%). More than half of MSM living in Denpasar (57.3%) and about 44.0% of MSM have stayed in Bali for more than 2 years. The majority of MSM also took the latest HIV tests less than 12 months ago (83.2%), which most of them were HIV-negative (78.7%). More than half of MSM experienced discrimination (73.8%) and have a good perception about HIV prevention (56.2%). In terms of finding sexual partners, most MSM finds their sexual partners both from the public venue and the internet (64.6%). Moreover, the majority of MSM have low social engagement with the gay or MSM communities (73.0%) and stated that they engaged in paid sex during the last six months (73.0%). In addition, most MSM did not disclose their HIV status to their non-permanent partners (75.7%).

Table 1 Demographic characteristics, HIV Disclosure Model constructs, and HIV status disclosure among MSM (n=370)

Variable	Frequency (n=370)	Percentage (%)
Age		
< 25 years old	104	28.1
≥ 25 years old	266	71.9
Level of education		
< Senior high school	40	10.8
Senior high school or higher	330	89.2
Domicile		
Outside Denpasar	158	42.7
Denpasar	212	57.3
Duration of stay in Bali		
Since birth	108	29.2
2 years or less	99	26.8
More than 2 years	163	44.0
Periods of HIV diagnosed		
< 12 months ago	308	83.2
≥ 12 months ago	62	16.8
HIV status		
Negative	291	78.7
Positive	79	21.3
Discrimination experience		
No	97	26.2
Yes	273	73.8
Perception about HIV prevention		
Bad	162	43.8
Good	208	56.2
Finding sexual partners		
Other ways (e.g. introduced by friends)	14	3.8
Public venue only	17	4.6
Internet only	100	27.0
Both public venue and internet	239	64.6
Social engagement		
Low	270	73.0
High	100	27.0
Engaged in paid sex		
No	100	27.0
Yes	270	73.0
HIV status disclosure		
No HIV disclosure	280	75.7
HIV disclosure	90	24.3

Table 2 shows the association between HIV status disclosure and demographic characteristics using the Chi-square test. Factors significantly associated with HIV status disclosure were duration of stay in Bali ($p = 0.007$), discrimination experience ($p < 0.001$) and engaged in paid sex ($p = 0.046$). These significant associations are in concordance with the results of binary logistic regression.

Table 2 The association between HIV status disclosure and demographic characteristics using Chi-square test (n=370)

Variable	HIV status disclosure		*p*-value
	No HIV Disclosure n (%)	HIV Disclosure n (%)	
Age			
< 25 years old	85 (81.7)	19 (18.3)	0.090
≥ 25 years old	195 (73.3)	71 (26.7)	
Level of education			
< Senior high school	33 (82.5)	7 (17.5)	0.287
Senior high school or higher	247 (74.9)	83 (25.1)	
Domicile			
Outside Denpasar	127 (80.4)	31 (19.6)	0.069
Denpasar	153 (72.2)	59 (27.8)	
Duration of stay in Bali			
Since birth	93 (86.1)	15 (13.9)	0.007**
2 years or less	74 (74.8)	25 (25.2)	
More than 2 years	113 (69.3)	50 (30.7)	
Periods of HIV diagnosed			
< 12 months ago	229 (74.4)	79 (25.6)	0.185
≥ 12 months ago	51 (82.3)	11 (17.7)	
HIV status			
Negative	219 (75.3)	72 (24.7)	0.719
Positive	61 (77.2)	18 (22.8)	
Discrimination experience			
No	60 (61.9)	37 (38.1)	<0.001**
Yes	220 (80.6)	53 (19.4)	
Perception about HIV prevention			
Bad	115 (71.0)	47 (29.0)	0.064
Good	165 (79.3)	43 (20.7)	
Finding sexual partners			
Introduced by friends	13 (92.9)	1 (7.1)	0.055[a]
Public venue only	16 (94.1)	1 (5.9)	
Internet only	79 (79.0)	21 (21.0)	
Both public venue and internet	172 (72.0)	67 (28.0)	
Social engagement			
Low	211 (78.2)	59 (21.8)	0.069
High	69 (69.0)	31 (31.0)	
Engaged in paid sex			
No	83 (83.0)	17 (17.0)	0.046*
Yes	197 (73.0)	73 (27.0)	

Note: [a] Fisher's exact test; **p*-value < 0.05, ***p*-value < 0.01.

The multivariate model in Table 3 informs that factors associated with HIV status disclosure to non-permanent partners among MSM consisted of discrimination experience and engagement in paid sex. MSM who experienced discrimination were 57% less likely to disclose their HIV status to non-permanent partners compared to those who did not experience discrimination (AOR = 0.43; 95%CI = 0.25-0.75; p = 0.003). On the other hand, MSM who engaged in paid sex were 2.11 times more likely to disclose their HIV status to non-permanent partners than those who did not engage in paid sex (AOR = 2.11; 95%CI = 1.12-3.98; p = 0.021). In addition, there was no interaction effect found between perception about HIV prevention and engagement in paid sex (p = 0.446), and also no high correlation found among variables by multicollinearity testing.

Table 3. Factors associated with HIV status disclosure among MSM (n=370)

Variables	AOR (95% CI)	p-value
Age		
< 25 years old	Ref	
≥ 25 years old	1.45 (0.79-2.67)	0.234
Level of education		
< Senior high school	0.47 (0.18-1.18)	0.107
Senior high school or higher	Ref	
Domicile		
Outside Denpasar	Ref	
Denpasar	1.22 (0.70-2.14)	0.484
Duration of stay in Bali		
Since birth	0.55 (0.25-1.20)	0.132
2 years or less	Ref	
More than 2 years	1.34 (0.72-2.49)	0.354
Periods of HIV diagnosed		
< 12 months ago	Ref	
≥ 12 months ago	0.57 (0.25-1.31)	0.188
HIV status		
Negative	Ref	
Positive	1.02 (0.51-2.06)	0.956
Discrimination experience		
No	Ref	
Yes	0.43 (0.25-0.75)	0.003**
Perception about HIV prevention		
Bad	Ref	
Good	0.69 (0.41-1.14)	0.149
Finding sexual partners		
Introduced by friends	0.22 (0.03-1.80)	0.160
Public venue only	0.18 (0.02-1.51)	0.114
Internet-only	0.70 (0.38-1.27)	0.238
Both public venue and internet	Ref	
Social engagement		
Low	Ref	
High	1.17 (0.65-2.12)	0.595
Engaged in paid sex		
No	Ref	
Yes	2.11 (1.12-3.98)	0.021*

DISCUSSION

As this study found that 24.3% of MSM had disclosed their HIV status, this was lower compared to a study conducted in Batam, Indonesia (43.7%)(23). This could be affected by the different study designs. The study in Batam, Indonesia use purposive sampling, face-to-face interviews, and recruit only HIV-positive MSM from the HIV clinics and hospitals. While this study uses a snowball sampling technique, recruits both HIV-positive and HIV-negative MSM from the internet, and excludes those who have sex with a permanent partner only. As the majority of MSM in this study were HIV-negative which tended to not disclose their status because they may feel "normal", this might explain the lower proportion of HIV disclosure that was found in this study(15, 24, 25).

In reducing HIV transmission, the results of this study provide meaningful findings that can potentially contribute to the improvements of HIV prevention programs among MSM in Indonesia. This study found that the discrimination experience was associated with decreasing likelihood of HIV status disclosure among MSM. Discrimination experience in this study refers to any discrimination perceived by respondents related to being an MSM, including their sexual orientation and gender identity. This finding indicated that those who have experienced discrimination were less likely to disclose their HIV status to their non-permanent sexual

partners. This result confirmed that the discrimination among MSM still exists and is also a significant barrier to HIV disclosure(21). Discrimination among MSM in the Indonesian context was related to some issues, such as prohibitive cultural perspectives, norms against same-sex marriage, and community belief that MSM behavior violate religious values(5, 6).

Moreover, MSM also perceived stigma and discrimination regarding their HIV status.9 A high proportion of MSM who did not disclose their HIV status in this study might imply the manifestation of an internalized social stigma **(**e.g**.** self-blame and self-loathing**)**, which could affect the decision to avoid the negative consequences of HIV status disclosure(26-28).

To encourage MSM in discussing HIV status with their partners before sex and prevent HIV transmission, MSM also needs to be equipped with adequate skills in managing negative consequences of disclosure as well as knowledge about the benefit of disclosing HIV status to sexual partners(23**,** 29)**.** Knowledge about the benefit of disclosure is important to prevent serosorting behavior that relies on assumptions that can lead to faulty assumptions**(19**, **25).** Moreover, community interventions that focus on reducing the stigma and discrimination related to HIV AIDS, and sexual orientation issues were also important**.** A qualitative study among MSM in five cities in Indonesia found that involving MSM or gay communities in outreach programs could reduce the stigma and discrimination, which also increases the engagement of MSM on the service uptake**.9** Therefore, it is essential to provide support and services for MSM whenever needed, especially by reducing the stigma and discrimination (30).

This study also found that MSM who engaged in paid sex were more likely to disclose their HIV status to non**-**permanent partners**.** Paid sex in this study refers to any sexual activities when the respondents give **(**or pay**)** and receive money, goods, services, or other items in exchange for sex**.** This indicated that MSM who engaged in paid sex might be easier to have HIV discussion before sex(31). The decision of disclosing HIV status in paid sex also could be explained by the concept of responsibility to protect themselves and their partners from HIV infection.(32, 33). Another situation might be the sex workers who required the clients to reveal their HIV status, as the sex workers do not want to risk themselves(34). However, this study not able to differentiate whether the MSM participated in this study as sex workers or clients, so the status disclosure in this study only focuses on the respondents' side and is not able to explain the HIV disclosure from the partner's side as well as mutual disclosure (both respondent and their partners). Moreover, this study also found that there was no interaction effect between the perceptions about HIV prevention with engagement in paid sex behavior, which implied that the decision for disclosing the HIV status was not affected by the perceptions. This finding was different from the previous study when higher perceptions about HIV prevention decrease the likelihood of HIV status disclosure among MSM.(35). To promote the disclosure practice before sex regardless of types of sexual activities, increasing the awareness of MSM regarding the benefit of disclosure is essential. Therefore, health promotion in encouraging MSM to discuss their HIV status before sex and promote partners to take HIV test was also a strategic approach to reduce the HIV transmission among MSM(10, 11).

In addition, this study also found that there were no modifying factors in the multivariate analysis that as a predictor of HIV status disclosure. Those factors consisted of age characteristics, level of education, domicile, duration of stay in Bali, periods of HIV diagnosis, and HIV status. In terms of HIV Disclosure Model constructs, perception about HIV prevention, finding sexual partners, and social engagement are also not predictors of HIV status disclosure. These findings were different compared to other studies, which could be affected by different study settings as well as social factors (e.g. community acceptance of MSM between the Indonesian context and other countries)(19, 23).

This study has several limitations. This study only focuses on the disclosure practice to non-permanent partners as an "intended" disclosure, which is not able to depict the disclosure practice as a dynamic process and as an "unintended" disclosure.(15, 36). Some factors that affect the decision for HIV disclosure from previous studies could not be included in the analysis, such as types of partners with whom HIV is disclosed, condom use, substance, and alcohol use behavior, the knowledge about HIV(24, 37, 38). Moreover, this study also uses online data collection which could produce biased selection. Despite the

limitations, this study provides insightful findings and discussion that are essential to promote HIV status disclosure practice among MSM in Bali, Indonesia.

CONCLUSION

In conclusion, the proportion of HIV status disclosure among MSM was 24.3%. The factor that increases the likelihood of disclosure was engaged in paid sex, while the factor that decreases the likelihood of disclosure among MSM was experience discrimination. On the other hand, the modifying factors (e.g. age characteristics, level of education, domicile, duration of stay in Bali, periods of HIV diagnosis, and HIV status) and other HIV Disclosure Model constructs (e.g. perception about HIV prevention, finding sexual partners, and social engagement) was not significantly associated with the HIV status disclosure among MSM in this study.

RECOMMENDATIONS

The intervention can be focused on the individual level (e.g. managing negative consequences of disclosure) and also on the community level (e.g. public campaign to reduce discrimination). This is essential to encourage MSM to discuss their HIV status before sex as well as provide better HIV services for them. In addition, it is important to conduct further research that uses a different approach to measuring the disclosure practice, especially considering the mutual disclosure concept and perspective of disclosure as a dynamic event.

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SOCIOECONOMIC INEQUITY IN ANTENATAL CARE SERVICE UTILIZATION AMONG YOUNG MOTHERS IN MYANMAR

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ABSTRACT

Inadequate antenatal care (ANC) for pregnant women, particularly younger women, poses potential health risks to these women in many countries. Even though access to and utilization of reproductive health services can be undermined by many demographic and geographical barriers, disparities in socioeconomic status on their own may also determine the use of these services among pregnant mothers. The objective of this study was to identify the level of ANC service utilization and assess whether the socioeconomic position was independently associated with ANC service utilization among young Myanmar mothers. Secondary data were drawn from the Myanmar Demographic Health Survey (2015-2016). The sample consisted of 721 young mothers (15-24 years) who had at least one child within 5 years prior to the survey interview. The level of ANC use was measured in the percentage of ANC utilization among young pregnant mothers who had received at least four ANC visits and compared to national and global level utilization among reproductive-age women. Bivariate and multivariate logistic regression were used to test the associations between ANC service utilization and socioeconomic status, controlling for potential confounders (i.e., geographic locations, demographic and reproductive characteristics) and potential mediators (i.e., mass media exposure and problems in accessing health care services). The findings showed that levels of ANC use were relatively low among young Myanmar mothers (46.3% and 54.5% among 15-19 and 20-24 year-olds, respectively). Young mothers with higher education levels were more likely to use services than those from lower educational backgrounds (odd ratios = 1.12, 95% CI = 1.07 - 1.19, $p < 0.001$). After adjusting for geographic, demographic and reproductive characteristics, the association remained significant (adjusted odd ratios = 1.10, 95% CI = 1.04 - 1.16, $p < 0.01$). Further, controlling for mass media exposure and problems in accessing health hardly reduced the strength of the association (adjusted odd ratios = 1.09, 95% CI = 1.02 - 1.15, $p < 0.01$). The findings suggested that the utilization of antenatal care services among young mothers can be partially fostered through improving education and addressing other socio-demographic barriers. In the short term, providing ANC education to poorly educated young mothers and their families may improve services. In the longer term, improving access to higher education for Myanmar women, in general, may reduce premature motherhood and also increase the use of ANC services among those who need them.

Keywords: antenatal care service utilization, young mother, social determinants

INTRODUCTION

Teenage motherhood has a potential influence on the health of individuals or consequences of socioeconomic problems in the later life of adolescents and therefore, it has become a global alarming problem (1). Adolescent pregnancy is also related to various health risks not only for adolescents mothers but for their babies as well (2). Poor pregnancy outcomes such as anemia, obstructed delivery, emergency Caesarean delivery, maternal mortality and newborn complications such as low birth weight, premature birth and increased perinatal and infant mortality are serious outcomes of teenage childbearing (3). Globally, around 70,000 teenage women die due to pregnancy and delivery-related causes yearly which are mostly from low-income countries and maternal mortality has become the leading cause of death among women in those countries (1).

Consequently, timely and quality antenatal care (ANC) service utilization has become a crucial health care intervention to reduce maternal mortality and for better pregnancy outcomes (4). Improving maternal and neonatal outcomes is highly associated with the utilization of ANC services among teenage mothers (5). The 2017 SDG report showed that there were some improvements in maternal mortality and utilization of maternal care services in many countries (6). Nevertheless, the utilization of ANC services differed among low and middle-income countries due to the disparity in various determinants such as age, geography, socioeconomic status, cultural beliefs and financial accessibility, etc.

According to the Myanmar Demographic Health Survey 2015-2016, the percentage of maternal deaths due to pregnancy-related causes among 15-19 years adolescents and 20-24 years youths is 2.6 and 7.7 at the time of the survey (7). Myanmar government had implemented a 5 Year Strategic Plan for Reproductive Health to decrease the maternal mortality ratio to 1.45 per 1,000 live births and to improve ANC service coverage (at least once) to 80% by the year 2015 (8). Maternal mortality has been reducing and ANC service utilization has been increasing in Myanmar like other regional and neighborhood countries but the mortality rate was still high compared to other nations such as Singapore, Thailand and Brunei (9).

Even though access to and utilization of reproductive health services should be equitably obtained by everyone who needs health services, inequity in accessing health care services among different levels of socioeconomic statuses and geographical locations can deteriorate the health status of young people. Comparing the health service use between high and low-income countries, poorer people from rich countries use more health care services as they have a higher need whereas, in low-income countries, poorer people have low use of health care services due to poverty and unaffordability of the health care cost even though they have a higher need (10). Therefore, people from low socioeconomic conditions experience poor health conditions and a greater need exists for health care services among poorer people, especially in low-income countries. In addition, even though SRH services and interventions are essential for adolescents, there remains very limited access to and use of health services among adolescents and youth (11). The accessibility and use of health care services, especially SRH services are essential and play a significant role in the reproductive life of adolescents (12).

In Myanmar, due to over 50 years of armed conflict between ethnic armed groups and the military has continued and made substantial disparities in regional and economic development, the health care system and health status of individuals especially between conflict-affected ethnic minority areas and non-conflict-affected central regions of Myanmar (13). As a result, people in conflict-affected ethnic areas have had poor health status, high maternal and neonatal mortality due to limited health care and disease prevention measures (14, 15). Hence, the geographical disparity in access to and utilization of ANC services for adolescents who need health care services is one of the important issues but it has not been studied by many researchers in Myanmar yet as most of the studies were conducted in a specific area of Myanmar, not countrywide assessment.

In summary, the level of utilization of ANC services and equity in access to health care among adolescents and young women who need health services are important issues to reduce pregnancy complications, maternal death and neonatal mortality among adolescent girls. Besides, previous studies showed that the level of ANC service utilization differed with age groups,

however, in Myanmar, there is little attention to analyze ANC service utilization between adolescent girls and adult women. Therefore, it is necessary to identify the level and social determinants of ANC service utilization among adolescents and adult women in Myanmar.

METHODOLOGY

Sample

In this study, the total sample consisted of 3728 females of 15-24 years age group from the Myanmar Demographic Health Survey (MDHS). Among them, 721 women were selected with the criteria of having at least one birth within the last five years. According to the sampling procedure of MDHS, it involved a stratified two-stage sample design and was conducted across the country, at the seven States and eight Regions. In the first stage sampling, a total of 442 clusters (123 urban and 319 rural) were selected and in the second stage, 30 households were chosen from each selected cluster, using equal probability systematic sampling.

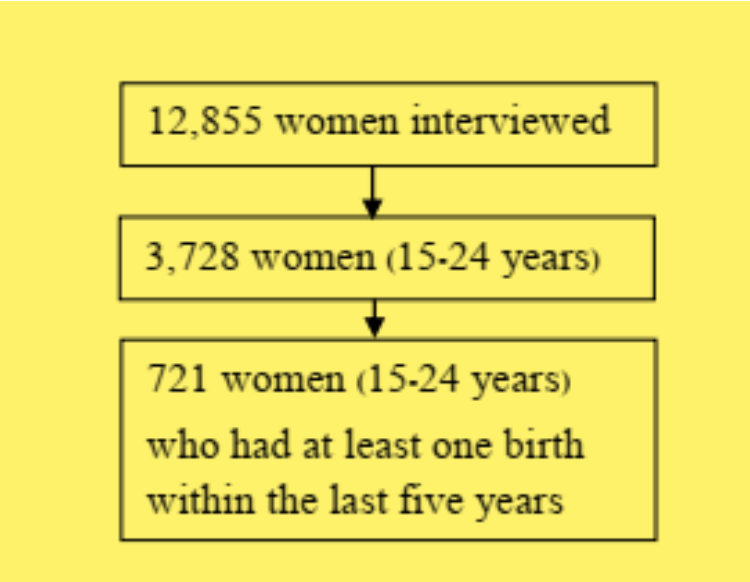

Figure 1 *Sampling Flow Chart*

Analysis

In this study, the outcome measure was ANC service utilization at least four times with skilled health personnel among adolescents and young adults. The independent variables in this study were socioeconomic characteristics such as education status, partner or husband's education, and wealth quintile which were analyzed as structural factors. To calculate for the wealth quintile, the wealth Index was measured by giving scores based on ownership of households such as television, bicycle or car, source of drinking water, type of latrine and structure of the house, etc. These scores were calculated using the principal component analysis method. Then, wealth quintiles were calculated by ranking the score of the household to the individual household member and divided each 20% of the population into five equal categories (i.e poorest, poorer, middle, richer and richest).

Exposure to mass media and problems in accessing health services were analyzed as an intermediary factor as these factors could be influenced by socioeconomic positions of people and have impacts on ANC service use. Problems in accessing health care services were measured as having barriers or

problems to receive health care (i.e getting permission from husband or family to receive health care, financial problems, the distance to the health facility and not wanting to go alone). Besides, geographical factors such as regions and place of residence and demographic and reproductive characteristics such as age and age at first marriage will also be analyzed as potential confounders for ANC use because they can influence the socioeconomic statuses of individuals, depending on disparities in geographic areas, age or reproductive status, and can directly affect ANC service use.

To conduct the study, data were analyzed by using STATA software and the analysis included a descriptive statistic, using frequency and percentage to express the background characteristics of young mothers by ANC service utilization. Bivariate and multivariate logistic regression will be used to show the associations between health service utilization and other factors. In the multivariate analysis, the utilization of antenatal care services was analyzed through three models to identify determinants affecting ANC service utilization. In the first model, multivariate analysis was done between ANC utilization and socioeconomic factors such as respondent's education, partner or husband's education, employment and wealth status. The second model analyzed the association between the utilization of ANC services and geographical locations, demographic and reproductive characteristics, and socioeconomic status. In the last model, multivariate analysis was done to identify the association between antenatal care service utilization and an intermediary factor such as exposure to mass media, problems in accessing health care services, geographical locations, demographic and reproductive characteristics, and socioeconomic status.

The likelihood-ratio test, AIC and BIC tests were performed to test the model fitness. The third model that included the predictors, socioeconomic status, confounders such as geographical, demographic and reproductive characteristics, an intermediary factor such as exposure to mass media, and problems in accessing health care services was found as the best-fitted model.

RESULTS

Background Characteristics

Table 1 showed the background characteristics of young mothers (15-24 years) who had at least one birth within the last five years by antenatal care service utilization with skilled health personnel at the time of the survey and ANC service utilization rate of adolescents (15-19 years) and young adults (20-24 years) showed 46.3% and 54.5% respectively.

Regarding the geographical composition of participants, young mothers from Yangon and Mandalay regions had the highest ANC service utilization, 81.8%, and 71.9% respectively, and those from Chin and Rakhine states had the lowest ANC service utilization rate, only 32.8%, and 37.3%. Besides, young mothers from non-conflict-affected and urban areas had used more ANC services than those from low and high conflict-affected and rural areas

Table 1 Antenatal care service utilization among young mothers in Myanmar and its associated factors

Background characteristics	ANC service utilization (at least four times with skilled health personnel) (n=721)						
	Yes (n=385)		No (n=336)		Total	X^2	p-value
	n	(%)	n	(%)			
Demographic and Reproductive Characteristics							
Age						**2.2**	**0.138**
15-19	44	(46.3)	51	(53.7)	95		
20-24	341	(54.5)	285	(45.5)	626		
Mean age (SD)				21.73 (1.9)			
Age at first marriage						**22.73*** **	**<0.001**
<15	12	(26.1)	34	(73.9)	46		
15-19	279	(52.4)	253	(47.6)	532		
20-24	94	(65.7)	49	(34.3)	143		
Mean age at first marriage (SD)				17.64 (2.1)			
Geographical Factors							
States & Regions						**51.13*** **	**<0.001**
Kachin	35	(67.3)	17	(32.7)	52		
Kayah	38	(71.7)	15	(28.3)	53		
Kayin	26	(52.0)	24	(48.0)	50		
Chin	20	(32.8)	41	(67.2)	61		
Sagaing	25	(59.5)	17	(40.5)	42		
Taninthayi	25	(55.6)	20	(44.4)	45		
Bago	24	(50.0)	24	(50.0)	48		
Magway	19	(51.4)	18	(48.7)	37		
Mandalay	23	(71.9)	9	(28.1)	32		
Mon	19	(52.8)	17	(47.2)	36		
Rakhine	25	(37.3)	42	(62.7)	67		
Yangon	27	(81.8)	6	(18.2)	33		
Shan	26	(38.2)	42	(61.8)	68		
Ayeyarwaddy	31	(53.5)	27	(46.6)	58		
Naypyitaw	22	(56.4)	17	(43.6)	39		
Areas of Subnational Conflict						**9.42** **	**0.009**
Non-conflict-affected areas	147	(61.0)	94	(39.0)			
Low-conflict-affected areas	126	(51.9)	117	(48.2)			
High-conflict-affected areas	112	(47.3)	125	(52.7)			
Place of Residence						**45.45*** **	**<0.001**
Urban	118	(77.6)	34	(22.4)			
Rural	267	(46.9)	302	(53.1)			
Socioeconomic Status							
Respondent's Education completed in single year						**-40.02*** **	**<0.001**
Mean (SD)				5.74 (3.5)			

Background characteristics	ANC service utilization (at least four times with skilled health personnel) (n=721)						
	Yes (n=385)		No (n=336)		Total	X^2	p-value
Husband's Education completed in single year (n=720)						-14.65***	<0.001
Mean (SD)				7.75 (13.2)			
Wealth Quintile						**67.8*** **	**<0.001**
Poorest	72	(33.3)	144	(66.7)	216		
Poorer	86	(52.4)	78	(47.6)	164		
Middle	77	(56.6)	59	(43.4)	136		
Richer	92	(73.6)	33	(26.4)	125		
Richest	58	(72.5)	22	(27.5)	80		
Intermediary Factor							
Exposure to Mass Media						**52.59*** **	**<0.001**
Not at all	38	(26.9)	103	(73.1)	141		
Less than once a week	79	(53.4)	69	(46.6)	148		
At least once a week	268	(62.0)	164	(37.9)	432		
Problems in accessing health care (Getting permission, money, distance to health facility, not wanting to go alone) (n=720)						**11.88** **	**0.001**
Not a big problem	377	(54.9)	310	(45.1)	687		
Big problem	8	(24.2)	25	(75.8)	33		

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

Determinants associated with antenatal care service utilization among young mothers

Bivariate analysis

In the bivariate analysis, the association between antenatal care service utilization and determinants showed that age at first marriage, geographical conditions, and socioeconomic positions of respondents were significantly associated with the utilization of ANC services among young mothers (Table 1). Besides, an intermediary factor such as mass media exposure and problem in accessing health care services were also significantly associated with ANC service utilization among women. However, the age of young mothers was not associated with the utilization of ANC services.

Multivariate Analysis

In the multivariate analysis, the utilization of antenatal care services was analyzed through three models to identify determinants affecting ANC service utilization (Table 2). In the first model, multivariate analysis was done between ANC utilization and socioeconomic factors such as respondent's education, partner or husband's education, and wealth status. The results from the first model showed that ANC service utilization was positively associated with respondent's education level and wealth quintile but it was not significant for partner or husband's education. Young mothers who had higher education years were 1.12 times more likely to utilize antenatal care services than those of lower education years. Besides, the odds of ANC usage increased with increased wealth status and women from the poorer, middle, richer and richest quintile were 1.76 times, 1.81 times, 3.71 times and 2.95 times more likely to utilize ANC services than from the poorest quintile.

The second model analyzed the association between the utilization of ANC services and socioeconomic status, the confounders such as geographical, demographic and reproductive characteristics. The results showed that ANC utilization was associated with education level, wealth status, place of residence and age at first marriage, but partner or husband education, age of mothers and area of subnational conflict were not significant to ANC use. The odds of ANC utilization increased with increased education

level, wealth status, and age at first marriage, and women from rural areas were 0.41 times less likely to use ANC services than those living in urban areas.

In the last model, multivariate analysis was done to identify the association between ANC utilization and socioeconomic status, the confounders and intermediary factors such as exposure to mass media and problems in accessing health care services. Like in the first and second model, the education level, wealth status place of residence and age at first marriage were still associated with ANC use and the odds of ANC utilization increased with increased education level and wealth quintile. Furthermore, exposure to mass media such as reading newspapers or magazines, listening to the radio, or watching television was highly significant to ANC utilization. Women who had mass media exposure less than once a week or at least once a week were 2.34 times and 2.29 times more likely to utilize antenatal care services than those who had no exposure to mass media. Besides, antenatal care utilization was also associated with having problems in accessing health care services and mothers who had big problems in accessing health care services were 0.39 times less likely to utilize ANC services than those who had no big problem.

The third model that included the predictors, socioeconomic status, confounders such as geographic, demographic and reproductive characteristics, intermediary factors such as exposure to mass media, and problems in accessing health care services was found as the best-fitted model because model 3 had the highest pseudo R2 and a better AIC than the other two models. Further, the likelihood-ratio test showed that model 3 was the best-fitted model as model 2 was nested in model 3 and significantly differed from model 2 while model 2 also significantly differed from model 1.

Table 2 Multiple Logistic Regression Model Based on Different Factors of Antenatal Care Utilization among Young Mothers

Variables	**Model 1 (n=720)**		**Model 2 (n=720)**		**Model 3 (n=719)**	
	Adjusted OR (95% Cl)	**p-value**	**Adjusted OR (95% Cl)**	**p-value**	**Adjusted OR (95% Cl)**	**p-value**
Socioeconomic Factor						
Respondent's Education completed in single year	1.12 (1.07 - 1.19)***	<0.001	1.1 (1.04 - 1.16)**	0.002	1.09 (1.02 - 1.15)**	0.005
Husband's Education completed in single year	1 (0.99 - 1.01)	0.908	1 (0.99 - 1.01)	0.789	1 (0.99 - 1.01)	0.935
Wealth Quintile						
Poorest	1		1		1	
Poorer	1.76 (1.14 - 2.71)*	0.011	1.78 (1.14 - 2.76)*	0.011	1.65 (1.05 - 2.59)*	0.03
Middle	1.81 (1.12 - 2.9)*	0.014	1.63 (1 - 2.65)	0.05	1.36 (0.82 - 2.25)	0.233
Richer	3.71 (2.19 - 6.31)***	<0.001	2.94 (1.69 - 5.13)***	<0.001	2.47 (1.39 - 4.38)**	0.002
Richest	2.95 (1.57 - 5.52)**	0.001	1.77 (0.89 - 3.51)	0.105	1.39 (0.68 - 2.8)	0.365

Variables	Model 1 (n=720)		Model 2 (n=720)		Model 3 (n=719)	
	Adjusted OR (95% Cl)	p-value	Adjusted OR (95% Cl)	p-value	Adjusted OR (95% Cl)	p-value
Geographical Factors						
Areas of Subnational Conflict						
Non-conflict-affected areas	-	-	1		1	
Low-conflict-affected areas	-	-	1.07 (0.72 - 1.59)	0.74	0.93 (0.61 - 1.41)	0.745
High-conflict-affected areas	-	-	1.38 (0.93 - 2.07)	0.113	1.1 (0.75 - 1.73)	0.553
Place of Residence						
Urban	-	-	1		1	
Rural	-	-	0.41 (0.26 - 0.67)***	<0.001	0.45 (0.27 - 0.78)**	0.001
Demographic and Reproductive Characteristics						
Age						
15-19	-	-	1		1	
20-24	-	-	1.19 (0.73 - 1.93)	0.487	1.18 (0.72 - 1.94)	0.505
Age at first marriage						
<15	-	-	1		1	
15-19	-	-	2.12 (1.04 - 4.33)*	0.039	2.24 (1.08 - 4.61)*	0.029
20-24	-	-	2.81 (1.26 - 6.25)*	0.011	2.88 (1.28 - 6.49)*	0.01
Intermediary Factors						
Exposure to Mass Media						
Not at all	-	-	-	-	1	
Less than once a week	-	-	-	-	2.34 (1.38 - 3.96)**	0.002
At least once a week	-	-	-	-	2.29 (1.41 - 3.72)**	0.001
Problems in accessing health care						
Not a big problem	-	-	-	-	1	
Big problem	-	-	-	-	0.39 (0.16 - 0.92)*	0.033
Pseudo R^2	0.0903		0.115		0.135	
Pseudo R^2 Change			0.02		0.02	
Prob>chi2	<0.001		<0.001		<0.001	
Observation	720		720		719	
Log likelihood	-452.43		-440.14		-429.34	
AIC	918.86		906.27		890.68	
BIC	950.92		965.8		963.93	
Likelihood-ratio test						
Prob > chi2 (Model1 nested Model2)			<0.001			
Prob > chi2 (Model2 nested Model3)					<0.001	

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

DISCUSSION

Utilization rate of antenatal care services

In Myanmar, government health expenditure for Maternal and Child Health was increased nearly three times between 2009/2010 and 2013/2014 to reduce maternal mortality by providing free of charge antenatal care and delivery services. However, the findings from this study showed that the utilization rate of ANC services at least four times with skilled health personnel among young mothers was still low, which was 46.32% among adolescents and 54.47% among young adults, compared to the ANC utilization rate, 59% among 15-49 years age group in Myanmar and 64% globally (16). Besides, a study in Indonesia showed that ANC service utilization at least four times among adolescents (15-19) and young adults (20-24) was 70% and 80% which was also higher than ANC utilization in Myanmar (5). However, one of the studies in Myanmar was found that ANC utilization at least four times among young mothers in an urban area of the Yangon region was 79% (17). It seems to be that the service utilization rate was higher in urban areas and there will be a huge gap in ANC use between urban and rural areas. Therefore, it can conclude that ANC use among young mothers (15-24 years) in Myanmar was lower than older age women and those of other countries. It also pointed out that ANC use among adolescent and young adult women should be enhanced and needed to improve equitable access to health care to reduce maternal and perinatal morbidity and mortality.

Socioeconomic inequity in ANC utilization

The findings suggested that socioeconomic status measured by women's education level was significantly and positively associated with ANC service utilization among women and the result was highly consistent with the findings from other studies in Indonesia, India, and Bangladesh (5, 18, 19). The reason why the education level of women affected ANC utilization might involve that more educated women had higher knowledge about health and were more accessible to obtain information about services. Besides, higher education might have more autonomy and decision-making power in their families and greater access to receiving health care services independently.

The utilization of ANC services was highly associated with wealth status and wealthier women seem to utilize more ANC services than poorer. This finding was also consistent with similar studies from other developing countries and their findings showed that women from the richest wealth quintile were 6.51 times and 5.56 times more likely to utilize ANC services at least four times than those from the poorest quintile in Bangladesh and India (19, 20). Higher ANC service utilization in the richest families seems to be that the wealthier families could have higher education and knowledge, more resources and greater autonomy to access necessary health care services than poor families.

Other findings

Moreover, the importance of geographical factors also determined the utilization of antenatal care services among female youths. The findings of this study observed that women who resided in rural areas were less likely to use ANC services than those living in urban areas. The result was highly consistent with most of the previous studies in developing countries like India, Indonesia, Bangladesh and Nigeria (5, 18-20). The reasons for differences between urban and rural could be due to service accessibility such as the existence and distance to health care facilities, transportation problems and financial barriers among the rural population (5, 18-20).

Another finding from this study observed that age at first marriage was positively associated with ANC use and higher age at first marriage could lead to higher utilization of ANC services among female youths. Older age women seem to have higher education, more knowledge about pregnancy and health care and more financial resources compared to younger age women. These factors might lead older women to utilize more ANC services than younger age groups.

Exposure to mass media had also influenced the utilization of ANC and positively associated with health care use among female youths. This finding was also consistent with findings from other studies and increasing the frequency in media exposure such as reading newspapers or magazines, listening to the radio, or watching television enhanced ANC service utilization

among young people (5, 11, 18). The results proved that communication channel was a crucial way to provide health message to adolescents and young adults and those who had more exposure to mass media could receive more health knowledge and service information from media, leading to increased ANC service utilization.

Besides, having problems in accessing health care services affected ANC service utilization among adolescents and young adult mothers. These problems had mostly related to lower autonomy and decision-making power of women especially adolescents and young adults and judgmental attitude and inappropriate communication skills of health service providers on sexual and reproductive health service utilization of young girls (21-23).

As the study used secondary data from the MDHS (2015-2016), some limitations were encountered in conducting the study. Although sociocultural norms were one of the important factors in ANC service use of adolescents, it could not be explored in the study as no information was collected regarding sociocultural norms in the MDHS 2015-2016. Further, ANC use was closely related to health service accessibility in terms of distance to health facilities and financial matters, but they could not be measured in this study due to data limitations. Therefore, further studies should focus on this issue to improve equitable access to ANC services among young mothers. As ANC service use data were collected by adolescents' and young adults' self-reported responses, it might have involved recall biases because the information was based on the previous history of ANC service use.

The current study has contributed several noteworthy determinants affecting antenatal care service utilization among female youths in Myanmar. Compared to the utilization of ANC services among reproductive-aged women (15-49 years) in Myanmar, utilization among adolescents (15-19 years) and young adults (20-24 years) was lower and this issue is required to have urgent attention by the government. Furthermore, adolescents are also recognized as populations with special needs and vulnerable to pregnancy complications than other age groups and appropriate policy should be addressed to improve ANC service utilization and pregnancy outcomes among female adolescents.

CONCLUSION

The findings from this study have pointed out that the level of antenatal care services utilization among young mothers was low and ANC utilization was independently associated with socioeconomic positions. Therefore, utilization of antenatal care services among young mothers can be partially fostered through improving education and addressing other socio-demographic barriers. In the short term, providing ANC education to poorly educated young mothers and their families may improve the use of services. In the longer term, improving access to higher education for Myanmar women, in general, may reduce premature motherhood, and also increase the use of ANC services among those who need them.

RECOMMENDATIONS

Since the findings suggested that low level of ANC utilization among young mothers in Myanmar was highly associated with socioeconomic status and some factors like geographic and reproductive characteristics and media exposure, service utilization can be enhanced through improving socioeconomic statuses, reducing early marriage, enhancing communication channels, lowering disparities in service accessibility between urban and rural areas and establishing more youth-friendly health centers.

Education is one of the most important social determinants for enhancing health service utilization among young girls and can be highly correlated with wealth status. Hence, improving in one condition can directly enhance the condition of another. Therefore, empowering women to have access to higher education is important and policy is needed to support adolescents and young adult females to foster their educational attainment. Besides, parents are needed to encourage to obtaining higher education for their daughters and financial supports or scholarship programs for female youths should be initiated by the government and international development funding agencies. Improving education can also increase the wealth status of a family and well-educated women would have more resources, knowledge, decision-making power and access to quality health care services.

Furthermore, the provision of sexual and reproductive health knowledge and service information through various communication channels should be enhanced by creating fascinating television programs, reproductive health magazines, or journal articles for youths and boosting SRH knowledge and service delivery locations on social media platforms. Besides, establishing youth-friendly health centers to obtain sexual and reproductive services is also important and service providers should be trained specially to meet and understand the needs of young populations. Therefore, the government should raise budget expenditure on the health of youths by establishing youth-friendly health centers, especially in rural areas and providing special training to health care workers for youths.

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RELATIONSHIP BETWEEN INTIMATE PARTNER VIOLENCE AND REPRODUCTIVE HEALTH OUTCOMES AMONG MARRIED WOMEN IN MYANMAR

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ABSTRACT

A corpus of preexisting literature revealed that intimate partner violence (IPV) limits women's controls over resources and decision-making. Research has shown that IPV disempowers women resulting in a lack of autonomy to use their preferred methods of contraception, reproductive health decision making, and being unable to negotiate safe sex leading to experiencing the unmet need for contraception and unwanted pregnancy. Myanmar has the highest prevalence of IPV compared to other lower-middle-income countries. Still, little is known about the relationship between IPV exposure and the unmet need for contraception and unwanted pregnancy in Myanmar. This study investigates the relationship between physical, emotional, or sexual IPV and the unmet need for contraception, as well as between IPV and unwanted pregnancy among married women in Myanmar. The study utilizes a cross-sectional Myanmar Demographic Health Survey 2015-2016 dataset. Samples are 3,130 women of reproductive age (15-49 years), currently married or in a union. The data are analyzed using cross-tabulations, bivariate and multivariate logistic regression. One in five married women ever experienced physical, sexual, or emotional violence by their spouse. Holding other variables constant, sexual abuse exposure increased the likelihood of the unmet need for contraception compared with women without IPV experiences by 86 percent. Women experiencing physical IPV had a 1.65 times higher likelihood of unwanted pregnancy than non-abused experienced women. Women with one form of IPV exposure were 1.67 times more likely to have an unwanted pregnancy. Meanwhile, those with two types of IPV experiences had a 2.39 times higher likelihood of unwanted pregnancy than women without any IPV. This study showed that IPV was associated with the unmet need for contraception and unwanted pregnancy. The findings will help policymakers in developing interventions to prevent IPV, adopting legislation to criminalize IPV, and strengthening outreach programs to increase women's accessibility to Reproductive Health Services.

Keywords: intimate partner violence, spousal abuse, reproductive health, unmet need for contraception, unwanted pregnancy

INTRODUCTION

Intimate partner violence (IPV) is defined by the World Health Organization (WHO) as "any behaviors within an intimate relationship that causes physical, psychological or sexual harm to those in the relationship." The majority of IPV victims are women and the perpetrators are men. Heise's ecological model explained that the long-time manifestation of patriarchal society, marital conflict, men's wealth control, male dominance in the family, gender inequalities such as imbalanced power relationships between men and women, family structure, social acceptance of violence, and cultural norms that force women to a subordinate to men (2). As a result of these factors, women experienced physical, psychological, and sexual abuse perpetrated by their current or former husbands or partners. IPV is not a rare event worldwide. One in three women suffered IPV in their lifetime globally. Besides, women from low-middle-income regions underwent more IPV than in high-income areas. Among the LMIC regions, Southeast Asia, Eastern Mediterranean, and Africa regions revealed a higher IPV prevalence than the average global prevalence, with 37.7 percent, 37 percent, and 36.6 percent (3).

IPV is a severe public health crisis affecting women's health. The WHO's pathways and health effects of IPV also highlighted that women with IPV exposure have limited sexual and reproductive health (SRH) control, lack of decision making, and find difficulties in healthcare services. Hence, women suffer wide-ranging health effects such as physical, mental and sexual, and reproductive health (1) (3). Many RH problems have occurred among reproductive-age women as a consequence of IPV. IPV discourages women from accessing RH services, which may worsen their RH conditions.

IPV disempowered women resulting in a lack of autonomy to negotiate their preferred methods of contraception (4). Thus, women with IPV experiences suffered unmet need for family planning, meaning that women desired to stop or delay childbirth but were not using any contraceptive methods. The findings from African countries and Colombia indicated that IPV was significantly associated with unmet need for contraception (4-6). Moreover, because of the sexual and reproductive coercion by partners, difficulties in negotiating safe sex, and sexual violence within the abused relationships, women get unwanted or unintended pregnancies (3). Studies in Vietnam and Nigeria showed that IPV was linked with unintended pregnancies (7, 8). Moreover, a qualitative study revealed that women got mistimed pregnancies because of the difficulties in negotiating safe sex and their husband's desire for having more children (9). Hence, these findings highlighted that IPV is related to the unmet need for family planning as well as unwanted pregnancies.

According to the recent statistics of RH in Myanmar, the unmet need for family planning was relatively high compared to other Southeast Asian countries (10). Besides, there were around 710,000 unwanted pregnancies in Myanmar based on the 2015 report (11). Women who wanted to terminate unwanted pregnancies were not able to get safe abortion practices because abortion is legally allowed in Myanmar only under one condition to save the life of the women (12). The maternal mortality rate was unacceptably high, and abortion is still one of the major causes of maternal deaths. Previously, researchers had already conducted IPV-related studies in the Myanmar context. However, studies emphasized more on the sociodemographic analysis of IPV victims, the impact of IPV on mental health, some qualitative researches on gender-based violence in conflict areas, and social inequalities and empowerment on women's abusive marriage (13-17). Studies from other countries worldwide had already proved that IPV is one of the major factors leading to adverse RH outcomes of women. Although IPV is not a new and rare event in Myanmar, little had known about the relationship between intimate partner violence and

women's RH outcomes in Myanmar. Hence, this study assessed the association between different forms of IPV and RH outcomes, including the unmet need for contraception and unwanted pregnancy among married women in Myanmar based on the 2015-2016 Myanmar Demographic and Health Survey (MDHS).

METHODS

This study used data from the Myanmar Demographic and Health Survey (MDHS), a nationally representative survey to examine the population and health status of reproductive age women and men between 15 and 49 years old and their under-five year children throughout Myanmar. It is a cross-sectional study design. The used module was adjusted with Myanmar culture, and a detailed description was reported in the 2015-2016 MDHS report (18). MDHS was implemented based on the standard procedures, methodologies, and manuals of the DHS program to collect the data. For the domestic violence module, specific training was provided to interviewers to ensure the staff manages safety and ethical concerns in domestic violence data collection because it is a sensitive topic (18).

Study sample and sample method

The MDHS covered 13,260 households based on the 2014 Myanmar census report. The survey applied a stratified two-stage sampling design, used equal probability systematic sampling, and included 30 households per cluster. The survey included all women and men aged 15-49 years who were permanent inhabitants of selected households or visitors who stayed in households the night before the survey interview was conducted.

Among the random selection of 12,500 households, 12,885 women were successfully interviewed for the women's questionnaires. Then, the domestic violence (DV) module was administered to a sub-sample of half of the households, thus 6,250 households were randomly selected. This module followed the WHO's guideline on domestic violence ethical collection of information and randomly chose one woman per household to complete the module. Overall, the domestic violence questions were asked to 4,563 women. Among them, 46 women did not complete the interview due to privacy and other reasons. Hence, there were 4,517 women, including married and unmarried women, who finished the DV questionaries. Then, the study excluded unmarried women because reproductive health condition questions were asked to married women only. The study emphasized the spousal violence committed by current husbands, hence, the study restricted to women who are currently living with a man or in a union. Thus, the study's final sample was 3,130 reproductive age 15-49 years, married women currently in the union who accomplished the DV section (Figure 1).

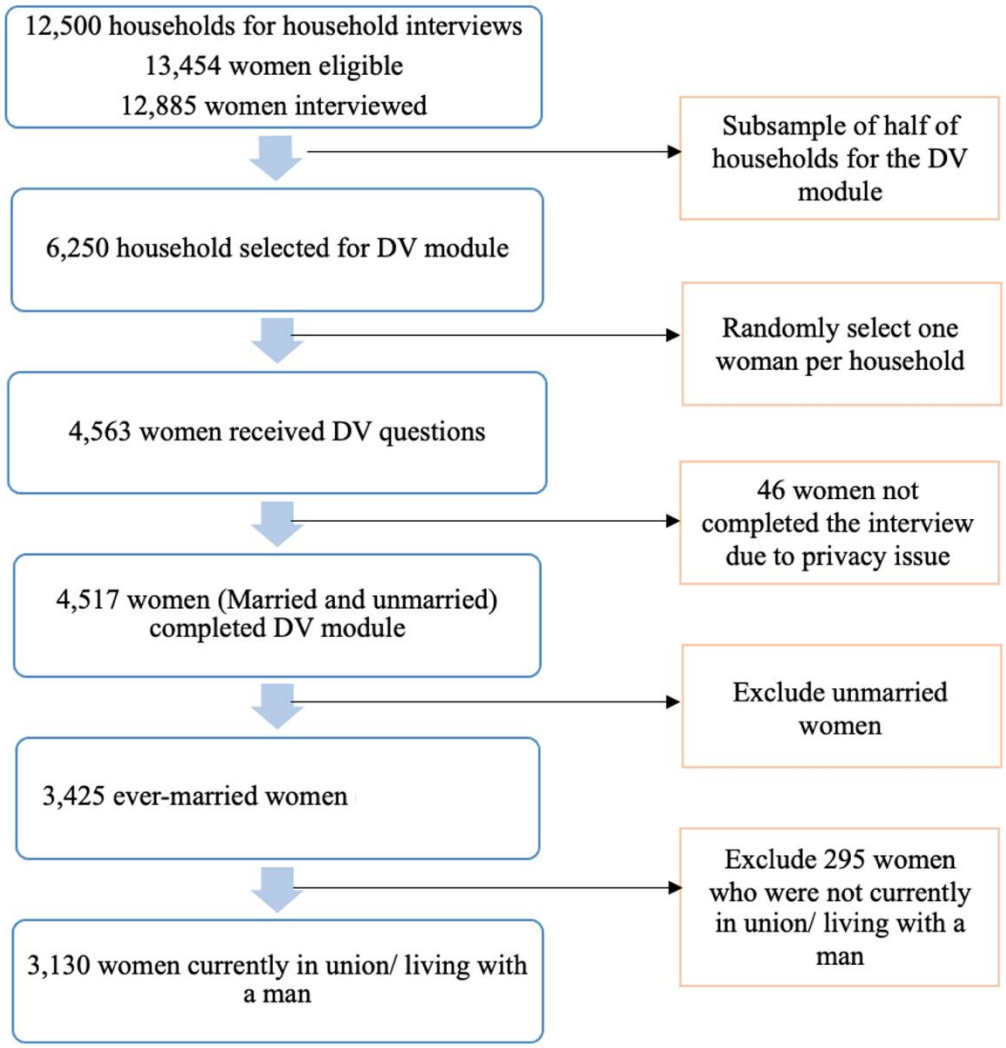

Figure 1: Sample Size of Study

Variables and operational definition

The operational definition of IPV as the study's main independent variable was adopted from WHO's definition of IPV (15). IPV referred to any acts of physical, sexual, or emotional harm to women committed by their husbands in a formal marriage relationship during their lifetime. Even though WHO defined any person within the relationship, either men or women can be the victims of IPV, this study focused on wife abuse perpetrated by the current husband. The main independent variables of interest were physical, emotional, and sexual violence committed by the current spouse during their marriage duration. This study also examined exposure to at least one form of IPV, two forms of IPV, or all three forms of IPV. Physical IPV was coded as 1 if women experienced any physical IPV and as 0 if no experience of it. The emotional and sexual violence variables were created similarly. Experiencing at least one form of IPV was coded as 1 if women were exposed to any one IPV and as 0 for those without IPV exposure. Other separate measures of exposure to two forms and all three forms of IPV were coded in a similar way.

Two outcome variables of interest were the unmet need for contraception and unwanted pregnancy. Unmet need for family planning was defined as the reproductive age women, who are married or in a union, desiring to stop or delay childbirth but are not using any contraceptive methods (10). Based on MDHS questionnaires, unmet need for contraception is described as women who are not pregnant, not postpartum amenorrhoeic, and fecund women who want to delay giving birth next child for two or more years or stop childbearing but are not using any contraception. Also, it included women who had mistimed or unwanted current pregnancy or women who are

postpartum amenorrheic and said that their last birth in the last 2 years was mistimed or not wanted at all, however, these women were not using any method of family planning and wanted no more children. The dummy variable was created for unmet need for contraception and coded as 0 if no unmet need for contraception and 1 if unmet need for contraception. Unwanted pregnancy was described as whether the last child born in the past five years was wanted at that time, later, or not at all. It was coded as 0 if wanted at that time and 1 if wanted later or not wanted at all based on MDHS questions.

This study's conceptual framework also took into account the factors related to the independent variables, as well as the dependent variables as control variables based on literature review (7, 19-26). These factors included age, education, residence, employment status of women, partner's education and partner's alcohol consumption, marital control behaviors of the husband such as jealous talking to other men, limiting women meeting with family and friends, husband insisting on where the woman is going and women's household decision making such as make decision for her health care and household purchases.

Data analysis

STATA 14 was used to analyze the data. Univariate analysis was performed to describe the variables of interest in the study including dependent variables, independent variables, and control variables. Cross tabulation was done between dependent and independent variables. Multivariate logistic regression was performed to assess the objective of the study and presented the odds ratio. While checking multicollinearity with correlation matrix, the exposure to one form, two forms, and three forms of IPV were highly correlated with the physical, sexual, and emotional IPV because they were generated from these IPV variables. Thus, the logistic regression was done separately for exposure to one, two, or three forms of IPV and each independent variable. This study did not use the weighted data because DHS experts explained that using sample weights is not suitable for estimating the correlation between dependent and independent variables (27).

Ethical considerations of the study

Domestic violence (DV) is a sensitive topic. Thus, this module applied the WHO's guidelines on the collection of domestic violence information ethically, that was, randomly selecting only one woman per household, providing specific training for interviewing the DV questionnaires, and ensuring the privacy of the participants (28). The Independent Ethics Committed Institutional Review Board, an independent ethics committee, had approved the survey procedure, sampling methods, standard questionnaires, and instruments used in the Demographic and Health Survey. Moreover, the Ethics Review Committee on Medical Research, including Human Subjects in the Department of Medical Research, Ministry of Health and Sports, approved the MDHS (18). The data used for this study had already got permission from the Demographic and Health Survey Program on February 22, 2021, through the DHS website (www.dhsprogram.com).

RESULTS

Table 1 indicated the univariate analysis of frequency and percentage distribution of variables of interest in the study. Around 17 percent of married women in Myanmar had an unmet need for contraception. The percentage of married women with an unwanted pregnancy was 8 percent. Many married women experienced physical and emotional IPV committed by their husbands with 15 percent and 14 percent respectively, while sexual IPV occurred the least with around 3 percent. Among married women, twenty-two percent of women exposed to at least one form of IPV, nine percent experienced two forms of IPV, and just around two percent of women are suffered all three forms of IPV during their lifetime. Nearly two-thirds of married women were aged between 25 and 44. Around half of the women had a primary education level. Over two-thirds of women were residing in rural areas. Women who are currently working were around 61 percent. Forty-five percent of women were in poor and poorest economic

conditions. Regarding the husband's education level, the husband with no education background was 15.9 percent while two-third of partners were in primary and secondary education levels. Husband with alcohol consumption habit was 49 percent. With regards to marital control behaviors of the husband, around 22 percent of men were jealous when their women were talking to other men. Husbands limited his wife to meet with her friends and family were low with 6 percent and 3 percent respectively. There was around 12 percent of the husband who insisted on where his wife was going. Regarding decision-making in households, around 43 percent of women decided on their health while 22 percent of women decided on the household purchase.

Table 1 Frequency and percentage distribution of the study sample by the dependent, independent, and control variables

Description	Number (N=3,130)	Percent
Unmet need for contraception		
Yes	530	16.9
No	2,600	83.1
Unwanted pregnancy (N = 1544)		
Yes	124	8.0
No	1,420	91.9
Physical IPV		
Yes	477	15.2
No	2,653	84.8
Emotional IPV		
Yes	436	13.9
No	2,694	86.1
Sexual IPV		
Yes	104	3.3
No	3,026	96.7
Exposure to at least one form of IPV		
Yes	683	21.8
No	2,447	78.2
Exposure to two forms of IPV		
Yes	282	9.0
No	2,848	91.0
Exposure to three forms of IPV		
Yes	52	1.7
No	3,078	98.3
Woman's age		
15 – 19	74	2.4
20 – 24	324	10.4
25 – 29	526	16.8
30 – 34	648	20.7
35 – 39	636	20.3
40 – 44	505	16.1
45 – 49	417	13.3
Women's education		
No education	472	15.1
Primary	1,509	48.2
Secondary	920	29.4
Higher	229	7.3
Women's residence area		
Urban	754	24.1
Rural	2,376	75.9
Women's current employment status		
Yes	1,912	61.1
No	1,217	38.9

Description	Number (N=3,130)	Percent
Wealth index		
Poorest	764	24.4
Poorer	665	21.3
Middle	613	19.6
Richer	584	18.7
Richest	504	16.1
Husband's education		
No education	498	15.9
Primary	1,247	39.8
Secondary	1,147	36.7
Higher	184	5.9
Don't know	54	1.7
Husband's alcohol consumption		
Yes	1,528	48.8
No	1,602	51.2
Husband jealous women talking to other men		
Yes	679	21.7
No	2,451	78.3
Husband limits women meeting with her friends		
Yes	179	5.7
No	2,951	94.2
Husband limits women meeting with family		
Yes	90	2.9
No	3,040	97.1
Husband insists on where the woman is		
Yes	377	12.0
No	2,753	88.0
Women make the decision on their health		
Yes	1,344	42.9
No	1,786	57.1
Women make the decision on household purchase		
Yes	686	21.9
No	2,444	78.1

Note: N = total number of married women, and % is the row percentage

Table 2 indicated the cross-tabulation of different forms of IPV and the unmet need for contraception and unwanted pregnancy. Around twenty percent of unmet need for contraception was found among women with any form of IPV exposure. A higher percentage of unmet need for contraception was found among women experiencing physical, emotional, or sexual IPV than women without IPV exposure. The occurrence of unwanted pregnancy among women with any IPV exposure was 12.3 percent. Similarly, with the unmet need for contraception, women with IPV exposure experienced more unwanted pregnancies than women without IPV exposure.

Table 2 Cross-tabulation of the unmet need for contraception and unwanted pregnancy by different forms of IPV

Forms of IPV	Unmet need for contraception (N = 3130)		Unwanted pregnancy (N = 1544)	
	Yes (%)	No (%)	Yes (%)	No (%)
Physical IPV				
Yes	18.9	81.1	13.7	86.3
No	16.6	83.4	6.9	93.1
Emotional IPV				
Yes	19.3	80.7	13.2	86.8
No	16.6	83.4	7.1	92.9
Sexual IPV				
Yes	27.9	72.1	15.5	84.5
No	16.6	83.4	7.7	92.3
Exposure to at least one form of IPV				
Yes	19.8	80.2	12.3	87.7
No	16.1	83.9	6.7	93.3
Exposure to two forms of IPV				
Yes	19.9	80.1	16.8	83.2
No	16.6	83.4	7.1	92.9
Exposure to all three forms of IPV				
Yes	23.1	76.9	15.4	84.6
No	16.8	83.2	7.9	92.1

Note: N = total number of married women, and % is the row percentage

Table 3 revealed the multivariate logistic regression of the association between physical, emotional, or sexual IPV and the unmet need for contraception. Women with sexual IPV exposure were more likely to have an unmet need for contraception by 86 percent than women without sexual IPV exposure. The lower the education of the women, the higher the likelihood of experiencing the unmet need for contraception. No significant associations were found between exposure to one form, two forms, or three forms of IPV and the unmet need for contraception.

Table 3 Logistic regression of association between physical, emotional, or sexual IPV and unmet Need for contraception among married women in Myanmar

Description	Unmet Need for Contraception
	AOR (95% CI)
Physical IPV (ref: no)	1.05 [0.78, 1.41]
Emotional IPV (ref: no)	0.97 [0.70, 1.35]
Sexual IPV (ref: no)	1.85* [1.14, 3.02]
Age (ref: 15-19)	
20-24	1.01 [0.50, 2.02]
25-29	0.80 [0.41, 1.57]
30-34	1.13 [0.58, 2.18]
35-39	0.99 [0.51, 1.92]
40-44	1.55 [0.80, 3.00]
45-49	1.27 [0.64, 2.49]
Women's residence (ref: urban)	
Rural	1.21 [0.91, 1.61]
Women's education (ref: no education)	
Primary	0.58*** [0.45, 0.76]
Secondary	0.65* [0.47, 0.91]
Higher	0.31*** [0.17, 0.59]

Description	Unmet Need for Contraception
	AOR (95% CI)
Wealth index (ref: poorest)	
Poorer	0.84 [0.63, 1.10]
Middle	0.91 [0.68, 1.22]
Richer	1.04 [0.76, 1.43]
Richest	0.74 [0.49, 1.11]
Women's employment (ref: no) Yes	1.08 [0.89, 1.32]
Husband's education (ref: no education)	
Primary	1.00 [0.75, 1.31]
Secondary	0.84 [0.61, 1.15]
Higher	1.07 [0.59, 1.94]
Don't know	0.78 [0.35, 1.72]
Husband's alcohol consumption (ref: no) Yes	1.03 [0.93, 1.14]
Husband jealous women talking other men (ref: no) Yes	1.06 [0.82, 1.36]
Husband limits to meet women's friends (ref: no) Yes	0.97 [0.60, 1.58]
Husband limits to meet women's family (ref: no) Yes	0.74 [0.38, 1.45]
Husband insists on where the woman is (ref: no) Yes	1.18 [0.86, 1.62]
Women make the decision on their health (ref: no) Yes	1.02 [0.77, 1.35]
Women make the decision on household purchase (ref: no) Yes	0.96 [0.76, 1.22]
Log-likelihood	-1380.79
Number of observations	3,130

Notes: COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, 95% confidence intervals in brackets
* p<0.05, ** p<0.01, *** p<0.001

As shown in Table 4, Model 1 indicated the logistic regression between physical, emotional, or sexual IPV and unwanted pregnancy. Holding other variables constant, women who experienced physical IPV were a 1.65 times greater likelihood of getting unwanted pregnancy than those without physical IPV experience. Model 2 examined the association between exposure to at least one form of IPV and unwanted pregnancy. The probability of getting unwanted pregnancies increased 1.67 times in women with at least one form of IPV exposure. Model 3 assessed the association between exposure to two forms of IPV and unwanted pregnancy. Women experiencing two forms of IPV were a 2.39 times higher likelihood of unwanted pregnancy than women without IPV exposure. Model 4 showed the relationship between exposure to all three forms of IPV and unwanted pregnancy and found no significant relationship.

Table 4 Logistic regression of association between different forms of IPV and unwanted pregnancy among married women in Myanmar

Description	Unwanted Pregnancy (AOR, 95% CI)			
	Model 1	Model 2	Model 3	Model 4
Physical IPV (ref: no)	1.68* [1.03, 2.86]	-	-	-
Emotional IPV (ref: no)	1.19 [0.69, 2.06]	-	-	-
Sexual IPV (ref: no)	1.35 [0.59, 3.07]	-	-	-
Exposure to at least one form of IPV (ref: no)	-	1.67* [1.07,2.55]	-	-
Exposure to two forms of IPV (ref: no)	-	-	2.39**[1.28,3.78]	-

Description	Unwanted Pregnancy (AOR, 95% CI)			
	Model 1	Model 2	Model 3	Model 4
Exposure to all three forms of IPV (ref: no)	-	-	-	1.35 [0.42, 4.36]
Age (ref: 15-19)				
20-24	0.57 [0.17, 1.86]	0.61 [0.19, 1.98]	0.59 [0.18, 1.91]	0.61 [0.19, 1.97]
25-29	0.84 [0.27, 2.60]	0.91 [0.30, 2.80]	0.85 [0.28, 2.63]	0.88 [0.29, 2.70]
30-34	0.52 [0.17, 1.65]	0.56 [0.18, 1.75]	0.54 [0.17, 1.70]	0.55 [0.18, 1.72]
35-39	0.60 [0.19, 1.93]	0.65 [0.20, 2.06]	0.61 [0.19, 1.95]	0.64 [0.20, 2.04]
40-44	0.67 [0.20, 2.26]	0.74 [0.22, 2.48]	0.68 [0.20, 2.27]	0.70 [0.21, 2.36]
45-49	1.19 [0.29, 4.81]	1.24 [0.31, 5.02]	1.19 [0.29, 4.83]	1.19 [0.30, 4.80]
Women's residence (ref: urban) **Rural**	1.00 [0.54, 1.84]	1.00 [0.55, 1.84]	0.98 [0.53, 1.80]	1.01 [0.55, 1.85]
Women's education (ref: no education)				
Primary	1.09 [0.64, 1.86]	1.08 [0.64, 1.85]	1.08 [0.64, 1.85]	1.08 [0.64, 1.85]
Secondary	0.74 [0.38, 1.44]	0.74 [0.38, 1.43]	0.74 [0.38, 1.43]	0.74 [0.38, 1.44]
Higher	0.37 [0.10, 1.40]	0.36 [0.09, 1.35]	0.38 [0.10, 1.44]	0.38 [0.10, 1.43]
Wealth index (ref: poorest)				
Poorer	1.24 [0.76, 2.03]	1.24 [0.76, 2.02]	1.21 [0.74, 1.98]	1.25 [0.77, 2.03]
Middle	0.90 [0.49, 1.66]	0.89 [0.48, 1.64]	0.89 [0.48, 1.64]	0.85 [0.47, 1.57]
Richer	0.81 [0.42, 1.59]	0.80 [0.41, 1.57]	0.80 [0.41, 1.57]	0.76 [0.39, 1.48]
Richest	1.09 [0.46, 2.57]	1.09 [0.46, 2.56]	1.09 [0.46, 2.56]	1.01 [0.43, 2.36]
Women's employment (ref: no) **Yes**	0.91 [0.62, 1.34]	0.92 [0.63, 1.34]	0.92 [0.63, 1.34]	0.93 [0.63, 1.36]
Husband's education (ref: no education)				
Primary	0.86 [0.50, 1.47]	0.86 [0.50, 1.47]	0.86 [0.50, 1.47]	0.88 [0.52, 1.52]
Secondary	0.94 [0.52, 1.70]	0.94 [0.52, 1.71]	0.94 [0.52, 1.71]	0.99 [0.54, 1.79]
Higher	1.37 [0.40, 4.73]	1.35 [0.39, 4.63]	1.35 [0.39, 4.63]	1.34 [0.39, 4.58]
Don't know	0.35 [0.04, 2.71]	0.35 [0.05, 2.73]	0.35 [0.05, 2.73]	0.35 [0.05, 2.71]
Husband's alcohol consumption (ref: no) **Yes**	1.13 [0.92, 1.40]	1.13 [0.92, 1.39]	1.14 [0.92, 1.39]	1.17 [0.95, 1.43]
Husband jealous women talking other men (ref: no) **Yes**	1.32 [0.84, 2.09]	1.36 [0.87,	1.34 [0.85, 2.11]	1.47 [0.94, 2.30]

Description	Unwanted Pregnancy (AOR, 95% CI)			
	Model 1	Model 2	Model 3	Model 4
Husband limits to meet women's friends (ref: no) **Yes**	1.07 [0.48, 2.41]	1.10 [0.49, 2.45]	1.11 [0.50, 2.47]	1.16 [0.52, 2.62]
Husband limits to meet women's family (ref: no) **Yes**	1.04 [0.39, 2.73]	1.22 [0.47, 3.16]	1.03 [0.39, 2.74]	1.39 [0.53, 3.65]
Husband insists on where the woman is (ref: no) **Yes**	1.08 [0.59, 1.96]	1.07 [0.59, 1.93]	1.06 [0.58, 1.93]	1.13 [0.62, 2.04]
Women make the decision on their health (ref: no) **Yes**	1.18 [0.67, 2.09]	1.15 [0.66,	1.14 [0.65, 2.01]	1.13 [0.64, 1.98]
Women make the decision on household purchase (ref: no) **Yes**	1.00 [0.63, 1.60]	0.98 [0.60, 1.55]	0.99 [0.61, 1.59]	0.97 [0.60, 1.56]
Log-likelihood	-414.11	-415.49	-414.28	-417.89
Number of observations	1,544	1,544	1,544	1,544

Notes: COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, 95% confidence intervals in brackets

* p<0.05, ** p<0.01, *** p<0.001

DISCUSSION

The study demonstrated that IPV was not a rare event in Myanmar, with around one in five married women in Myanmar experiencing any physical, sexual or emotional abuse perpetrated by their husbands. Physical violence was the highest among spousal abuse with 15 percent, followed by emotional violence with 14 percent and sexual violence with 3 percent. Myanmar showed a lower prevalence than the average global prevalence and Southeast Asia prevalence (37.7 percent) (3). The prevalence of violence varied among countries, regions, and communities because of the socio-cultural norms supporting patriarchal society, gender inequalities, and acceptance of violence within the community. These situations enhanced the culture of violence against women by their partners (3). This study highlighted that intimate partner violence was not a small problem among married women in Myanmar.

The findings of this study indicated that different forms of IPV are significantly associated with adverse reproductive health outcomes; the unmet need for contraception and unwanted pregnancy, among married women in Myanmar. Women with sexual IPV exposure were a higher likelihood of the unmet need for contraception than women without IPV exposure. The study result was consistent with findings from 26 countries of Africa and Colombia (4, 5). This finding highlighted the lack of reproductive decision-making and power imbalances in the sexual relationships among abused experienced women because of fear of violence. IPV disempowered women resulting in a lack of autonomy to negotiate their preferred methods of contraception (4). Thus, women with sexual IPV exposure were not able to use a contraceptive method even though they want to stop or delay childbearing. Another finding indicated that exposure to physical IPV increases the likelihood of unwanted pregnancy. Moreover, the higher the women exposure different forms of IPV, the greater the likelihood of getting unwanted pregnancy. This result was in line with findings from Vietnam, Nigeria, and a study in low-middle-income countries (7, 8, 29). A plausible explanation could be that women faced many difficulties in negotiating sex and contraceptives used in abused relationships because of the sexual and reproductive coercion by partners. As a result of this, women were not able to make their reproductive health decision freely resulting in unwanted pregnancies (3).

The result of the study provided some implications for policy on reproductive health care. As IPV disempowered the decision-making and negotiating skills of women, many women faced difficulties in accessing reproductive health services and gained unwanted pregnancies. The health care sector should understand the linkage between IPV and adverse reproductive health outcomes of women. Providing health care services at the clinic will not be enough for IPV victims. It is better to implement women-centered outreach programs to increase women's accessibility to reproductive health services and provide necessary help to those women to receive the care they need.

This study had some significant advantages. This study revealed that different forms of IPV are significantly associated with adverse reproductive health outcomes among married women in Myanmar. Moreover, MDHS is a nationally representative survey; thus, the results of this study can represent the entire nation. However, this study had some limitations. Habitually, women were reluctant to talk about spousal violence because it was a sensitive topic involving their partners and relationship status resulting in under-reporting of cases. However, this would not be influenced much on assessing the association between dependent and independent variables. Another limitation was that the study used secondary data so that there were some limitations in selecting variables. Hence, the study did not include some important control variables such as experiences of childhood abuse.

CONCLUSION

This study highlighted that IPV is not a rare event, and it is a severe public health problem related to many reproductive health problems among married women. However, IPV is not a problem that cannot be addressed. Firstly, it is crucial to raise awareness of IPV in the community to lower the tolerance to IPV without accepting IPV as a general phenomenon among relationships, through awareness-raising activities. Moreover, it is vital to implement gender-transformative interventions, encourage women's empowerment, to strengthen interventions to provide essential care to women including the screening of IPV at reproductive health clinics. Most importantly, it is mandatory to protect IPV victims legally and to speed up approval to criminalize IPV. Finally, there is a need to conduct more studies that address the linkage between IPV and RH service utilization, the effect of the abortion law on IPV victims, and the effectiveness of women's empowerment programs/activities to help IPV victims.

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DAUGHTERS IN SONLESS FAMILIES IN VIETNAM AND THE DISADVANTAGES IN RECEIVING PARENTAL CARE IN EARLY CHILDHOOD

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ABSTRACT

Discrimination against daughters due to son preference in Asia is varied. In most cases, it does not directly lead to excess female child mortality but places girls under disparities in family resource distributions, especially with the youngest child in the family. However, as a country with a strong son preference, the evidence about daughter discrimination in Vietnam is lacking and not well-known. Thus, this study explores associations between son preference and disparities in parental care for the last children aged under-5 years old in the family. Using the Vietnam Multiple Cluster Survey (MICS) 2014, this study focused on four available children's health and well-being outcomes, including adequate immunization, appropriate care-seeking for illness, attending early childhood education, and adequate care (supervision) from parents. Two different multivariate logistic regressions were performed for each outcome to detect gender's effects and sons' effects separately. This study involved 877, 477, 490, and 1,515 children in the Vietnam MICS 2014 having data about immunization, care-seeking for illness, early childhood education, and care from parents, respectively. The findings show no differences between sons and daughters regarding receiving adequate immunization, receiving appropriate care-seeking for illness, attending early childhood education, or receiving adequate care. However, among children who do not have brothers, boys were less likely to receive inadequate care from parents than girls (adjusted odds ratio [aOR]: 0.37, 95% confidence interval [95%CI]: 0.21 – 0.67, $p < 0.01$). In addition, the youngest girl in the family with at least one older brother was less likely to receive inadequate care from parents (aOR: 0.53, 95%CI: 0.32 – 0.90, $p < 0.05$) than a girl without brothers. These findings proved that daughter discrimination due to son preference has existed in Vietnam. Therefore, policies or interventions in health and education to promote children's gender equalities need to be focused more on girls in sonless families than girls in general. Free welfare for children can be a potential solution to reduce daughter discrimination.

Keywords: son preference, daughter discrimination, sonless, early childhood experience,

INTRODUCTION

The long-standing belief in the value of sons, or well-known as son preference, has existed in many societies (1). Millions of girls' lives have been taken directly or indirectly worldwide due to son-favoring practices (2). In order to have a son, many couples have chosen sex-selective technologies, while others who cannot overcome the moral issues related to abortion will keep bearing until they have a son (3, 4). A tragedy begins when son-targeting fertility results in more "unwanted daughter" than a son, especially after reaching the feasible number of children that a couple can rear (5, 6). In this case, being born as a girl places a child at a disadvantage.

In societies with strong son preference, daughter discrimination occurs as a solution for parents to keep a slot for their dream son (7). In severe cases, it leads to the female child's death due to infanticide or abandonment (7, 8). This phenomenon results in unusual excess female child mortality, which can be observed even nowadays in South Asia, particularly in India (9). For daughters who survive, they can face gender disparities in the family resource distribution. Girls are limited in receiving food, healthcare service, education, and parental care, which affect children's health and development (8, 10-12). Besides this *generalized discrimination* due to the long-lasting existence of the patriarchal system, girls born in societies with strong son preference are exposed to additional difficulties from the *selective discrimination* (11). In this context, not all daughters in a family are "unwanted." Daughter discrimination worsens for girls who do not have brothers, especially with the youngest girl in a family (6, 8, 13). Indeed, while *generalized discrimination* drives gender inequalities in children's health and well-being outcomes, *selective discrimination* is much more challenging to detect in strong son preference societies.

Despite a country with strong son preference, previous studies in Vietnam did not provide evidence about daughter discrimination. Son preference in Vietnam is reflected by an imbalanced sex ratio at birth of 111.5 in 2019, which is higher than the typical sex ratio at 105 males per 100 females (14). However, the official reports in Vietnam have not shown excess female child mortality, indicating widespread female infanticide (9, 14, 15). Moreover, gender disparities in early childhood health outcomes have not been revealed (9, 16, 17). However, these studies and reports focused on the sex of a child to detect *generalized discrimination* rather than daughters' fate under the influence of their siblings' sex structure. Besides, most studies concerning son preference in Vietnam have only focused on women's fertility behavior (16, 18-20). Because of lacking apparent evidence about gender inequalities in early childhood related to son preference, daughter discrimination in Vietnam might exist but still missing in the literature. Therefore, this study explores associations between being a girl in sonless families and disparities in parental care in early childhood to prove the existence of daughter discrimination in Vietnam. Since daughter discrimination became worst with the youngest girls in the family (8, 13), this study focuses on the last child's health and well-being outcomes. For under-5 children, gender disparities can be detected through many indicators, including adequate immunization, appropriate care-seeking for illness, early childhood education, and adequate care (supervision) from parents (9). These four outcomes will be used in this study.

METHODS

Data source and study population

This study utilized data from the Vietnam Multiple Cluster Survey 2014 (Vietnam MICS 2014), particularly the under-5 children dataset. The Vietnam MICS 2014 used a multi-stage stratified sampling method to represent Vietnamese women and children's well-being. Firstly, a country was divided into 12 strata based on six regions (The Red River Delta; Northern Midlands and Mountainous area; North Central and Central Coastal area; Central Highlands; Southeast; Mekong River Delta) and two areas (urban, rural). Then, 510 clusters were drawn from these strata using systematic probability proportional to size sampling methods. Finally, 20 households were

systematically sampled from each cluster. All under-5 children in a household were investigated, resulting in a sample size of 3,316 children who completed questionnaires. Among these children, this study focused on the last child in a family with at least one older sibling. Their parents need to be currently in a union. Children who had dead siblings or from a multi-pregnancy were excluded since these situations could affect the way parents treat their children.

Dependent variables

This study explores the differences in parental care on four outcomes: adequate immunization, appropriate care-seeking for illness, attending early childhood education, and adequate care (supervision) from parents.

- Adequate immunization: a child was vaccinated on time with full vaccines required at their age according to Vietnam National Immunization Program (21). Only children aged under 36 months were asked about immunization history.
- Appropriate care-seeking for illness: a child received advice or treatment from a health facility or provider when he/she had a symptom of diarrhea or acute respiratory infections in the last two weeks before the survey.
- Attending early childhood education: a child attended any public or private education. This question was asked only for children aged 36 to 59 months of age.
- Adequate care: a child was not left alone or under the supervision of under-10 years old children for more than one hour.
- Other cases which had the data but did not fit with these above definitions were referred to inadequate immunization, inappropriate care-seeking for illness, not attending early childhood education, and inadequate care.

Primary independent variables

Three main predictors were used in this study, including the sex of the child (Son/Daughter), having older brothers (Yes/No), and sons' effects. For the sons' effects, children were divided into four categories based on their gender and whether they had brothers, namely a daughter without brothers, a daughter with brothers, a son without brothers, a son with brothers.

Control variables

In order to separate the effect of son preference on the disparities in parental care, other factors representing children-specific, household, and community characteristics were controlled. These variables were the age of a child (0-11; 12-23; 24-35; 36-47; 48-59 months old), previous birth interval (< 2; 2; 3; ≥ 4 years), mother's age (15-29; 30-49 years old), mother's education (None; Primary; Lower secondary; Upper secondary; Tertiary), wealth index quintiles (Poorest; Second; Middle; Fourth; Richest), household dependency ratio (the number of dependents aged under 15 or over 65 years old divided by the number of individuals aged 15-65 years old in a household), region (The Red River Delta; Northern Midlands and Mountainous area; North Central and Central Coastal area; Central Highlands; South East; Mekong River Delta), area (urban, rural), and ethnicity (Kinh, non-Kinh).

Data Analysis

Data were analyzed using STATA version 15.1 for Window. Values were presented in number with percentage for categorical variables and mean with standard deviation for the continuous variables. Multivariate binary logistic regressions were used to explore the associations between son preference and disparities in children's outcomes. For each outcome, two models were built. The models in Panel A included the sex of a child and having older brothers to test whether gender disparities in parental care existed in Vietnam. This study further explored associations between son preference and the last child's outcomes using sons' effects for models in Panel B. All models were controlled by children-specific, household, and community characteristics. There was no multicollinearity in these models with variance inflation factors (VIF) lower than 10 for all predictors. Pseudo-R squared, Bayesian information criterion (BIC), and Akaike information criterion (AIC) were presented for model comparisons. The significant level was chosen as a p-value < 0.05

Ethical consideration

This study received approval from the Institutional Review Board of the Institute for Population and Social Research, Mahidol University, Thailand (COE. No. 2021/05-088).

RESULT

The characteristics of the study population were shown in Table 1. The numbers of the last child for immunization, care-seeking for illness, early childhood education, and care from parents were 877, 477, 490, and 1,515 children. Among them, there were 53.5 percent receiving inadequate immunization, 42.8 percent receiving inappropriate care-seeking for illness, 25.5 percent not attending early childhood education, and only 9.3 percent receiving inadequate care from parents.

Table 1 Characteristics of the study opulation

Characteristics	Immunization (n = 877)	Care-seeking (n = 477)	Early childhood education (n = 490)	Care from parents (n = 1,515)
Sex of the last child				
Son	469 (53.5%)	258 (54.1%)	244 (49.8%)	793 (52.3%)
Daughter	408 (46.5%)	219 (45.9%)	246 (50.2%)	722 (47.7%)
Having older brothers				
Yes	462 (52.7%)	249 (52.2%)	270 (55.1%)	820 (54.1%)
No	415 (47.3%)	228 (47.8%)	220 (44.9%)	695 (45.9%)
Sons' effects				
Son without brothers	212 (24.2%)	114 (23.9%)	104 (21.2%)	351 (23.2%)
Son with brothers	257 (29.3%)	144 (30.2%)	140 (28.6%)	442 (29.2%)
Daughter without brothers	203 (23.2%)	114 (23.9%)	116 (23.7%)	344 (22.7%)
Daughter with brothers	205 (23.4%)	105 (22.0%)	130 (26.5%)	378 (24.9%)
Control variables				
Child-specific characteristics				
Age (month)				
0-11	292 (33.3%)	96 (20.1%)		370 (24.4%)
12-23	355 (40.5%)	143 (30.0%)		386 (25.5%)
24-35	230 (26.2%)	81 (17.0%)		262 (17.3%)
36-47		62 (13.0%)	201 (41.0%)	208 (13.7%)
48-59		95 (19.9%)	289 (59.0%)	289 (19.1%)
Previous birth interval (year)				
< 2	100 (11.4%)	60 (12.6%)	50 (10.2%)	173 (11.4%)
2	118 (13.5%)	69 (14.5%)	89 (18.2%)	238 (15.7%)
3	107 (12.2%)	74 (15.5%)	69 (14.1%)	195 (12.9%)
≥ 4	552 (62.9%)	274 (57.4%)	282 (57.6%)	909 (60.0%)

Characteristics	Immunization (n = 877)	Care-seeking (n = 477)	Early childhood education (n = 490)	Care from parents (n = 1,515)
Sex of the last child				
Household characteristics				
Mother's age (year)				
15-29	363 (41.4%)	199 (41.7%)	117 (23.9%)	553 (36.5%)
30-49	514 (58.6%)	278 (58.3%)	373 (76.1%)	962 (63.5%)
Mother's education				
None	45 (5.1%)	43 (9.0%)	25 (5.1%)	101 (6.7%)
Primary	140 (16.0%)	93 (19.5%)	93 (19.0%)	267 (17.6%)
Lower secondary	347 (39.6%)	192 (40.3%)	212 (43.3%)	597 (39.4%)
Upper secondary	184 (21.0%)	80 (16.8%)	76 (15.5%)	279 (18.4%)
Tertiary	161 (18.3%)	69 (14.5%)	84 (17.1%)	271 (17.9%)
Wealth index quintiles				
Poorest	178 (20.3%)	157 (32.9%)	108 (22.0%)	349 (23.0%)
Second	160 (18.2%)	80 (16.8%)	80 (16.3%)	265 (17.5%)
Middle	184 (21.0%)	90 (18.9%)	99 (20.2%)	296 (19.5%)
Fourth	177 (20.2%)	73 (15.3%)	105 (21.5%)	298 (19.7%)
Richest	178 (20.3%)	77 (16.1%)	98 (20.0%)	307 (20.3%)
Household dependency ratio	1.02 (0.50)	1.05 (0.52)	1.02 (0.53)	1.03 (0.52)
Community characteristics				
Region				
Red River Delta	161 (18.4%)	62 (13.0%)	94 (19.2%)	274 (18.1%)
Northern Midlands and Mountain area	147 (16.8%)	90 (18.9%)	92 (18.8%)	271 (17.9%)
North Central and Central Coaster area	135 (15.4%)	91 (19.1%)	86 (17.6%)	234 (15.5%)
Central Highlands	176 (20.0%)	120 (25.2%)	97 (19.8%)	305 (20.1%)
Southeast	132 (15.0%)	55 (11.5%)	65 (13.3%)	228 (15.0%)
Mekong River Delta	126 (14.4%)	59 (12.4%)	56 (11.4%)	203 (13.4%)
Area				
Urban	340 (38.8%)	174 (36.5%)	209 (42.7%)	600 (39.6%)
Rural	537 (61.2%)	303 (63.5%)	281 (57.3%)	915 (60.4%)
Ethnicity				
Kinh	710 (81.0%)	342 (71.7%)	394 (80.4%)	1,198 (79.1%)
Non-Kinh	167 (19.0%)	135 (28.3%)	96 (19.6%)	317 (20.9%)

Note: Categorical variables were presented with the number of observations and percentages. Continuous variables were presented with mean and standard deviation.

Results from multivariate logistic regressions were shown in Table 2. Panel A in this table presented models with net effects of sex of the last child and whether he/she had older brothers on health and well-being outcomes after controlling other factors. According to these models, there were no gender differences in receiving inadequate immunization, receiving inappropriate care-seeking for illness, not attending early childhood education, and receiving inadequate care from adults. In general, the last child's outcomes were not affected by whether they had brothers or not.

On the other hand, when combining sex and the presence of the previous son into sons' effects, findings presented in Panel B of Table 2 showed that sons' effects were only associated with the care from parents to the last child. Among children who did not have brothers, sons were 63.0 percent less likely to receive inadequate care from adults than daughters. Moreover, daughters with brothers were also 47.0 percent less likely to receive inadequate care from adults than daughters without brothers.

Table 2 Gender's and sons' effects on parental care for the last child aged under-5 children

Characteristics	**Receiving inadequate immunization (n = 877)**	**Receiving inappropriate care-seeking for illness (n = 477)**	**Not attending early childhood education (n = 490)**	**Receiving inadequate care (n = 1,515)**
	Adjusted OR [95%CI]			
Panel A: Gender's effects on the last child's outcomes controlling other factors				
Sex of a child				
Boy	-	-	-	-
Girl	1.16 [0.85 – 1.58]	0.97 [0.66 – 1.43]	0.95 [0.57 – 1.58]	1.43 [0.98 – 2.09]
Having older brothers				
No	-	-	-	-
Yes	0.92 [0.68 – 1.26]	0.81 [0.54 – 1.20]	1.36 [0.81 – 2.28]	0.91 [0.62 – 1.32]
LR Chi-squared (Degree of freedom)	233.98*** (24)	41.05* (26)	168.65*** (23)	166.13*** (26)
Pseudo R-squared	0.1931	0.0630	0.3030	0.1771
AIC	1027.55	644.19	435.87	825.90
BIC	1146.96	776.72	536.53	969.63

Characteristics	Receiving inadequate immunization (n = 877)	Receiving inappropriate care-seeking for illness (n = 477)	Not attending early childhood education (n = 490)	Receiving inadequate care (n = 1,515)
Panel B: Sons' effects on the last child's outcomes controlling other factors				
Sons' effects				
Daughter without brothers	-	-	-	-
Son without brothers	0.86 [0.55 – 1.35]	1.04 [0.60 – 1.81]	0.63 [0.28 – 1.39]	0.37** [0.21 – 0.67]
Son with brothers	0.80 [0.52 – 1.23]	0.83 [0.49 – 1.42]	1.33 [0.66 – 2.70]	0.64 [0.39 – 1.05]
Daughter with brothers	0.92 [0.59 – 1.45]	0.81 [0.46 – 1.45]	0.87 [0.42 – 1.81]	0.53* [0.32 – 0.90]
LR Chi-squared (Degree of freedom)	233.98*** (25)	41.06* (27)	171.48*** (24)	175.04***(27)
Pseudo R-squared	0.1931	0.0630	0.3081	0.1866
AIC	1029.55	666.19	435.03	818.99
BIC	1153.74	782.88	539.89	968.04

Note: All models were controlled with children-specific characteristics (age, previous birth interval), household characteristics (mother's age, mother's education, wealth index quintiles, household dependency ratio), and community characteristics (region, area, ethnicity).
OR: Odd ratio; 95%CI: 95% Confidence interval; AIC: Akaike's information criterion; BIC: Bayesian information criterion
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

DISCUSSION

It is the very first study in Vietnam exploring daughter discrimination due to son preference. The strength of this study is controlling for sibling sex (consider the variable having a brother or not having a brother) inside the model analyzing the relationship between child sex and parental care, instead of just making a simple regression model about parental care between boys and girls. The results show that daughters born in families without any previous sons face disadvantages, particularly receiving inadequate care (supervision) from adults. These findings emphasize the need for separately evaluating *generalized* and *selective discrimination* against daughters on tracking gender equality in children's health and well-being, especially in countries with strong son preferences.

According to this study's findings, without combining the effect of having older brothers, there are no gender differences regarding immunization, care-seeking for illness, early childhood education, and care from adults among Vietnamese children. These findings are consistent with previous studies and reports, which make Vietnam different from other societies with strong son preference (9, 14, 16, 17, 22). In some countries, such as India or China, gender disparities in children's outcomes have been observed for a long time (8-10, 23, 24). For example, girls have a lower rate of complete vaccination than boys (10). Parents also delay the care-seeking when their girls get sick place these children in danger of not getting an effective cure (8, 23). Furthermore, girls attend education later and shorter than boys (24). Indeed, these disparities have not occurred in Vietnam due to the government's long-term strategies to increase women's value in society and encourage the involvement of both genders in constructing a country after achieving independence in 1945 (25).

Differentiate with other countries with son preference, selective discrimination in immunization, care-seeking for illness, and early childhood education cannot be found in Vietnam. In general, under the idea of son preference, daughters' outcomes depend on their previous sibling's sex structure (11). In India, daughters without brothers are less likely to receive full vaccination than sons without brothers (10, 13). Moreover, these children also face a lower rate of receiving advice or treatment when getting sick than sons without brothers (13). In many cases, having older brothers can reduce discrimination against next daughters (26). One reason for these selective discriminations comes from the distinction in the utility of rearing sons and daughters, affecting parents' decision to invest in children's health and education (27). It is the key point to explain differences between Vietnam and other countries with strong son preference because Vietnamese under-5 children have free health insurance and do not need to pay the fee for vaccines used in National Immunization Program or for early childhood education. These supports from the Vietnamese government play important roles in improving children's health and well-being and promoting gender equality.

In Vietnam, while son preference is not associated with immunization, care-seeking behaviors, and early childhood education, it affects the probability of receiving adequate care for daughters in sonless families. This finding provides evidence about daughter discrimination in Vietnam which is not well-known in the literature. Although nonadult supervision places children at risk of unintended injuries, only a few studies in the world have tried to explore gender disparities in receiving adequate care from adults and show no significant associations between boys and girls (22, 28). Moreover, we cannot find any studies investigating the influences of siblings' sex structure on gender differences in care from adults. Thus, further studies need to be conducted to give more evidence about this selective gender discrimination, especially in strong son preference societies. From our results, disparities in care from adults also follow the similar principle of other types of daughter discrimination due to son preference for which daughters without brothers have the worst outcomes, and having an older brother will reduce discrimination against next daughters. These findings can be explained under the effects of son-targeting fertility behaviors, making girls more likely born earlier in larger-size families than boys (5). Moreover, since sonless couples try to have a son as soon as possible, the birth interval between each child, or each girl in this case, will be shorter (29). In this context, older sisters take responsibility for supervising their younger siblings, which increases the rate of nonadult supervision. Besides, this study result shows that daughters with brothers are more likely to receive adequate care from a parent than those in sonless families. These results are consistent with a mixed-gender preference, which also existed in Vietnam along with son preference (20).

For this study, there were some limitations. Firstly, we could not measure the strength of parents' son preference, which might link with how parents treat their children directly. However, children's sex structure could affect this individual attitude, especially those who already have a son. Thus, this study observed son preference through behavioral evidence presented in sonless families used by many studies before. Secondly, some information such as whether parents gave their children private services or medical and education expenses for a child could not retrieve. Since the amount of investment in children based on their sex might be strong evidence about parents' sex preference, it suggested exciting topics for studies in the future.

CONCLUSION

Unlike other countries with strong son preference, daughter discrimination has existed in Vietnam but is challenging to detect. Without influences of sons' effects, boys and girls are not different in immunization, care-seeking for illness, early childhood education, and care. Indeed, daughters without brothers were less likely to receive adequate care than sons without brothers and daughters with brothers. Moreover, the presence of sons in a family did not influence the possibilities of receiving adequate immunization, receiving appropriate care-seeking for illness, and attending early childhood education of the last child.

RECOMMENDATION

Our findings suggest the existence of daughter discrimination in Vietnamese society, which is undetectable by only comparing boys' and girls' outcomes. Thus, this kind of disparities may also be detected in other children's health and well-being outcomes, requiring further studies to explore. There is a need to prioritize girls in sonless families by specific policies and program interventions to promote gender equality in society. Increasing public awareness about the consequences of son preference may help to reduce this practice. Furthermore, free welfare for children is also a potential solution to deal with the gender disparities in children's health and well-being outcomes.

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A SOCIAL ECOLOGY OF SEXUAL HEALTH AND WELL-BEING OF OLDER GAY MEN AND TRANSGENDER WOMEN IN CHIANG MAI, THAILAND: A QUALITATIVE STUDY

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ABSTRACT

With increasing ageing populations in Thailand, including sexually diverse communities, there has been little attention given to older gay men and transgender women regarding their sexual health and well-being. Several international studies indicated that these communities have been underserved, especially in countries that lack human rights to protect against social and cultural stigma. Despite the seeming acceptance of sexual diversity in modern days of Thailand, the well-being of older gay men and transgender women communities that had experienced discrimination, victimization, and identity concealment in their early years could have been better understood through open-ended exploration. This study explores the social-ecological factors contributing to the sexual health of older gay men and transgender women in Chiang Mai, Thailand. This qualitative study was guided by a grounded theory approach. Eight in-depth interviews were conducted in Thai with four older gay men and four older transgender women aged 60 years or older and Chiang Mai locals, purposively recruited through a local community-based organization that has been working for this focal population. The semi-structured interview guide was informed by the social-ecological model. All interviews were digitally recorded and transcribed. The researcher conducted a thematic analysis using line-by-line and thematic coding from the transcripts. Several themes emerged from the interviews across the social-ecological model. They are (1) individual level: embarrassment of ageing, feeling of loneliness; (2) interpersonal level: isolation, friends and family support; (3) sociocultural level: culture and beliefs, stigma and discrimination; and (4) structural level: social exclusion, discrimination and stigmatization from service providers, and lack of law supporting ageing sexual minority populations. The intersectional impact of multi-level factors on sexual health and well-being of older gay men and transgender women demonstrated that individual- and interpersonal-level experiences could contribute to their well-being, both physically and mentally. Interventions on acknowledging awareness and the health needs of such marginalized communities may support understanding and improvement of their health quality. Sociocultural- and structural-level factors suggest that further social policy and intervention research should promote inclusion and equality for older gay men and transgender women in Thailand.

Keywords: gay men and transgender women, older adults, sexual health, social-ecological model, Thailand

INTRODUCTION

Through literature review, research, and evolving cultures, the understanding of sexual health has developed with the inclusion of reproductive health (1). The attempt to best define sexual health has progressed through times, from the report of the 1994 International Conference on Population and Development (ICPD) to the Surgeon General's Report and the National Strategy for Sexual Health and HIV (2,3). The World Health Organization (WHO) had later tasked global experts to understand and develop a clearer definition for sexual health and finally concluded in 2002 as:

"A state of physical, emotional, mental and social well-being in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence. For sexual health to be attained and maintained, the sexual rights of all persons must be respected, protected and fulfilled (2)."

The WHO 2010 report indicates that the ability of men and women to achieve sexual health and social well-being depends on accessibility of information, services, as well as environment (4). Each gender has different roles, responsibilities and expectations, given by society and culture, which shape their relationship of gender-based rights and their general sexual health. The WHO's 2002 report on sexual health also indicated that for one's sexual health to be achieved, sexual rights, including the right to access appropriate health-care services and respect for bodily integrity, should be protected (5).

Sexual and gender minorities (SGM), also known as lesbian, gay, bisexual, and transgender (LGBT) persons, are a diverse population (6). Despite the fact that these communities have become more visible and engaged in society, there have been disparities in their health and well-being. Stigma, discrimination, and criminalization towards these populations have been such social and structural barriers in accessing health care needs (7). These challenges and experiences in life address the burden of mental and physical health issues.

The study of SGM populations in Thailand has been given attention to by both local and international researchers across various aspects, such as health, mental health, and social health. However, there has been little attention to SGM older adults around their sexual health, mental health and well-being (8,9). Several international studies revealed that SGM older adults have been underserved, especially in countries lacking human rights to protect against social and cultural stigma, which could seriously impact their aging, mental health and health quality (10-12). According to Best Living Taste (BLT) Bangkok statistics, Thailand has the fourth largest of SGM populations in Asia, at 4 million persons among the nation's population (13). Moreover, the Department of Older Persons has investigated the older populations in Thailand and ranked Chiang Mai as the third largest number (18.8%) of the province's total population, following Bangkok and Nakhon Ratchasima, respectively (14). Among these, there could be a significant number of older adults ages 60 or more, defined in section 3 of the Act on the Elderly, B.E. 2546 as "the elderly" (15, p.4). Kittiteerasack et al. and Hair et al. (16, 17) are among the first researchers to examine Thai SGM older adults' mental health issues. Although a number of key populations remain visible and active, there is scant evidence about sexual health and health disparities in Thailand (8). Several studies also supported that older LGBT populations should be more focused on overall health and sexual health research in all aspects (16,18). The foremost concerns that affect older LGBT people are similar to those that affect older heterosexual people: loneliness, health-related problems and financial issues. About 36 percent of older men reported concealing their sexual identity throughout their lives and realized that this had led to internalised homophobia (19). There is very little research on the mental health of older gay men, but there are suggestions that older gay men have raised levels of depression compared with older adults in the general population (20). Additionally, some older transgender women tend to experience depression which led to concerning issues such as suicide attempts. A study among Thai transgender women found that half of the participants lived with depression, and one-third of those were older (21).

Understanding of sexual health and well-being among this particular population is needed. The WHO's 2002 report of a technical consultation on

sexual health also suggested that issues around sexuality were complex and that the need to understand emotional, psychological and cultural factors of sexual health should be addressed (5). Therefore, this qualitative study aims to explore the social-ecological factors contributing to the sexual health of older gay men and transgender women in Chiang Mai, Thailand.

METHODS

This qualitative study was conducted in June and July 2021 in Chiang Mai, Thailand. Mplus Thailand Foundation, a community-based organization (CBO) serving sexual health and human rights for gay men and transgender women in Chiang Mai, provided recruitment support through the connection of their clients and members.

Study design

The study applied the concept of social-ecological theory (22) to explore individual, interpersonal, socio-cultural and structural factors associated with sexual health and coping strategies of older gay men transgender women in Chiang Mai, Thailand (see *Figure 1*). It also greatly supports the need for a qualitative approach because the topic around the population of interest is largely unexplored. It would be premature to design a survey since essential questions have not yet been sufficiently investigated. That would allow for greater generalizability but at the expense of validity. Like what the main issues really are and the diversity among the issues, not all LGBT people are the same. So, that wouldn't allow for an appropriate survey of the issues. This qualitative approach will allow open-ended exploration, which is critical to do.

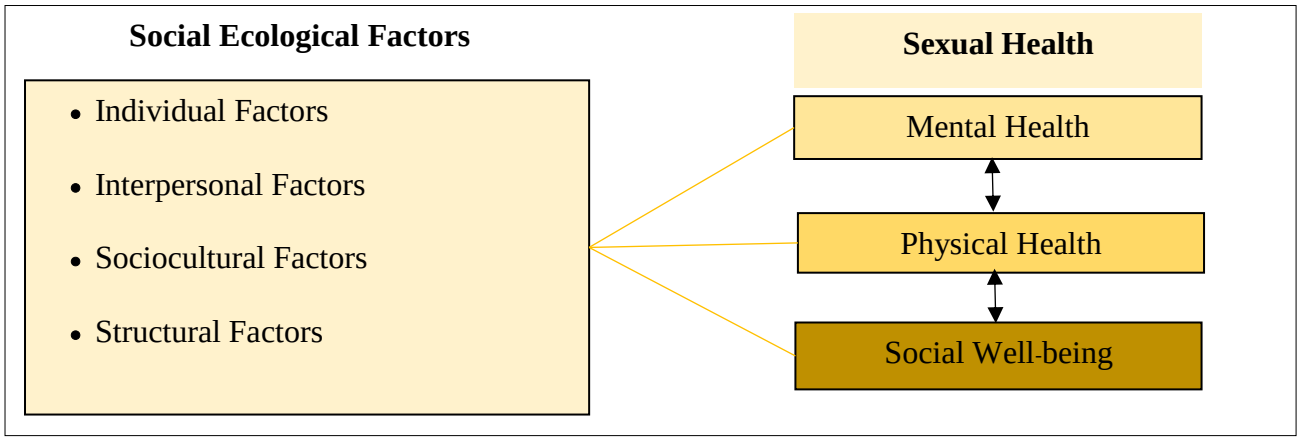

Figure 1 Conceptual framework

Study participants

This study received assistance in recruitment from the local CBO partner, which has been serving gay men and transgender women in Chiang Mai for over ten years, using purposive sampling, which aims to provide rich information of the study focus and population of interest (23,24). The respondents are older local gay men and transgender women of Chiang Mai living in urban and semi-urban areas. With recruitment assistance provided by the CBO, focal populations were screened for eligibility through direct contacts by CBO staff and members. The CBO has been serving gay and transgender communities for over a decade and has had over 5,000 client pool across the province, including neighbouring provinces. The staff could purposefully recruit long-term local older gay male and transgender female clients who have been receiving sexual health services at the CBO as well as having shared issues of struggles and challenges in life as gender minority population—which would benefit the study by facilitating the illustration and highlight of the study focus. Eligibility criteria were being Thai, self-identified as a gay man or transgender woman, age 60 years or older, and have resided in Chiang Mai for at least ten years.

Data collection

Upon confirmation of eligibility and permission from the CBO staff, the author was provided the respondents' means of contact to arrange for the interview. Eight in-depth interviews (45-60 minutes) were conducted by the author using a semi-structured interview guide with older gay men (n=4)

and older transgender women (n=4). Basic sociodemographic information was collected at the beginning of the interview. Questions focused on the respondents' views and experience regarding being gay/transgender and general sexual health and well-being issues. The interviews were conducted in their homes, CBO partner's office, and in a private room of the researcher's office in Chiang Mai. All interviews were digitally recorded and transcribed verbatim.

Data analysis

The in-depth interviews were transcribed verbatim (any personally identifying information was removed) and reviewed using thematic analysis (25). The coding technique was used through Atlas.ti program. A code book was developed based on the semi-structured interview guide. Once the codes have been defined and categorized, emerging themes have then been developed with guidance of the social-ecological theory, developed by Bronfenbrenner (22) and successfully applied by several relevant studies (26,27). This theory was applied to explore and understand the multilevel context—individual, interpersonal, sociocultural, and structural—of factors that contribute to the sexual health of older gay men and transgender women in Chiang Mai. The social ecology characterizes the interrelations among environmental conditions, human behavior, and well-being. The concept also analyses characteristics of environmental settings as consisting of multiple physical, social, and cultural aspects which can affect health outcomes, including physical health, emotional well-being, and social structure (28).

Ethical considerations

The study was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Chulalongkorn University (No. 157/2564). All respondents were explained the objectives of the study and provided written consent prior to conducting the interviews.

RESULTS

Four older gay men and four older transgender women of Chiang Mai locals were interviewed. The majority of the respondents had post-secondary education with full-time professions. Half of them live alone. *Table 1* shows the sociodemographic characteristics of the respondents. Guided by the social-ecological model, several themes emerged under each level (see *Figure 2*), explaining multi-level issues and challenges addressing the sexual health and well-being of older gay men and transgender women in Chiang Mai.

Table 1 Participants sociodemographic characteristics

ID	Age	Sexual Orientation	Occupation	Education	Living Arrangement
TGW1	60	TGW	Ex-performer	University	Alone, semi-urban
TGW2	62	TGW	Event MC/Host	Vocational	With friends, urban
TGW3	61	TGW	Makeup artist	Vocational	With partner, urban
TGW4	63	TGW	Beauty therapist	High school	Alone, semi-urban
GM1	62	GM	Tour guide	University	With partner, urban
GM2	65	GM	Therapist	Vocational	Alone, urban
GM3	60	GM	Unemployed	High school	With family, semi-urban
GM4	61	GM	Office clerk	University	Alone, semi-urban

GM, gay man; TGW, transgender woman

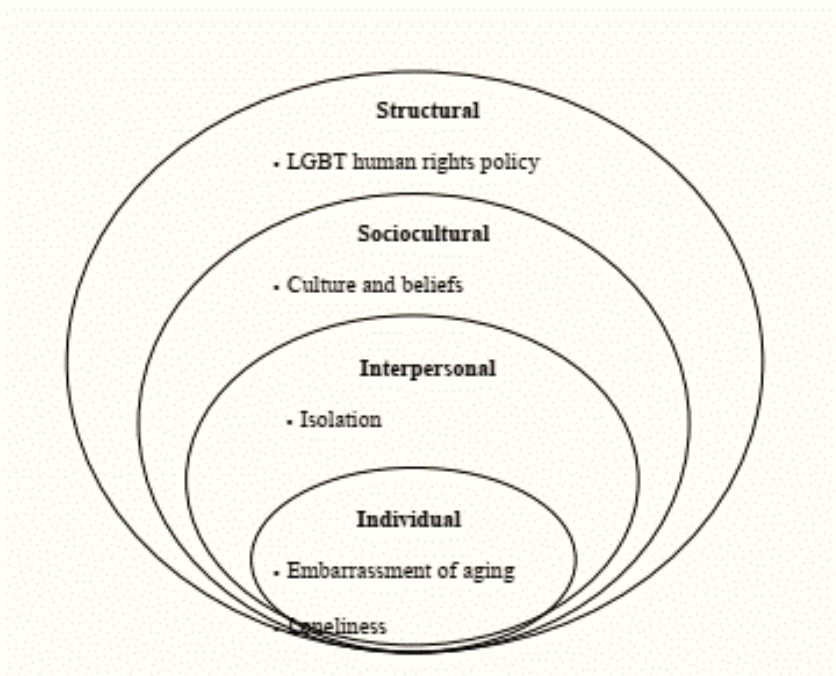

Figure 2 Social ecological model of sexual health and well-being of older gay men and transgender women in Chiang Mai, Thailand

Individual Level

Embarrassment of ageing

Physical appearance plays an important role in today's world. Their experience of ageing is unavoidable, yet ways to respond to it could affect the person's public and social connections. Some respondents expressed a lack of confidence and feeling of embarrassment in being in public due to physical ageing:

"I don't usually get out much. I don't look the same anymore. I can't compete with teenagers these days. You can fool people on social media using filters, but the reality is reality…no filter. If it is not for work or something important, I would just stay in." (TGW3)

"I am not like before. My skin is no longer tight and fresh. My belly is bigger, and my hair is thinner. If there is a group photoshoot, I tend to stay

away. I accept it, but I don't like to show it that much." (GM3)

Another respondent indicated loss of attention, including sexual attention, from being seen as an older person, compared to when they were younger, and that personal standards needed to be much lower in seeking sexual relationship:

"Going out and about is never the same at this age. I used to get some kind of visual attraction back then, but now it is just…oh, just an old guy. I can't keep dying my hair every two weeks. I'd rather have grey hair than cancer [laugh]. I have Facebook, but I barely post anything…except food. I still go to work and go straight home afterwards. I don't think I look that old, but kids just keep looking younger and younger." (GM1)

"I can't be picky these days when I meet someone. It is either that or nothing. I can't really choose. If I want to enjoy someone and be a little active about it, I need to be less picky. Someone around my age would understand." (GM2)

Loneliness

Some respondents provided comments on being lonely as most of their heterosexual friends and family members had their own married lives with children. This resulted in the decrease of socialization and that they had to do things on their own, which in a long term could suggest an emotional health issue of loneliness.

"My good friends from school all get married and have kids. We hardly hang out. Of course, it is kind of lonely but what can I do. At least I still have a job. I can still visit them, but it is not the same anymore, you know." (GM2)

"My folks are all busy with their kids. Arranging a dinner get-together is so difficult. I am used to doing things by myself and go to places alone. And finding someone to date at my age…is not really an option anymore." (TGW4)

Another respondent addressed positivity that having a partner is important as for being an older non-heterosexual person, as well as support system one could receive from a meaningful relationship:

"Lonely? I like to keep myself busy. I am lucky I have my boyfriend. At this age, you need to value whoever sticks with you through times. I can't have a child. All I have is him, at least I can rely on him if I get sick." (TGW3)

Interpersonal Level

Isolation

The data revealed that being alone was not by choice. As people moved on with their adulthood, having a family somehow indirectly pushed them to isolation. Being indirectly excluded from immediate family and friends, though not intentionally, could influence isolation which also leads to negative mental well-being. A few respondents added:

"When everyone around you is busy with their own people, and you're alone…of course, you have to be by yourself. You can't go with them and be a third person. You don't want to go with your friend's family and then be an outsider. You have to learn to live by yourself." (GM2)

A transgender woman respondent expressed the accepting decision of living alone as a result of her partner's passing, which also ended her need for sexual relationship:

"I was in a 30-year relationship. He passed away a few years ago. I don't want to have a new relationship. I am too old. I don't want to feel that pain again. I am alone now and it's okay. I don't care about sex anymore either." (TGW1)

Friends and Family Support

Several respondents addressed their support from friends and family for being gay or transgender which has been earned through time and behavioral approval. The acceptance of their sexuality/sexual orientation might not be since their first disclosure, and the data suggests that time and good behaviors could increase the acceptance and support. Some respondents indicated some kind of conditional support from family:

"Everyone in my family is ok with me being this way. It was not easy growing up, but I am older now. If you are nice and good, they will think of you and bring their kids to visit you." (TGW4)

"Everyone moved out and built their own family. I can't build a family so I am here at home with my mother. I need to take care of her; she is very old. They still come to visit and send some money to help. We still keep in touch." (GM3)

One transgender woman stated the fortunate acceptance from her community was gained through her respectful partner:

"I guess I was lucky that my boyfriend was a respectful person in this neighborhood, so people here tended to accept me and be kind to me." (TGW1)

Sociocultural Level

Culture and Beliefs

Rich culture and tradition could put pressure on sexually diverse people in addition to obtaining acceptance from family and society. A long-lasting tradition of certain culture where male child is expected to bear the burden of extending the family and generations still exists in Thailand. An older gay man expressed his experience as a Thai-Chinese son:

"My family is half Chinese, so being gay is not really something they would easily accept.

Going to places with my family back then was tough for me. I had to behave and acted straight. People kept asking about when I would form a family. So much pressure. Now I am old, and they are gone. I have done my best being their child. I didn't think it was any sin." (GM4)

Stigma and Discrimination

Stigma and discrimination perceived from some public places could pose challenges in life. This could very well act as a barrier to the person for practicing one's rights to enhance their physical and mental well-being. An older transgender woman explained a difficulty from enjoying her basic rights in public places that she felt discriminated against:

"There are places that I cannot really go…like a recreational facility, some gym, swimming pool. I am like this and it confuses people. It rather draws attention from people to maybe make fun of me. Maybe that is in my head but it is just not comfortable. I cannot go to the men section, and in the women section, they look at me strangely." (TGW2)

Stigma was associated with misbehaving or having some disease as being gay or transgender at a healthcare facility. A few respondents described their experience receiving healthcare services as an older gay man and transgender woman:

"I meet many clients and things could sometimes happen behind a closed door. I am still sexually active and I always take good care of myself and be responsible. I take PrEP. But when I go for a checkup and get a new bottle, there is always some vibes that sort of tell me that they [providers] disapprove of me having sex at this age." (GM2)

"I go for my medication and checkup routine, but the way people look at me and even some nurses question me as if I am a sex worker. I don't really care much but this is 2021. Shouldn't this be a normal thing? Couldn't they think maybe I went to get my hormones shots?" (TGW4)

Structural Level

LGBT Human Rights Policy

The lack of law to protect LGBT populations in the country restricts some human rights as anyone or any partners should freely practice. An older transgender respondent indicated her experience from a healthcare facility that did not acknowledge same-sex partners:

"Before my boyfriend passed, we wanted to get married…but of course, impossible. There should be some kind of law for us. I went to a hospital with him when he was sick, and the nurse asked me whether I was his family member. What was I do? Like, together for 30 years but no legal support. 30 years together almost meant nothing in that situation." (TGW1)

Social Exclusion

Older adults in certain venues can still experience discrimination on the basis of age. Additionally, it raises a deeper level of discrimination if at your own community. An older gay man described discomfort and disappointment for the age-restricted gay recreational venue:

"Some place like gay spa or bathhouse, they charge so much more if you're older than this age. Or free membership if you are x age or discounts. It is not nice. Better just say only ages x-x. I understand that they want to keep younger looing clientele in their place, but it is just not nice." (GM4)

DISCUSSION

This study among older gay men and transgender women in Chiang Mai reveals multi-level factors contributing to their sexual health and well-being. Thai culture has been described as "tolerant but unaccepting" of sexual and gender minorities, such as transgender people and gay people (29). One aspect of this is that sexual and gender diversity can be acknowledged in some situations and social contexts that are deemed "appropriate". Acceptance and non-acceptance are not fixed and unchanging but depends on what is considered appropriate for a particular situation (30).

The findings suggest that at the individual level, the loss of satisfaction at own appearance contributes to loneliness and isolation. This also affects interpersonal and social activities, including having a sexual relationship with someone. This could pose a concern as a previous study also showed that gay men's struggle through physical appearance and sexual functioning changes due to ageing contributed to loneliness and could develop risky coping strategies such as alcohol/drug use and unsafe sex (31). The findings on individual level are also subsequent consequences of those on the structural level. Several studies prove that challenges on day-to-day life of these populations, including the loss of inclusion or sense of belonging to the recreation/public facilities, are one of the roots to put them at risk of social isolation (32).

The results also suggest that the intersecting factors at the sociocultural and interpersonal levels impact the well-being of older gay men and transgender women at the individual level. This highlights the existence of minority stress among this older population of the study. It is also important to acknowledge that there are psychological and social costs to having to hide one's sexuality or gender identity. Although this may help someone to "pass" in a particular situation, a lifetime of having to monitor what one is allowed to say, how one is allowed to act, who someone is allowed to mention as their friends or partner, can take a psychological toll. This is referred to as "sexual minority stress" (33). The socio-cultural challenges that gay men and transgender women have experienced, as well as having to adapt and respond to their social environment, can impact on their physical and mental health (33).

In terms of stigma and discrimination, it is important to describe differences within LGBT people. Not all LGBT people face the same challenges, and some have greater resources to deal with these challenges. As in many other cultures, LGBT people face distinct challenges according to their socioeconomic status, education, ethnicity, family background, and health status (8). It is evident that stigmatization and discrimination are still apparent among healthcare services at the socio-cultural and structural levels. Previous studies in Thailand also supported that LGBT people experienced prejudice from healthcare providers (7,27). In 2016, the LGBTQ+ community was identified as a "health disparity population" by the National Institute on Minority Health and Health Disparities (34) , somewhat because people who self-identify as part of this population tend to experience challenges in accessing health care. Yarns et al. also indicated that challenges and experiences of discrimination and victimization posed potential vulnerability to the person (12). Another study similarly supported that the experience of sexual stigma, for some people throughout their life course, could negatively affect their sexual health (35). LGBT people include all races, ethnicities, social classes, and religions; however, they seem to experience prejudice and discrimination from providers when accessing health care services. Therefore, community-based organizations providing health services to LGBT populations play an essential role globally.

CONCLUSION

The intersectional impact of multi-level factors on sexual health and well-being of older gay men and transgender women demonstrated that individual- and interpersonal-level experiences could contribute to their well-being, both physically and mentally. Personal and public understanding of ageing society should be taken place as Thailand is becoming one, regardless of gender. Interventions on acknowledging awareness and health needs of such marginalized communities may support understanding and improvement their health quality. Sociocultural- and structural-level factors suggest that further social policy and intervention research should be focused in order to promote inclusion and equality for older gay men and transgender women in Thailand.

RECOMMENDATIONS

As this is not yet a popular topic to study in Thailand, more issues around ageing LGBT populations should be studied. The findings from this study could support the need for future quantitative research to be surveyed in order to further examine possible factors associating with all aspects of well-being of these populations, especially mental health. Additionally, there is a need for raising awareness, developing training to health service providers and advancing available resources to support the ageing LGBT communities.

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PREVALENCE OF MATERNAL NEAR MISS IN MAGWAY REGIONAL HOSPITAL, MAGWAY, MYANMAR

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ABSTRACT

Maternal mortality is a significant public health concern. Women die daily from pregnancy complications, delivery-related issues, and childbirth. Pregnancy-related morbidity and mortality in Myanmar dramatically increased from 17.6% in 2012 to 20.2% in 2018. In Myanmar, there are limited studies on maternal near-miss. Therefore, this study aimed to estimate the prevalence and quality of maternal health care services in Magway Regional Hospital, Myanmar. This cross-sectional study employed a health facility-based secondary data analysis to estimate the prevalence of maternal near-miss cases and the quality of maternal health care services in Magway Regional Hospital in 2019. A multistage sampling technique was used. All medical records of pregnant women, admitted or referred to the Obstetrics and Gynecology (OG) ward during pregnancy or within 42 days of termination of their pregnancy in 2019, were collected. WHO maternal near-miss approach was adopted as a measurement tool to examine the maternal near-miss and quality of care. Frequency, percentage, mean and standard deviation were presented for descriptive analysis. A total of 3,291 pregnant women between the ages of 15 to 50, who were admitted into the Magway Regional hospital, were included in this study. Among all, there are 11 cases of a maternal near-miss with 7 cases of maternal death. The maternal near-miss ratio was 3.9 per 1,000 live births. The maternal mortality ratio was 246 per 100,000 live births, and the maternal mortality index was 0.39. For the quality of care, only 48.67% and 30% of pregnant women received anticonvulsants and therapeutic antibiotics when required, respectively. The results revealed that the maternal near-miss ratio in this study was low. In contrast, the maternal mortality ratio was 246 per 100,000 deliveries, higher than the worldwide average maternal mortality ratio (211 per 100,000 deliveries in 2017). Moreover, the study highlighted that the quality of care during the reviewed period needed to improve, showed the highest number of deaths following abortion-related sepsis cases.

Keywords: maternal near-miss, maternal mortality, pregnancy complications, Myanmar

INTRODUCTION

Since the Millennium Development Goals in the 1990s, the world has been committed to reduce maternal mortality. In twenty first century, Sustainable Development Goal (SDG) is a continuation of this commitment among many agenda. For the SDG, it had been simply integrated with 17 Goals and 169 targets through the advances of social, political, economic and health care sector. Amongst the targets, reduction of global maternal mortality ratio (MMR) to less than 70 deaths per 100,000 live births by the end of 2030 is the first priority process indicator made by countries (1**)**. In spite of these efforts, global maternal mortality is nevertheless undeniably high with approximately 810 women die every day from pregnancy complications, delivery-related issues, and childbirth (2**).** Moreover, compared with the developed countries, reduction of MMR is an even slower progress and a major challenge in developing countries where there are risk of economic development and resources-limited setting **(**3**).** In these countries, most of women died from severe maternal outcomes or life-threatening conditions during their pregnant life, delivery or puerperal period. Only smallest numbers of women survived from these dangerous conditions. Distressingly, three quarters of maternal mortality are from the preventable causes such as heavy bleeding (hemorrhage), pre-eclampsia, and infection.

In the light of this situation, focusing on women with serious maternal complications (both maternal near-miss cases and maternal deaths) and evaluating the quality of care proposed by World Health Organization **(**4**)**, would provide a better suggestion of maternal health care system. A maternal near-miss (MNM) is defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy" **(**5**).** The main intention of this MNM criteria approach is to get a better clinical practice and to reduce avoidable serious cases by using the research-based finding. There are many studies about maternal near-miss cases by using WHO maternal near-miss approach. Across the worldwide, the total prevalence number of MNM was 18.67 per 1000 live births. Alarmingly, the second highest number of MNM cases was detected in Asia, at nearly 17 per 1000 live births.

One of the ASEAN countries, Myanmar has the total number of MMR 247 deaths in 2014, then it apparently decreased in 2015 and 2016 with 246 deaths and 245 deaths respectively **(**6**).** In 2017, maternal deaths slightly increased with MMR 250 deaths per 100,000 live births reported by Maternal Death Surveillance and Response (MDSR) **(**7**)**. The top three major leading causes of maternal mortality ratio were unspecified abortion, which accounted for 23%, followed by other complications of labor and delivery (18%) and postpartum hemorrhage (PPH) with 7%. Yearly hospital data reports showed that the main leading causes of morbidity were pregnancy related cases, childbirth and puerperium cases, which were dramatically increased over the 6 years period in Myanmar (from 17.6% in 2012 to 20.2% in 2018). Additionally, in 2018 these morbidity cases reached almost 600,000 cases. These data signify an issue or concern with the importance of detecting pregnant women with severe complications **(**8**)**. Maternal Death Review also illustrated that more than half of maternal cases died in the post-partum period, and around 15% died during delivery. One quarter (25%) of the maternal death cases were happened during pregnancy life**.** The review data highlighted that receiving the qualified maternal health care from antenatal period to postpartum period is an essential factor to decrease the deaths and risk of pregnancy complications **(**6**).** Therefore, while many health care strategies implementing to prevent deaths, there is also needed to consider the advances of continuity and quality of maternal health care. Even though, there are many studies about maternal mortality ratio in Myanmar; there is still lacking on the information of MNM and the quality of care. Therefore, the main objectives of this study are to estimate the prevalence of MNM and the quality of care in Magway Regional Hospital Magway, Myanmar.

METHODS

Research design

This cross-sectional study employed a health facility-based secondary data analysis to estimate the prevalence of maternal near miss cases and quality of care in Magway Regional Hospital, Magway, Myanmar.

Study area

Magway Division is located in central part of country (Myanmar). As of 2015 census data, it had a total population of nearly 4 million. In term of population density ranking, Magway region stood at seventh place (11). The data was collected from the Obstetrics and gynecology ward of Magway Regional Hospital, which was the major public hospital, located on the main road of Magway City.

Study period

March to June 2021.

Study population

All pregnant women who were admitted or referred to Magway Regional Hospital within 42 days of termination of their pregnancy in 2019 were included in the study. The records with incomplete maternal near miss related data were removed from the analysis.

Sample Size

From the hospital data, there were 3396pregnant women attended for maternal care and services in 2019. After excluding the misinformation, maternal death and data error, the final sample size in this study was 3291 pregnant women.

Sampling technique

Multi-stage sampling technique was used. Two stages were practiced and a purposive sampling technique was used in each stage. Magway was purposively selected since it was one of the biggest states in Myanmar. Further, according to report of Myanmar census data, in 2016, Magway is included in the highest range where maternal death is 77 deaths. The deaths rate remained stable in 2017, at 79 deaths, but the number of deaths fell suddenly in 2018, at 64 deaths per 100,000 live births. Public hospitals in that region also provide major operation, emergency obstetric care and maternal health care services in treating the serious cases from antenatal to postnatal period. As one of the tertiary hospital with the highest numbers of admission of pregnant women, Magway Regional Hospital was purposively selected as a study area. All pregnant women who were admitted or referred to Magway Regional Hospital during within 42 days of termination of their pregnancy in 2019 and match with the study criteria were included in the study.

Measurement tool and Data collection

In this study, hospital records were the main source of information. Reviewing the hospital record was performed to identify the maternal near-miss cases and quality of care using the WHO Maternal Near-miss Tool in an individual data collection form. In the process of reviewing on the hospital record, confusing facts were clarified with the help of hospital staffs.

MNM identification

The maternal near-miss cases were identified as a near-miss case if the one or more of listed conditions were presented. The WHO near-miss criteria and tool used, and the listed conditions were as "Cardiovascular dysfunction, Respiratory dysfunction, Renal dysfunction, Coagulation/hematologic dysfunction, Hepatic dysfunction, Neurologic dysfunction, Uterine dysfunction/hysterectomy, and Multiple organ dysfunction".

Quality of maternal healthcare services

The proportion of care received was calculated for the quality of maternal healthcare services for each condition (indicator) as show in following Figure 1. Based on WHO maternal near miss approach, they expected use of the intervention should be nearly 100%, then, they recommended intervention below 95% as opportunity to improve care. For instance, for all reviewed records of pregnant women who had eclampsia, what was the proportion that they received magnesium sulfate? For the proportion below 95%, it interpreted as an opportunity to improve care.

Indicators	Number	Percentage
1. Prevention of postpartum haemorrhage		
Target population: women giving birth in health-care facilities		
Oxytocin[a] use		
Use of any uterotonic (including oxytocin)		
2. Treatment of severe postpartum haemorrhage		
Target population: women with severe PPH		
Oxytocin[a] use		
Ergometrine		
Misoprostol Other uterotonics		
Any of the above uterotonics		
Tranexamic acid		
Removal of retained products		
Balloon or condom tamponade		
Artery ligation		
Hysterectomy		
Abdominal packing		
Proportion of cases with SMO Mortality		
3. Anticonvulsants for eclampsia		
Target population: women with eclampsia		
Magnesium sulfate[a]		
Other anticonvulsant		
Any anticonvulsant		
Proportion of cases with SMO		
Mortality		
4. Prevention of caesarean section related infection Target population: women undergoing caesarean section		
Prophylactic antibiotic during caesarean section 5. Treatment for sepsis		
Target population: women with sepsis		
Parenteral therapeutic antibioticsa		
Proportion of cases with SMO		
Mortality 6. Ruptured uterus		
Target population: women with ruptured uterus Laparotomy		
Laparotomy after 3 hours of hospital stay Proportion of cases with SMO		
Mortality		
7. Preterm birth		
Target population: women having a preterm delivery after 3 hours of hospital stay		
Corticosteroids for fetal lung maturation[a]		
Early neonatal mortality		

Figure 1 Outcome indicators related to specific conditions for assessing the quality of maternal healthcare services **(**5**).**

Descriptive analysis

The data entry and analysis were done by using SPSS software version 22. The prevalence of maternal near-miss was determined as the number of maternal near-miss cases per 1,000 live births. For descriptive statistic, frequency and percentage were presented for categorical data.

Reliability and Validity

Since the study used WHO maternal near-miss tool and all data were extracted from the medical records by a single researcher, the reliability and validity of the instrument were not performed.

Ethical Consideration

The study was ethically approved from Research Ethics Review Committee for Research involving Human Research Participants, Chulalongkorn University (COA. No. 085/2021), and got the approval permission of accessing and using the medical records from Magway Regional Hospital. This study did not require direct interaction or contact with the participants. All data were extracted from medical records without any patient identification. Confidential information on the participant's identity was disclosed. Therefore, the researcher exempted participant information sheet and consent form from individual participants.

RESULT

In this study, a total of 3,291 women were recorded with 2,896 deliveries and 2,840 live births. The study finds that 3,273 pregnant women had no life-threatening conditions, whereas 18 pregnant women experienced severe maternal outcomes. From this result, there are 11 cases of maternal near miss and 7 cases of maternal death. Therefore, the maternal near miss ratio was 3.9 per 1,000 live births. Maternal mortality ratio was 246 per 100,000 live births, and maternal mortality index was 0.39. Table 1 shows the information related to organ dysfunction of the pregnant women in this study. Among all, eleven pregnant women were experienced a total of 13 organ dysfunctions. Of the dysfunctions, coagulation dysfunction was presented in five pregnant women (45.45%). Unexpectedly, the two pregnant women, who suffered both cardio-vascular and hematologic dysfunctions; also got shocked and transfused packed cell up to 5 units. There was only one pregnant woman was found in each other severe maternal outcomes (cardio-vascular, respiratory, hepatic, and neurologic).

Table 1 Organ dysfunction involved **(**n = 11**)**

Organ dysfunctions	Number of cases (n)	Percentage (%)
• Cardio-vascular Dysfunction (Shock)	1	9.09
• Coagulation or Hematologic Dysfunction (Transfusion of red blood cell concentrates ≥5 units)	5	45.45
• Cardio-vascular Dysfunction and Coagulation or Hematologic Dysfunction	2	18.18
• Respiratory Dysfunction (Severe tachypnea)	1	9.09
• Hepatic Dysfunction (Jaundice in the presence of preeclampsia)	1	9.09
• Neurologic Dysfunction (Uncontrollable fits)	1	9.09

Quality of maternal healthcare services

Maternal healthcare services quality supported by hospital are illustrated on Table 2 and 3. In the study, proportion of target participants which received the recommended evidence-based intervention for severe postpartum hemorrhage, preterm delivery and prevention of caesarean related infection are above 95%. Among study population (3,291), more than 2,000 pregnant women gave birth by spontaneous virginal delivery or using caesarean section during the study period in MRH.

The study hospital used relevant treatment and management (oxytocin 81.82%, ergometrine 9.09%, misoprostol 18.18% and removal of retained products 63.63%) for each postpartum hemorrhage patients: they

fully received at least one treatment for treating postpartum hemorrhage which is greater than study criteria (95%). Moreover, almost half of study population delivered the baby with caesarean section: all those surgical patients (100%) got prophylactic antibiotics. Further, the result illustrated that over one hundred women delivered premature baby. Even though total percent of corticosteroids were used for fetal lung maturation, two neonates were dead in the study period due to eclampsia and history of attempt delivery at home.

In contrast, even over three quarters (89.23%) of participants were received suggested preventive treatment (oxytocin and other uterotonic) in preventing postpartum hemorrhage; its management did not pass according to study identification criteria. Similarly, the upmost prevalence number of life-threatening condition was founded as eclampsia (226 cases) during the study; it led to dead and organ dysfunctions up to four cases. Dealing with its treatment, only 48.67% of them received anticonvulsants from the health facility. Then, another noticeable point is that ten patients had severe sepsis infection, however, very few numbers (30%) of them received therapeutic antibiotics. Due to this inadequate quality of care, five mothers were died from sepsis. Regarding with rupture uterus, about 20 % of cases underwent laparotomy after 3 hours of hospital stay. As stated in quality identification criteria, these managements for eclampsia, sepsis and rupture uterus cases were not passed; hospital urgently need to improve interventions on these severe pregnancy complications.

Tab le 2 Quality of maternal healthcare services related characteristics of study population

Indicators	Number (n)	Percentage (%)	Received treatment* n (%)	Pass (Yes/No)
1. Prevention of postpartum hemorrhage				
Target population: women giving birth in health-care facilities	2896		2584 (89.23)	No
Oxytocin use	2464	85.08		
Use of any uterotonic	120	4.14		
2. Treatment of severe postpartum hemorrhage				
Target population: women with severe PPH	11		11 (100)	Yes
Oxytocin use	9	81.82		
Ergometrine	1	9.09		
Misoprostol	2	18.18		
Tranexamic Acid	1	9.09		
Removal of retained products	7	63.63		
Balloon or condom tamponate	1	9.09		
Hysterectomy	1	9.09		
Proportion of cases with severe maternal outcomes	1			
Mortality	1			
3. Anticonvulsants for eclampsia				
Target population: women with eclampsia	226		110 (48.67)	No
Magnesium sulfate	110	48.67		
Proportion of cases with severe maternal outcomes	4			
Mortality	1			
4. Prevention of caesarean section related infection				
Target population: women undergoing caesarean section	1236		1236 (100)	Yes
Prophylactic antibiotic during caesarean section	1236	100		
5. Treatment for sepsis				
Target population: women with sepsis	10		3 (30)	No
Parenteral, therapeutic antibiotics	3	30		
Proportion of cases with severe maternal outcomes	6			
Mortality	5			
6. Ruptured uterus				
Target population: women with ruptured uterus	5		1 (20)	No
Laparotomy	1	20		
Proportion of cases with severe maternal outcomes	1			
Mortality	0			
7. Preterm birth				
Target population: women having preterm delivery after 3 hours of hospital stay	125		125 (100)	Yes
Corticosteroids for fetal lung maturation	125	100		
Early neonatal mortality	2			

*Number of women and percentage who received at least one treatment for each indicator

DISCUSSION

The ratio of maternal near miss at Magway Regional Hospital was 3.9/1000 live births. It was higher than WHO recommendation that is generally expected to be around 7 severe maternal outcomes/1000 deliveries **(**5**)**. But, the result was lower than Asian countries (17 per 1000 live births) and worldwide trend (18.67 per 1000 live births) in generally **(**9**)**. Moreover, this finding was considerably lower than those documented in previous study conducted in developing country like Nepal: 36 near-miss obstetrical cases were reported. **(**10**)**. This might be difference in the years of study, the study population as well as various definitions in identifying in cases of pregnancy complication and organ dysfunctions. Further, the present study was retrospective data collection in one general hospital (tertiary care) which would give lower number of maternal near miss case.

The maternal mortality ratio in this study was 246 per 100,000 live births and maternal mortality index was 0.39. This ratio was nearly the same with Union MMR of 250 per 100,000 live births in 2017 (11), and it was noted that Magway's maternal mortality ratio might highest in tertiary hospitals. The other comparable result of MMR 254/100,000 live births was reported in the study of maternal near miss and maternal deaths in Mozambique (12). These results are similar to present study. But MMR for the present finding was much lower than the recent study conducted in the Nepal where 324 maternal mortality ratio per 100,000 live births occurred (10). This wide variation in range was seen due to the difference in the study population and deliveries rate.

The target population with the use of special intervention is assessed. In studied hospital, magnesium sulfate as anticonvulsant, oxytocin for prevention of postpartum hemorrhage and therapeutic antibiotics were underused. Even though sepsis and eclampsia were the most registered cause of MNM, the management for eclampsia and sepsis due to abortion were only 48% and 30% recorded. Controversially, Ethiopia study had administration of parenteral antibiotics for 96.2% and parenteral anticonvulsant for 95% while blood transfusion was the least provided management (13). The quality of care might be weak because diagnosis, idea about standardizing treatment and controlling drug usage depended on only physicians' experience. Sadly, another reason is pregnant women in MGH do farming and housework; they can't afford the cost of treatment and medicines even though they know their situation are worsened.

The study has some limitations. Because, it was conducted at one public hospital, the results might not be representative of entire nation. As it was secondary data analysis, it has retrospective study's nature; history related with pregnancy complications, delivery time and the correct dosage used by health facilities might be conflicted. On account of these facts, maternal near miss ratio and maternal mortality might be underestimated or overestimated in this study.

CONCLUSION

There were very limited studies regarding maternal near miss in Myanmar. Therefore, this study aimed to find the prevalence and quality of care regarding maternal near miss, in Magway Regional Hospital, Magway, Myanmar. The ratio of Maternal Near Miss at MRH was 3.9/1,000 live births, while maternal mortality ratio was 246 per 100,000 deliveries and maternal mortality index was 0.39. Also it found that there were some incomplete/inaccurate medical records; therefore, not only the improvement of the quality of care of reproductive health care services/system but also the medical record audit system should be strengthened.

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UTILIZATION OF DELIVERY SERVICES AND ITS CONTRIBUTING FACTORS AMONG ADOLESCENT MOTHERS IN INDONESIA: AN ANALYSIS OF 2017 INDONESIA DEMOGRAPHIC AND HEALTH SURVEY

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ABSTRACT

The maternal mortality ratio (MMR) in Indonesia remains high, with 305 deaths per 100,000 live births in 2015. Its reduction is still not substantially improved; only about one-third since 1990. Most mortality happens due to complications during childbirth. Among the age group, approximately 36 of 1,000 adolescent girls (15-19 years old) in Indonesia experienced childbirth. However, the utilization of delivery services is still low. Only 63% of women use institutional delivery services in Indonesia. The aims of this study are to assess the utilization level of delivery services and identify factors that contribute to the utilization of delivery services among Indonesian adolescent mothers. The design of this study is a cross-sectional survey using secondary data from the 2017 Indonesia Demographic and Health Survey (IDHS). The study population is 866 women who had their last birth at 15-19 years old. The level of delivery services utilization is calculated based on whether health providers assisted the mothers during delivery and whether the mothers gave childbirth in a health facility. The descriptive statistics were used to assess the utilization of delivery services, and simple logistic regression and multivariable logistic regression to identify the contributing factors on utilization of delivery services. The study showed that 64.5% of adolescent mothers have good utilization of delivery services. Factors that associated with good delivery services utilization are adolescent mothers who have senior high school/university education (AOR=1.68, 95% CI 1.05-2.68), currently working (AOR=1.56, 95% CI 1.10-2.20), have full or partial autonomy for seeking healthcare (AOR=1.68, 95% CI 1.09-2.60), lived in an urban area (AOR=1.72, 95% CI 1.21-2.44), lived in Sumatera (AOR=0.44, 95% CI 0.29-0.66), lived in Kalimantan region (AOR= 0.23, 95% CI 0.13-0.40), have health insurance (AOR=1.42, 95% CI 1.04-1.93), husband accompanied during ANC (AOR=1.69, 95% CI 1.15-2.47), and discussed 5-6 topics during ANC with health providers (AOR=1.48, 95% CI 1.07-2.05). Socio-demographic, place of living, insurance, spouse support, and topic discussion are associated with delivery services. Therefore, strategic policies and programs' approaches to adolescent mothers should focus on 1) expanding health facility coverage, 2) providing maternal education for women and men, and 3) expanding the health insurance coverage to improve maternal health in Indonesia.

Keywords: utilization, delivery services, adolescent mothers, Indonesia

INTRODUCTION

In Indonesia, Maternal Mortality Ratio (MMR) in 2015 is 305 per 100,000 live births (1) which its reduction is still not substantially improved, only about one-third since 1990. It also did not achieve the Millennium Development Goals (MDGs) which aimed to reduce the MMR to 102 deaths per 100,000 live birth by 2015 and achieving the Sustainable Development Goals (SDGs) to only 70 maternal deaths per 100,000 live birth by 2030 is still have a long way to go.

In developing countries, approximately 12 millions of girls (ages 15-19) give birth each year. Worldwide, complications during pregnancy and childbirth are the key factors in adolescent death. Compared with older women, adolescent mothers are at increased risk for systemic infections, puerperal endometritis, and eclampsia. The babies of adolescent mothers are also at increased risk of preterm delivery, low birth weight, and poor newborn health (2). In Indonesia, approximately 36 out of 1000 adolescent girls (15-19 years old) have had a childbirth, making the country the second highest rate of childbirth from adolescent girls in South-East Asia (3).

The delivery services utilization plays an important role in declining MMR. However, only 71% of births in 2014 were performed by health providers (4). In Indonesia the delivery rate in health institutions is still low, only about 63% in 2012 (5). This may be due to differences in access to maternal health services between urban and rural areas, and the gap between the rich and the poor is still a challenge (6).

It is important to assess the utilization of delivery services which using the concept of "Continuum of Care" that the pregnant women who receive antenatal care are more likely to deliver safely (7). However, there is still a lack of research on the utilization of delivery services especially for adolescent mothers in Indonesia.

As reducing maternal mortality is still important in the 2030 Sustainable Development Goals (SDGs) agenda, it is necessary to use the data in the latest national publications to assess the factors contributing to delivery services utilization. Therefore, the objectives of this study is to identify factors that associate with the delivery services utilization in Indonesian adolescent mothers. It is hoped that the results of this study will help support strategic policies and programs' approach with a focus on the delivery services utilization in adolescent mothers.

METHODS

This study is a cross-sectional survey using secondary data from the 2017 Indonesia Demographic and Health Survey (IDHS) which is the latest survey of demographic and health in Indonesia. Only Woman's Questionnaire was used in this study. The study used the Individual Women's data – Individual Record (IR) data set from IDHS. The total number of women that included in the dataset is 49,627 women. Among these women, this study only selected women who gave birth within last five years before survey which is 15,021 observations and women whose age was 15-19 years old at the last birth in 5 years prior the survey which is 866 observation. The data cleaning process is as follows in Figure 1.

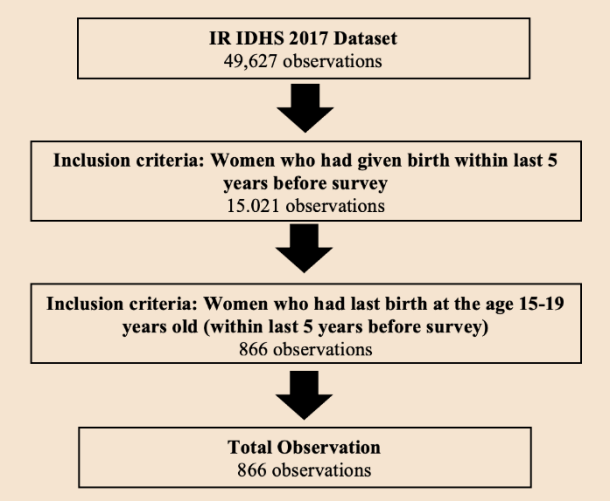

Figure 1 Data Cleaning Process

Dependent Variables

The dependent variable of this study is delivery services utilization. Delivery services variable will be combined from two variables which are delivery assistant and place of delivery. Delivery assistant variables has two categories: 0 for non-health providers and 1 for health providers. Whereas the categories for place of delivery are 0 for non-health facility and 1 for health facility. The calculation of the score is categorized from the total variables' calculation of delivery assistant and place of delivery. 0: Poor utilization if the total score is 0-1 and 1: Good utilization if the total score is 2.

Independent Variables

The Independent variables of this study are education of mothers, working status of mothers, knowledge of danger sign during pregnancy, knowledge of danger sign during delivery, knowledge of danger sign during postpartum period, mother's autonomy for seeking healthcare, type of residence, region, wealth index, insurance coverage, husband accompanied during ANC, topic discussed during ANC, and parity. To follow the concept of continuum care, then ANC utilization is included as an independent variable for the utilization of delivery services.

Data Analysis

The data analysis of this study will be carried out using Stata 16 software. Descriptive analysis will be presented in the frequency and percentages distribution. Multiple logistic regression was used to assess the association between independent variables and the dependent variable.

RESULTS

Table 1 shows that nearly half of the mothers have junior high school as their highest education level. Most of mothers are not working, had poor knowledge of danger sign during pregnancy, delivery, and postpartum period, had a full or partial autonomy of seeking healthcare for themselves (86.3%), lived in rural area (65.4%) and in Java-Bali region (59.0%). More than half of the mothers are in the poorest and poorer wealth quintile while gradually decrease from middle into richest quintile. Most of mothers have health insurance and are accompanied by their husband during ANC visit (79%). More than 50% of mothers have discussed 0-4 topic(s) with health providers from the total of six discussion topics during ANC visit. Nearly all (97.4%) mothers only have one chil

Table 1 Distribution of sample characteristics of adolescent mothers in Indonesia (N=866)

Variables	Number	Percent
Education of mothers		
None/primary	226	26.2
Junior HS	413	47.7
Senior HS/University	227	26.1
Working status of mother		
No	607	70.0
Yes	259	30.0
Knowledge of danger sign during pregnancy		
Poor	526	60.9
Good	340	39.1
Knowledge of danger sign during childbirth		
Poor	577	66.6
Good	289	33.4
Knowledge of danger sign during postpartum period		
Poor	732	84.6
Good	134	15.4
Mother's autonomy for seeking healthcare		
Not at all	119	13.7
Full or partial	747	86.3
Type of residence		

Variables	Number	Percent
Rural	566	65.4
Urban	300	34.6
Region		
Java-Bali	511	59.0
Sumatera	159	18.3
Kalimantan	70	8.1
Sulawesi	71	8.2
Maluku-Papua	55	6.4
Wealth index		
Poorest	262	30.3
Poorer	249	28.8
Middle	202	23.3
Richer	109	12.5
Richest	44	5.1
Health insurance		
Does not have	422	48.7
Have	444	51.3
Husband accompanied during ANC		
No	182	21.0
Yes	684	79.0
Topic discussed during ANC		
0-4 topic(s)	467	53.8
5-6 topics	399	46.2
Parity		
>1 child	22	2.6
1 child	844	97.4

Table 2 shows the distribution of delivery services utilization among adolescent mothers in Indonesia. The results show that most of them (70.7%) were assisted by health providers during childbirth and gave childbirth in health facility (75.6%).

Based on those two indicators, the delivery services utilization are classified into poor utilization and good utilization. Adolescent mothers who have a good utilization in delivery services are 64.5% and those who have a poor utilization in delivery services are 35.5%.

Table 2 Distribution of delivery services utilization among adolescent mothers in Indonesia (N=866)

Variables	Number	Percent
Delivery assistant		
Non-health providers	254	29.3
Health providers	612	70.7
Place of delivery		
Non health facility	212	24.4
Health facility	654	75.6
Delivery services utilization		
Poor	307	35.5
Good	559	64.5

Table 3 shows the association of independent variables to delivery services utilization among adolescent mothers in Indonesia. Mothers who had senior high school or university as the highest level of education are 1.68 times more likely to have a good utilization of delivery services compared to those who have no education or primary school. Working mothers are more likely (AOR=1.56) to have a good utilization of delivery services than non-working mothers. Regarding

the mother's knowledge, those who knows the danger sign during pregnancy are more likely to have a good utilization of delivery services than mothers who do not know. Women who have knowledge of danger sign during childbirth also more likely to have a good utilization of delivery services than those who do not. Even though, there are no significant difference between knowledge of danger sign during pregnancy and childbirth with utilization of delivery services.

Adolescent mothers who have full or partial autonomy for seeking healthcare are 1.68 times higher to have a good utilization of delivery services. Compared to mothers who lived in Java and Bali region, those who lived outside Java-Bali had lower chance to have a good utilization of delivery services. Mothers who have higher wealth quintile were more likely to have a good utilization of delivery services than their poorer counterpart. Those who have health insurance are also more likely (AOR=1.42) to have a good utilization of delivery services than those who does not have health insurance.

Mothers who accompanied by their husband/partner during ANC visit are more likely to have a good utilization of delivery services (AOR= 1.69) compared to those who are not accompanied by their husband/partner. Regarding the topic discussion during ANC, mothers who discussed 5-6 topics with health providers are 1.48 times more likely to receive good utilization of delivery services than mothers who only have 0-4 discussion topic(s). Similarly, mothers who only have one child are more likely to have a good delivery services utilization than those who have more than one child. At last, adolescent mothers who have a good utilization of ANC are more likely to have a good utilization of delivery services (AOR=1.11), although there is no significant different between this variable and utilization of delivery services after adjusted with other variables.

Table 3 Factors associated to delivery service use among adolescent mothers in Indonesia (N=866)

Variables	Unadjusted OR	95% CI	Adjusted OR	95% CI
Education of mother **(Ref: None/primary)**				
Junior HS	1.37	0.98-1.91	1.21	0.83-1.76
Senior HS/University	1.80*	1.22-2.66	1.68*	1.05-2.68
Working status of mother **(Ref: No)**				
Yes	1.47*	1.08-2.01	1.56*	1.10-2.20
Knowledge of danger sign during pregnancy (Ref: Poor)				
Good	1.47*	1.10-1.97	1.05	0.72-1.51
Knowledge of danger sign during childbirth (Ref: Poor)				
Good	1.52*	1.12-2.06	1.09	0.74-1.61
Knowledge of danger sign during postpartum period (Ref: Poor)				
Good	1.28	0.86-1.91	0.88	0.55-1.41
Mother's autonomy for seeking healthcare (Ref: Not at all)				
Full or partial	1.55*	1.05-2.30	1.68*	1.09-2.60
Type of residence (Ref: Rural)				
Urban	2.20*	1.61-3.01	1.72*	1.21-2.44
Region (Ref: Java)				
Sumatera	0.42*	0.29-0.61	0.44*	0.29-0.66
Kalimantan	0.23*	0.14-0.39	0.23*	0.13-0.40
Sulawesi	0.49*	0.30-0.82	0.56	0.31-1.00
Eastern Indonesia	0.47*	0.27-0.83	0.59	0.30-1.13
Wealth index **(Ref: Poorest)**				
Poorer	1.47*	1.03-2.09	1.00	0.67-1.50
Middle	2.49*	1.68-3.70	1.60*	1.02-2.52
Richer	3.11*	1.87-5.20	1.68	0.93-3.04
Richest	2.93*	1.40-6.11	1.39	0.60-3.21
Health insurance **(Ref: Doesn't have)**				
Have	1.44*	1.09-1.90	1.42*	1.04-1.93

Variables	Unadjusted OR	95% CI	Adjusted OR	95% CI
Husband accompanied during ANC **(Ref: No)**				
Yes	2.19*	1.57-3.05	1.69*	1.15-2.47
Topic discussed during ANC **(Ref: 0-4 topic(s))**				
5-6 topics	1.96*	1.47-2.61	1.48*	1.07-2.05
Parity **(Ref: >1 child)**				
1 child	2.12	0.91-4.95	1.66	0.67-4.08
ANC UTILIZATION **(Ref: Poor)**				
Good	1.54*	1.15-2.07	1.11	0.79-1.55
***P value <0.05**				

DISCUSSION

This study aims to identify factors that contribute to the utilization of delivery services among Indonesian adolescent mothers. According to the results, education, place of living, economic status, mother's autonomy, spouse support, and discussion during ANC are associated with the utilization of delivery services.

The higher education of adolescent mothers increased the odds to have a good utilization of delivery services. Adolescent mothers who had senior high school or university as their highest education level increased the odds to have a good delivery services utilization. This is similar with the results of other studies that found education of mother is the main factor of delivery at health facility by skilled health providers. Highly educated mother have higher chance to know of the advantages of the utilization of qualified maternal health services and the required empowerment to access care (8-9). They may also be more aware about the risks of maternity and seek safe delivery services.

Adolescent mothers who had full or partial autonomy for seeking health had a better odds to use delivery services than those with no autonomy at all. Those with the authority can decide better about seeking health care including delivery services. Since pregnancy, they could plan about the place of delivery and whom they want to be assisted in childbirth. If mothers have no authority then family members will decide about their health and in some rural areas often expect them to give birth with traditional birth attendance at home (10).

Urban adolescent mothers had higher chance to have a good utilization of delivery services. This is likely due to proximity of distance, number of health facility, and number of health providers which are more well distributed in urban than in rural areas. When the signs of childbirth come, urban mothers tend to get treatment faster because they have closer access and more options to health services. Meanwhile, adolescent mothers in rural areas if they are not well prepared for delivery and are far from the health facilities they may tend to deliver at home. In addition, adolescent mothers may be less exposed with maternal services and more familiar with traditional birth attendants especially in rural areas (11). Prior studies also have reported that most women in rural areas give higher rate for the traditional birth attendants (TBAs) services than medical healthcare practitioners, particularly in terms of interpersonal communications and relationships (12).

Adolescent mothers who lived outside Java-Bali region were less likely to have a good delivery services utilization. Regions that significantly lower are Sumatera and Kalimantan which may due to less number of health providers and facilities compared to Java-Bali region. In Java, the large number of midwives has been found to be a strong determinants of delivery assisted by qualified health providers (13). The proximity of access and a lot of referral health facilities can provide more easiness to seek delivery services for adolescent mothers who lived in Java-Bali, especially those with complications.

Delivery services utilization is also influenced by the wealth index or economic status of adolescent mothers. Mothers who had higher quintile of wealth index were more likely to have a good delivery services. It is easier for rich women to get access to health facilities and health workers because they can cover the costs of transportation, delivery service and postnatal services. They may be less worried about the cost of delivery even if they experience complications.

A study also found that economic status was found to be positively associated with the utilization of maternal health care with adolescents in the wealthier group reporting better engagement with maternity care compared to their poorer counterpart. The study suggested that poor adolescents lack resources to spend on healthcare. Poor adolescents are also more likely to be disengaged from social networks, thus, less likely to be reached by programs aiming to improve maternal health service utilization of adolescent mothers (14).

The results also showed that adolescent mothers with ownership of health insurance had a higher utilization of delivery services. Comprehensive health insurance programs to cover the poor may help to remove a barrier of cost to maternal health care seeking and could be an intermediate consideration (15). Insurance coverage had significant association with utilization of maternal and child health care from pregnancy to childhood period. Mothers with higher education level, higher wealth index and have insurance are more likely to have maternal and child health care from adequate antenatal care to completed immunization (16).

Another factor that associated with good utilization of delivery services is spouse support in accompanying their wives during ANC visit. Adolescent mother who accompanied by their husband/partner during ANC increased the odds to have a good delivery services utilization. Similarly, there is a study which also found that husbands accompanying their wives was positively associated with women give birth at a health facility (17).

This proves the advantages of support from partners in seeking delivery services. Adolescent mothers who are accompanied by their husbands during ANC visit are also have a good utilization of ANC which can also gain a sense of awareness to take part in using delivery services. This is also likely for the mothers and their husband/partner to prepare and plan better for whatever is needed for delivery, such as place of delivery, transportation, and who will be assisted in delivery.

The importance of planning since pregnancy for using delivery services emphasize the association between ANC and delivery services utilization. Adolescent mothers who had a good ANC utilization were more likely to have a good delivery services. Although the result was not statistically significant, this was relevant with the concept of continuum of care regarding mothers who use ANC services will tend to be good at use of childbirth services. Mothers who received ANC services will have better knowledge about safe delivery services for themselves and their babies and will be better prepared for delivery. Other studies also identified the influence of frequent ANC visits were attending at least four times significantly influenced young women's utilization of skilled birth delivery care (18-19).

Strength and limitations

As using the national survey data, this study is representative for adolescent mothers in Indonesia. It also assessed adolescent age 15-19 years old, which is the vulnerable population. The results found the association between region and delivery services that can be used to develop strategic planning and program, especially as health system in Indonesia is decentralization.

The Indonesia Demographic Health Survey (IDHS) provides limited information on certain topics and variables. This may result in not all not all determinants being able to be assessed using these data. Furthermore, all variables were assumed to be fixed in a period of five years prior to the survey. The design of this study is cross-sectional, which limits the assessment of causality between the variables.

CONCLUSION

As most of maternal mortality in Indonesia happened during childbirth, the assessment of delivery services utilization is necessary especially among adolescent mothers (15-19 years old) which the childbirth rate is quite high in those age group. Based on the objective, factors that associated with delivery services are mother's education, mother's working status, mother's autonomy for seeking health care, residence, region, wealth index, health insurance, husband accompanied during ANC, and topic discussed during ANC.

Since the study results found that mother's education and region were significantly associated to delivery services, there should be programs which focus on improving maternal health knowledge especially for

adolescent mothers. In addition, since each region has its own characteristics and special needs for health care development, it requires programs or policies that specifically directed to every region.

RECOMMENDATIONS

Policy Recommendation

The recommendations that can be suggested by this study are as follows:

1. *Improving access and quality of care for maternal health services by expanding health care coverage in every region*

Since Indonesia uses decentralization in the health system, it is recommended that local health officials in the district / city develop strategic policies and planning methods that focus on adolescent mothers, as regional differences still exist. Health care coverage can be expanded by increasing the number of health facilities and health service providers, providing training to health service providers, especially training in delivery services, and providing information on maternal health in youth-friendly health centre.

2. *Providing maternal education for women and men*

Husband/partner support has a great influence on the use of maternal health services among adolescent mothers. It means that men's involvement in maternal health is critical and needs further encouragement. It can not only provide women with maternal health education, but also provide men with relevant knowledge to improve their level of knowledge and provide more support to wives/partners during pregnancy, childbirth and postpartum. Additionally, high-risk pregnancy education programs can be implemented at the national level then district/city level to prevent early pregnancy.

3. *Extending the health insurance coverage*

Government of Indonesia launched *Jaminan Kesehatan Nasional* (JKN) in 2014 which is an Universal Health Coverage. However, the coverage is still not 100%. Efforts are needed to socialize, map the uncover population, and expand the coverage for all Indonesian, especially for women who cannot afford the delivery services cost.

Recommendation for Future Studies

On the topic, future studies should emphasis and explore more the problems related to the disparity of every region in delivery services among adolescent mothers as every region has their own unique characteristic. Furthermore, a qualitative study is also can be an appropriate method to gain a deeper understanding of why adolescent mothers may or may not use the delivery services.

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THE RELATIONSHIPS BETWEEN GENDERED POWER RELATIONS AND MODERN CONTRACEPTIVE USES AMONG MARRIED WOMEN IN MYANMAR

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ABSTRACT

Women's reproductive health remains a problem among the poorest population within the Southeast Asian region of Myanmar. Women's pregnancy-associated death rate is high, while unwanted pregnancies and unsafe abortions are prevalent. It is often cited that the prevailing male-dominated norms in Myanmar's family relations underlie women's reproductive health state. Little is known how factors concerning gendered power relations and women's empowerment in the household contribute to women's contraceptive practices. This study draws on the social dominance theory and women's empowerment notion to examine the association between gendered power dimensions and modern contraceptive practices among married women in Myanmar. The study sample of 7,627 currently married women (15-49 years) derived from the Myanmar Demographic and Health Survey 2015-2016 (MDHS) was used. Data were analyzed by applying the Chi-square test (Bivariate Analysis) and binary logistic regression model (Multivariate Analysis) to identify the associations between gendered power relations and modern contraceptive use. Results show that slightly more than 49% of the study sample used modern contraceptive methods. Four bases of gendered power factors, namely force, resource control, social obligations, and consensual ideologies, were significantly associated with the use of women modern contraception. Moreover, age, place of residence, educational level of wife and husband were significant predictors of women's use of modern contraceptive methods. Findings suggest that in Myanmar society, gendered power dimensions and women's empowerment factors are related to women's modern contraceptive use. The gendered power relations can reduce or enhance women's autonomy which in turn affects contraceptive choices. Women with high autonomy are more likely to use modern contraceptive methods. Policymakers should consider initiating gender-transformative reproductive health programs emphasizing the empowerment of women and girls and the involvement of men to rework society's rigid male-dominated norms.

Keywords: gendered power relations, women's empowerment, modern contraceptive use, Myanmar

INTRODUCTION

Globally, the use of modern contraceptives among married or in union women aged 15-49 years old has gradually increased from 36% in 1990 to 45% in 2019 (1). Despite the increase in modern contraception, the burden of unmet need for modern contraceptives remains a significant global issue because about 222 million women in developing countries have unmet need for modern contraception (2). Besides, around 21.6 million unsafe abortions happened annually in almost developing countries and it took 13% of all maternal deaths of the world (3). Women in developing world failed to use modern contraceptive methods because of cultural, social, demographic and economic barriers (4). Particularly, gendered power dynamics play a critical role in women's utilization of modern contraceptive methods. Over the past decades the theory of women's empowerment has been applied to gain some insight into the link between gendered power relations and family planning. Progress in women's empowerment can increase women's use of modern contraception, ensuring that women's sexual and reproductive health statuses are improved (5). Previous studies indicated that higher modern contraceptive use correlates with higher levels of empowerment, and it can lead to decreasing maternal and child deaths (3, 6, 7).

According to the MDHS 2015-2016, 16% of married women aged 15-49 years did not meet their needs for family planning and that percentage is significantly higher than the other Southeast Asia nations (8). This statistical figure indicates that Myanmar is behind in its commitment to reduce unmet need in family planning to less than 10% as it is recommended by the United Nations (9). From 2015 to 2016, there were 746,000 unwanted pregnancies in Myanmar and an estimated 5% of all pregnancies had ended in abortion. Myanmar's maternal mortality ratio is the second-highest in Southeast Asia with high rates of unwanted pregnancies and primarily unsafe abortion (10). Women's contraceptive use in Myanmar remains a major public health problem because women are unable to make their own decisions due to experiencing the adverse effects of gender inequality (11). According to the United Nations, Myanmar's gender inequality index ranks as 118 out of 189 countries in 2019 (12). In fact, gender is a culture-specific construct that includes expectations and

norms practiced by a society to guide the roles and behaviors of women and men, and power is defined as the ability to control the actions of others (13, 14). In patriarchal societies like in Myanmar, men are considered as breadwinners, heads of households and decision makers because men attain power, position and privilege from patriarchal social structures while women are acknowledged as passive caregivers who are uncertain to achieve the chances to control over resources (15, 16). Such patriarchal gender norms and unequal power relations are more likely to confine not only the ability of women to access to opportunities and to control over resources but to make free choices for their lives (17). This is because of women's less autonomy over their life choices (18).

Preexisting researches have indicated that women's modern contraceptive use is highly influenced by women's autonomy and women's ability to make their own choices for their reproductive health services (19, 20). Myanmar women are unlikely to access necessary health services because of gendered power relations within the family. They are experiencing low social status, and high financial dependency on husband because of husband's disapproval of wife travelling outside of the community to earn income (8, 21, 22). In Myanmar, existing literature have primarily focused on the identification of women's empowerment and barriers to access women's health services in general. To date, no any study that applies women empowerment theory to demonstrate the relationships between gendered power relations and the modern contraceptive methods utilization among married women in Myanmar. Thus, this study aims to investigate the associations between gendered power relations and women's use of modern contraception in Myanmar.

METHODS

Sampling and Samples

This study utilizes the data of the Myanmar Demographic and Health Survey (MDHS) 2015-2016, the first and the most up to date nationwide survey regarding health in Myanmar. For this analysis, a purposive sampling method was employed to select the samples from the MDHS dataset and to answer the research questions of this study. As the targeted population of this study was currently-married or in union women who use one type of modern contraceptives in Myanmar and the data on

decision-making power were not appropriate for unmarried women, only currently-married or in union women of reproductive ages (15-49 years) were

included in this study. Among the 12,885 women who were interviewed during MDHS (2015-2016) survey, 7,870 women are currently married, while 4,146 women are in the status of never in union, 421 women are widowed, 390 women are divorced and 58 women are in the status of no longer living together/separated. Therefore, this study used 7,870 currently- married women (15- 49 years) as the analytical sample. In addition, this study has excluded 217 infecund women and 26 missing observations. Thus, the samples of the study are 7,627 currently-married or in union women of reproductive ages (15-49 years) in Myanmar.

Data Analysis Methods

The dependent variable for the study is whether or not women use of any modern contraceptive method. It is conceptualized following the definition of DHS, which recognizes modern contraceptive methods as pill, intra uterine device, injections, diaphragm, condom, female sterilization, male sterilization, implants, lactational amenorrhea, female condom, foam and jelly, emergency contraception and the category "other modern method". The independent variable of this study is women's empowerment conceptualized into four aspects relating to gendered power dynamics between a husband and a wife. They include force, resource control, social obligations and consensual ideologies. The force factor includes women's acceptance of beating if wife argues with husband. The resource control factors consider the decision on large household purchases, ownership of a house and ownership of land. The social obligation factors include women's current work status, number of living children and desire for children. Lastly, the consensual ideologies are measured using a set of variables including decision on family or relative visits, women's exposure to mass media about family planning and sex of household head.

The analysis also controls for women's age, place of residence, family wealth index, educational level, and husband's education to look at the contributions of socio-demographic factors upon the women's uses of modern contraception methods. Unweighted data were analyzed using statistical data package, STATA SE 15.1. The univariate analysis was performed using descriptive statistics. Then, a Chi-square test was employed to explore the relationship between each categorical independent variable and the dependent variable. A binary logistic regression model was applied to identify the association between the dependent and independent variables by means of odds ratio with a 95% confidence interval. Statistical significance was considered at p-value=<0.05.

RESULTS

A total of 7,627 currently married women are included in this study. According to descriptive analysis results, 49.02% of currently married women used modern contraception. In addition, around 75% of the respondents were residing in rural areas (74.04%) and approximately over 60 % of them were from poorest to middle wealth quintiles households. Moreover, the majority of the samples completed primary education (45.80%). With regard to women's empowerment features, 64.31% of women owned a house, 57.66% of women owned land, and 60.74% of women were currently working. Besides, descriptive analysis informed that 59.55% of women were not able to access family planning information from mass media. Further, 86.59% of women lived in husbands headed households and 89.51% of women did not accept wife beating. Moreover, 74.63% and 87.02% of currently married women participated in the decisions on large household purchases and family or relative visits. Furthermore, 49.56% of women had 1-2 children and 39.60 % of women had 3 children and above. And, around 60 % of respondents did not want to have more children (60.23%). Meanwhile, Table 1 showed results from Chi-square analysis indicating values less than 0.001 for ten variables, less than 0.01 for two variables and less than 0.05 for one variable. However, ownership of land and ownership of a house variables did not show significant Chi-square values. As most of the predictors under women's empowerment factors and all predictors of socio demographic factors were statistically significant under Chi-square test, it indicated that these independent variables should be included in the multivariate analysis for further exploration of its association with the use of modern contraception.

Table 1 Bivariate analysis of factors associated with women's use of modern contraception (N=7,627)

Variable	Modern Contraceptive Use of Married Women			
Factors	**Yes**	**No**	**Total**	**X^2 Test**
	%	%	N	
Force Factors				
Women's acceptance of beating if wife argues with husband				14.07***
No	49.76	50.24	6827	
Yes	42.75	57.25	800	
Resource Control Factors				
Decision on large household purchases				8.88**
Others decide	46.10	53.90	1935	
Wife decides	50.02	49.98	5692	
Ownership of a house				0.05
No	49.19	50.81	2722	
Yes	48.93	51.07	4905	
Ownership of land				1.57
No	49.86	50.14	3229	
Yes	48.41	51.59	4398	
Social Obligation Factors				
Women's current work status				7.86**
Not working	47.03	52.97	2994	
Currently working	50.31	49.69	4633	
Number of living children				233.60***
0 children	27.33	72.67	827	
1-2 children	55.82	44.18	3780	
3 children and above	46.46	53.54	3020	
Women's desire for children				98.33***
Wanted	42.04	57.96	3033	
Unwanted	53.64	46.36	4594	
Consensual Ideological Factors				
Decision on family or relative visits				13.21***
Others decide	43.64	56.36	990	
Wife decides	49.83	50.17	6637	
Women's exposure to mass media about family planning				66.43***
No	45.18	54.82	4542	
Yes	54.68	45.32	3085	
Sex of household head				18.22***
Male	49.98	50.02	6604	
Female	42.82	57.18	1023	
Socio-demographic Factors				
Age of women				6.41*
15-29 years	52.59	47.41	1082	
30-49 years	48.43	51.57	6545	
Place of residence of women				57.66***
Urban	56.36	43.64	1980	
Rural	46.45	53.55	5647	

Variable	Modern Contraceptive Use of Married Women			
Factors	**Yes**	**No**	**Total**	**X^2 Test**
	%	%	N	
Wealth index of women				52.51***
Poorest	43.66	56.34	1640	
Poorer	46.64	53.36	1576	
Middle	47.94	52.06	1556	
Richer	53.17	46.83	1499	
Richest	54.94	45.06	1356	
Education level of women				122.00***
No education	35.15	64.85	1158	
Primary education	49.16	50.84	3493	
Secondary education and above	54.27	45.73	2976	
Husband's education				75.99***
No education	37.97	62.03	1222	
Primary education	49.64	50.36	2957	
Secondary education and above	52.41	47.59	3448	

*p<0.05, **p<0.01, ***p<0.001

Table 2 showed the results from two logistic regression models. With regard to model construction, Model I was constructed with all women's empowerment factors. Model II added to Model I socio-demographic factors. For model comparison, this study used likelihood ratio test and AIC, BIC values (Akaike's information criterion and Bayesian information criterion). The findings informed that Model II is better because it had high log likelihood value, lower AIC, BIC values, and significant Prob>chi2 value.

Based on the findings of Model I, force factor variable indicated that women who accept wife beating if wife argues with husband were 21% less likely to use modern contraception than those who did not accept it as a justifiable manner. According to the analysis results, resource control variable revealed that women who had assets such as land were 15% less likely to use modern contraceptives compared to those who did not own land. Social obligations related variables also informed that women who had current occupation were 1.15 times more likely to use modern contraception than those who were not currently working, and women who did not want any more children were 1.61 times more likely to use modern contraception than women who had desire for more children. Moreover, women who had 1-2 living children and women who had 3 children and above were 2.95 times and 1.81 times more likely to use modern contraception compared to those who had no children. Also, the results of consensual ideologies related variables highlighted that women who were exposed to mass media for family planning information were 1.45 times more likely to use modern contraception compared to those who were not exposed to mass media. In addition, the results showed that women from male headed households are 27% more likely to use modern contraception than those who are living in female headed households. Interestingly, decision on large household purchases, decision on family or relative visits and ownership of a house variables were not significantly associated with women's use of modern contraceptives in Model I.

In Model II, women's acceptance of wife beating if wife argues with husband variable which was entitled with force factor had greater odd ratio and higher p-value (AOR=0.85, 95% CI=0.73-0.99, p<0.05) compared to the value of Model I (AOR=0.79, 95% CI=0.68-0.92, p<0.01). In addition, women's current work status representing social obligation factor had greater odd ratio and less p-value in Model II (AOR=1.21, 95% CI=1.10-1.33, p<0.001) compared to the value of Model I (AOR=1.15, 95% CI=1.04-1.26, p<0.01). Despite adding control variables into Model I, decision on large household purchases, decision on family or relative visits and ownership of a house variables were not significantly associated with women's

use of modern contraception. However, almost all of the control variables showed significant association with the use of modern contraception. This is because Model II's results informed that women aged 30-49 years were 51% less likely to use modern contraception compared to 15-29 years old married women whilst women who were residing in rural area were around 17 % less likely to use modern

contraception compared to those who were living in urban area. Besides, the results of Model II showed that women completed primary education and secondary education and above were 1.56 times and 1.74 times more likely to use modern contraception compared to those who had no education, while women whose husband completed primary education and secondary education and above were 1.30 times and 1.29 times more likely to use modern contraception compared to those who did not have any education. House wealth is not significantly associated with women's use of modern contraception.

Table 2 Odds ratio from the binary logistic regression analysis of association between women's empowerment and modern contraceptive use among married women in Myanmar (N=7,627)

Variables	Model I	Model II
	AOR (95% CI)	AOR (95% CI)
Force Factors		
Women's acceptance of beating if wife argues with husband		
No	Reference	Reference
Yes	0.79 (0.68, 0.92)**	0.85 (0.73, 0.99)*
Resource Control Factors		
Decision on large household purchases		
Others decide	Reference	Reference
Wife decides	1.06 (0.95, 1.20)	1.10 (0.98, 1.24)
Ownership of a house		
No	Reference	Reference
Yes	0.97 (0.83, 1.15)	1.13 (0.95, 1.33)
Ownership of land		
No	Reference	Reference
Yes	0.85 (0.73, 0.99)*	0.85 (0.72, 0.99)*
Social Obligation Factors		
Women's current work status		
Not working	Reference	Reference
Currently working	1.15 (1.04, 1.26)**	1.21 (1.10, 1.33)***
Number of living children		
0 children	Reference	Reference
1-2 children	2.95 (2.47, 3.51)***	3.68 (3.06, 4.42)***
3 children and above	1.81 (1.49, 2.19)***	2.68 (2.17, 3.31)***
Women's desire for children		
Wanted	Reference	Reference
Unwanted	1.61 (1.45, 1.80)***	1.70 (1.52, 1.90)***
Consensual Ideological Factors		
Decision on family or relative visits		
Others decide	Reference	Reference
Wife decides	1.13 (0.97, 1.32)	1.12 (0.96, 1.31)

Women's exposure to mass media about family planning		
No	Reference	Reference
Yes	1.45 (1.32, 1.59)***	1.26 (1.13, 1.40)***
Sex of household head		
Male	Reference	Reference
Female	0.73 (0.64, 0.84)***	0.72 (0.63, 0.83)***
Socio-demographic Factors		
Age of women		
15-29 years		Reference
30-49 years		0.49 (0.42, 0.58)***
Place of residence of women		
Urban		Reference
Rural		0.83 (0.72, 0.94)**
Wealth index of women		
Poorest		Reference
Poorer		1.03 (0.89, 1.19)
Middle		1.02 (0.88, 1.19)
Richer		1.14 (0.97, 1.34)
Richest		1.04 (0.86, 1.26)
Education level of women		
No education		Reference
Primary education		1.56 (1.34, 1.81)***
Secondary education and above		1.74 (1.46, 2.07)***
Husband's education		
No education		Reference
Primary education		1.30 (1.12, 1.51)***
Secondary education and above		1.29 (1.10, 1.52)**
Pseudo R2	0.04	0.06
Pseudo R2 changes		0.02
Prob > chi2	0.000	0.000
Observation	7627	7627
Log Likelihood	-5066.63	-4973.12
AIC	10157.26	9990.24
BIC	10240.53	10142.91
Likelihood-ratio test		
Prob>chi2 (Model 1 nested in Model 2)		0.000

*p<0.05, **p<0.01, ***p<0.001

DISCUSSION

The results clearly demonstrate that four bases of gendered power factors are significantly associated with women's use of modern contraception. Based on the key findings of this study, the results show that women who do not accept wife beating if wife argued with husband, women who have living children, women who do not have desire for more children, women who have current work, and women who are exposed to mass media for family planning information are more likely to use modern contraception. The findings of this study also substantiate previous results of studies in other contexts (23-27). With regard to the contexts of Myanmar, women assume that they can have social security and financial stability through marriage since they anticipate that husband would take whole responsibility of theirs (28). Meanwhile, similar with the other patriarchy society, men in Myanmar believe that they possess inborn superiority over women, while women assume that they belong to subordinate position (29). As a result, Myanmar women are anticipated to stay inside the home to do household chores and to give devotion to all family members, while Myanmar men are expected to be breadwinners and household leaders of the family (29). Although men achieved power, position and privilege from that patriarchal social structures, it compelled Myanmar women and girls for oppression and marginalization in socio-economic, political and cultural areas (15, 29). Owing to married women's low social status, high financial dependency on husband and husband's disapproval

to go outside and to make income, Myanmar women cannot access necessary health services including use of modern contraceptives (8, 21, 22). Compared to men in Myanmar, such kind of unequal gendered power relations derived from existing social and cultural norms reflecting that Myanmar women had less ability to perform independent decisions for their own choices related to the likelihoods of health, education, employment, social welfare, and so on. Low autonomy reduces the negotiation power of married women regarding household decisions, resource control, freedom of movement, freedom of violence and freedom of reproduction which are correlated with currently married women's

modern contraceptive behavior, reproductive behavior and decision-making behavior (15, 18, 30, 31). This study highlights that four bases of gendered-power factors are significantly associated factors of women's use of modern contraception in Myanmar, and informs that power imbalance at family level induces unfavorable reproductive health outcomes including women's unmet need for modern contraception. Therefore, this study addresses the importance of gender equity and its implications on women's use of modern contraception.

This study also discloses the key findings of socio-demographic factors as second imperative of the study. The results reveal that age of women, place of residence of women, educational level of women and husband's education status are significantly associated factors of women's use of modern contraceptives in Myanmar. These findings cohere with other studies across the world including Myanmar (23, 25, 26, 32-34). Based on the findings of this study, the results informed that women's use of modern contraception declines with age. Moreover, the use of women's contraceptive decreases if women live in rural area and education level of respondents and their husbands are low. Myanmar women residing in rural area were experiencing more barriers because majority of them possessed lower literacy, faced difficulties to access modern contraceptive information and services because of geographical barriers compared to those who were living in urban areas (21, 35). The study also highlights that low social conditions lower the likelihood to use modern contraception of women. Embedded social and cultural norms that gave unequal power and positions between genders increased the barriers of women's use of modern contraception regardless of their education status, place of residence, and so on (36). As a result, women from rural areas are less likely to use modern contraception. Thus, the program interventions should focus on those women who are in low social status and who live in rural areas in order to increase their use of modern contraception.

As another distinguished finding, this study informs that wealth index of women is not a good predictor for women's use of modern contraception although most of the studies prove that women's modern contraception increases with their wealth index level (25, 32). The possible justification might be because of deeply-

rooted social and cultural norms that give more bargaining power and decision-making power to men but not women in Myanmar, that can limit the ability to access modern contraception regardless of women's wealth index status and ownership of assets (15). Meanwhile, the findings highlight that gender equity that can bring equal gendered power relations and can increase women's use of modern contraception should be focused as the first priority of reproductive health programs by promoting women's empowerment interventions that can support enhancement of socio-economic status of married women in Myanmar. Due to cross-sectional nature of MDHS, this study could not include some critical measures of women's empowerment variables such as economic freedom and intimate partner violence, and other factors like men's involvement and cultural contents.

CONCLUSION

Findings suggest that in Myanmar society, gendered power dimensions and women's empowerment factors relate to women's modern contraceptive use. The results also highlighted that married women in Myanmar were dominated by their husband's power. Position and privilege gained from patriarchal social structures inhibited women's access to reproductive health services including women's use of modern contraception. The gendered power relations can reduce or enhance women's autonomy regarding contraceptive choices. Women who have autonomy are more likely to use modern contraceptive methods. Thus, policy makers should consider formal and informal compulsory education programs, initiating gender transformative reproductive health programs emphasizing the empowerment of women and girls especially for those who are living in rural areas as well as involvement of men to rework the society's rigid male-dominated norms.

RECOMMENDATIONS

The Myanmar government should focus on putting sexual and reproductive health subjects in formal and informal school curriculum including the curricula of professional health institutions on the basis of age-appropriate

sexuality education. In addition, future studies should target unmarried women as a study population as they are frequently excluded from modern contraceptive use studies.

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ประกาศ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

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ด้านประชากรและวิทยาศาสตร์สาธารณสุข ครั้งที่ 12

(The 12th International Graduate Students Conference on Population and Public Health Sciences)

ตามที่ สถาบันวิจัยประชากรและสังคม สถาบันพัฒนาสุขภาพอาเซียน มหาวิทยาลัยมหิดล และวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย ได้มีบันทึกข้อตกลงความร่วมมือระหว่างสามสถาบัน เพื่อการพัฒนาวิชาการด้านการเรียนการสอน การวิจัย และกิจกรรมนิสิตนักศึกษาระดับบัณฑิตศึกษา ทั้งนี้ได้กำหนดให้มีการนำเสนอผลงานวิจัยของนิสิต อาจารย์ และบุคลากรร่วมกันทั้งสามสถาบัน ในการประชุมวิชาการบัณฑิตศึกษานานาชาติด้านประชากรและวิทยาศาสตร์สาธารณสุข ครั้งที่ 12 "The 12th International Graduate Students Conference on Population and Public Health Sciences" (IGSCPP) ในวันที่ 12 กรกฎาคม 2564 ณ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย เพื่อให้การดำเนินการเป็นไปโดยเรียบร้อย มีประสิทธิภาพ และบรรลุวัตถุประสงค์ จึงขอแต่งตั้งคณะกรรมการในการดำเนินงานประชุมดังกล่าว ตามรายนามและตำแหน่งต่อไปนี้

<u>คณะกรรมการดำเนินงาน</u>

1. ศาสตราจารย์ นพ.สุรศักดิ์ ฐานีพานิชสกุล	ที่ปรึกษา
2. พญ.นันทา อ่วมกุล	ที่ปรึกษา
3. พญ.นิพรรณพร วรมงคล	ที่ปรึกษา
4. ศาสตราจารย์ ดร.สถิรกร พงศ์พานิช	ประธานกรรมการ
5. ผู้ช่วยศาสตราจารย์ ดร.นพ.ภูดิท เตชาติวัฒน์	ประธานกรรมการร่วม
6. รองศาสตราจารย์ ดร.อารี จำปากลาย	ประธานกรรมการร่วม
7. ศาสตราจารย์ ดร.จิตรลดา อารีย์สันติชัย	รองประธานกรรมการ
8. รองศาสตราจารย์ ดร.วัฒน์สิทธิ์ ศิริวงศ์	กรรมการ
9. ผู้ช่วยศาสตราจารย์ ดร.เนาวรัตน์ กาญจนาการ	กรรมการ
10. นางสาวอรุณี เขียวชะอุ่ม	กรรมการ
11. นางสาวศุกรินทร์ วิมุกตายน	กรรมการ
12. อาจารย์ ดร.วันดี ศิริโชคชัชวาล	กรรมการและเลขานุการ

ภาระหน้าที่ความรับผิดชอบ

ให้คณะกรรมการปฏิบัติงานหน้าที่พิจารณากำหนดกรอบ แนวทาง หัวข้อของการประชุม และกำหนดกรอบแนวทางเนื้อหา/กิจกรรม วิทยากร และผู้เข้าร่วมประชุม

คณะกรรมการดำเนินการ

1. ศาสตราจารย์ ดร.สถิรกร พงศ์พานิช	ที่ปรึกษา
2. ผู้ช่วยศาสตราจารย์ ดร.เนาวรัตน์ กาญจนาคาร	ประธานกรรมการ
3. ศาสตราจารย์ ดร.จิตรลดา อารีย์สันติชัย	ประธานกรรมการร่วม
4. ผู้ช่วยศาสตราจารย์ ดร.มาลี สันภูวรรณ์	ประธานกรรมการร่วม
5. รองศาสตราจารย์ ดร. นายแพทย์ ศักดา อาจองค์ วัลลิภากร	ประธานกรรมการร่วม
6. ผู้ช่วยศาสตราจารย์ ดร. นายแพทย์ วิชช์ เกษมทรัพย์	กรรมการ
7. ผู้ช่วยศาสตราจารย์ ดร.อรพินท์ เล่าซื้	กรรมการ
8. ผู้ช่วยศาสตราจารย์ ดร.ดุสิตา พึ่งสำราญ	กรรมการ
9. ผู้ช่วยศาสตราจารย์ ดร.จงจิตต์ ฤทธิรงค์	กรรมการ
10. อาจารย์ ดร.วันดี ศิริโชคชัชวาล	กรรมการ
11. อาจารย์ ดร.มนทกานติ์ เชื่อมชิต	กรรมการ
12. รองศาสตราจารย์ ดร.กาญจนา รังษีหิรัญรัตน์	กรรมการ
13. นางสาวดาวนภา เมธาธีระนันท์	กรรมการ
14. นายภูมิรัตน์ โกกิลกนิษฐ	กรรมการ
15. นายธงชัย จินดาสิทธางกูร	กรรมการ
16. นายเอกพิสิฐ ธนวัชร์สมบัติ	กรรมการ
17. นางสาววันเพ็ญ พรเจริญ	กรรมการ
19. นางอโณทัย เกิดเจริญ	กรรมการ
20. นางสาวกุลญาณินทร์ ศรีดาชาติ	กรรมการและเลขานุการ
21. นางสาวกาญรัตน์ อินทุรัตน์	กรรมการและผู้ช่วยเลขานุการ
22. นางสาวสฐาปนีย์ นิลทะราช	กรรมการและผู้ช่วยเลขานุการ

ภาระหน้าที่ความรับผิดชอบ

ให้คณะทำงานปฏิบัติงานหน้าที่การเตรียมการด้านการเชิญวิทยากร ประสานงานวิทยากร จัดทำระบบประชาสัมพันธ์ การรับสมัคร การลงทะเบียน และการเตรียมการด้านสถานที่จัดประชุม ด้านเอกสารประกอบการประชุม ด้านการเงินการบัญชีของการประชุม รวมทั้งกิจกรรมอื่นใดที่เกี่ยวข้อง และประสานงานกับหน่วยงานอื่นใดที่เกี่ยวข้อง

คณะทำงานวิชาการ

1. ศาสตราจารย์ นพ.สุรศักดิ์ ฐานีพานิชสกุล	ที่ปรึกษา
2. Alessio Panza, M.D, M.Com.H, DTMH	ที่ปรึกษา
3. Peter Xenos, Ph.D.	ที่ปรึกษา
4. อาจารย์ ดร.เกรียงไกร เลิศทัศนีย์	ที่ปรึกษา
5. ศาสตราจารย์ ดร.จิตรลดา อารีย์สันติชัย	ประธานกรรมการ
6. ศาสตราจารย์ ดร.สุภา เพ่งพิศ	ประธานกรรมการร่วม
7. รองศาสตราจารย์ ดร.รศรินทร์ เกรย์	ประธานกรรมการร่วม
8. ศาสตราจารย์ ดร.ปัทมา ว่าพัฒนวงศ์	ประธานกรรมการร่วม
9. รองศาสตราจารย์ ดร.วัฒน์สิทธิ์ ศิริวงศ์	รองประธานกรรมการ
10. ผู้ช่วยศาสตราจารย์ ดร.บังอร เทพเทียน	กรรมการ
11. ผู้ช่วยศาสตราจารย์ ดร. กาญจนา ตั้งชลทิพย์	กรรมการ
12. ผู้ช่วยศาสตราจารย์ ดร.ปิยวัฒน์ เกตุวงศา	กรรมการ
13. ผู้ช่วยศาสตราจารย์ ดร.ดวงใจ บรรทัพ	กรรมการ
14. ผู้ช่วยศาสตราจารย์ ดร.ชีระวิทย์ รัตนพันธุ์	กรรมการ
15. ผู้ช่วยศาสตราจารย์ ดร.อรพินท์ เล่าซื้	กรรมการ
16. ผู้ช่วยศาสตราจารย์ ดร.อรุณศรี มงคลชาติ	กรรมการ
17. ผู้ช่วยศาสตราจารย์ ดร.สมศักดิ์ วงศ์สาวาส	กรรมการ
18. ผู้ช่วยศาสตราจารย์ ดร.พจนา หันจางสิทธิ์	กรรมการ
19. ผู้ช่วยศาสตราจารย์ ดร.มนสิการ กาญจนะจิตรา	กรรมการ
20. อาจารย์ ดร. สิรินทร์ยา พูลเกิด	กรรมการ
21. Lecturer Dr. Dyah Anantalia Widyastari	กรรมการ
22. ผู้ช่วยศาสตราจารย์ ดร.โซอ่ะ ฮง	กรรมการ
23. อาจารย์ ดร.สพ.ญ.สรัญญา สุจริตพงศ์	กรรมการ
24. อาจารย์ ดร. ณปภัช สัจนวกุล	กรรมการ
25. Dr. Truc Ngoc Hoang Dang	กรรมการ
26. ผู้ช่วยศาสตราจารย์ ดร. อิสรีย์ฐิกา ชัยสวัสดิ์	กรรมการ
27. ผู้ช่วยศาสตราจารย์ ดร.ดุสิตา พึ่งสำราญ	กรรมการ
28. ผู้ช่วยศาสตราจารย์ ดร.ธันวดี สุขสาโรจน์	กรรมการ
29. ผู้ช่วยศาสตราจารย์ ดร.จงจิตต์ ฤทธิรงค์	กรรมการ
30. ผู้ช่วยศาสตราจารย์ ดร.พจนา หันจางสิทธิ์	กรรมการ
31. ผู้ช่วยศาสตราจารย์ ดร.เนาวรัตน์ กาญจนาคาร	กรรมการ
32. รองศาสตราจารย์ ดร.เขมิกา ยามะรัต	กรรมการ
33. ผู้ช่วยศาสตราจารย์ ดร.ณัฏฐา ฐานีพานิชสกุล	กรรมการ
34. รองศาสตราจารย์ ดร.กาญจนา รังษีหิรัญรัตน์	กรรมการ
35. อาจารย์ ดร.เทพนาฏ พุ่มไพบูลย์	กรรมการ
36. อาจารย์ ดร.มนทกานติ์ เชื่อมชิต	กรรมการ

37. อาจารย์ ดร.ปกเกศ วงศาสุลักษณ์	กรรมการ
38. ดร.นุชนาฏ หวนนากลาง	กรรมการ
39. ดร.อรอุมา ซองรัมย์	กรรมการ
40. อาจารย์ ดร.อนุชิต ภานุมาสวิวัฒน์	กรรมการ
41. พญ.นิพรรณพร วรมงคล	กรรมการ
42. รองศาสตราจารย์ ดร.รัตนา สำโรงทอง	กรรมการ
43. ภก.ดร.ประมณฑ์ วิวัฒนากุลวาณิชย์	กรรมการ
44. อาจารย์ ดร.ไกรวุฒิ กัลวิชา	กรรมการ
45. อาจารย์ ดร.อัญชลี ประสารสุขลาภ	กรรมการ
46. อาจารย์ ดร.วันดี ศิริโชคชัชวาล	กรรมการ
47. รองศาสตราจารย์ ฉวีวรรณ บุญสุยา	กรรมการ
48. พญ.นันทา อ่วมกุล	กรรมการ
49. พญ.นภาพรรณ วิริยะอุตสาหกุล	กรรมการ
50. นางสาวกุลญาณินทร์ ศรีคาชาติ	กรรมการและเลขานุการ
51. นางสาวกาญจัตน์ อินทุรัตน์	กรรมการและผู้ช่วยเลขานุการ
52. นางสาวสฐาปนีย์ นิลทะราช	กรรมการและผู้ช่วยเลขานุการ

ภาระหน้าที่ความรับผิดชอบ

ให้คณะทำงานปฏิบัติงานหน้าที่พิจารณาบทความวิจัยเพื่อการนำเสนอในการประชุมของผู้สมัครพิจารณาให้รางวัลการนำเสนอดีเด่น (Outstanding Oral / Poster Presentation Award) รวมทั้งจัดทำบทความวิจัยตีพิมพ์เผยแพร่ลงใน Proceeding งานประชุม / Journal of Health Research และหน้าที่อื่นๆ ที่เกี่ยวข้อง

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป จนเสร็จสิ้นภารกิจ

ประกาศ ณ วันที่ 28 มิถุนายน พ.ศ. 2564

(ศาสตราจารย์ ดร.สถิรกร พงศ์พานิช)
คณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข


วิทยาลัยวิทยาศาสตร์สาธารณสุข
College of Public Health Sciences
Chulalongkorn University


Mahidol University
ASEAN Institute
for Health Development


50th Anniversary of Institute for Population and Social Research, Mahidol University