The 13th International Graduate Students Conference on Population and Public Health Sciences

JULY 8, 2022

HYBRID CONFERENCE

College of Public Health Sciences
Chulalongkorn University

ASEAN Institute for Health Development
Mahidol University

Institute for Population and Social Research
Mahidol University

WELCOME MESSAGE

Prof. Sathirakorn Pongpanich, Ph.D.
Chairperson, Executive Committee, 13th IGSCPP
Dean
The College of Public Health Sciences,
Chulalongkorn University,
Thailand
www.cphs.chula.ac.th

Dear Colleagues,

On behalf of the College of Public Health Sciences, Chulalongkorn University and Scientific Committees of the 13th 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 Assoc. Prof. Dr.Aree Jampaklay, Director of Institute for Population and Social Research, Mahidol University and Assoc. 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 13th International Graduate Students Conference on Population and Public Health Sciences.

WELCOME MESSAGE

Assoc. Prof. Phudit Tejativaddhana, Ph.D.
Co-Chairperson, Executive Committee, 13th IGSCPP
Director
ASEAN Institute for Health Development,
Mahidol University, Thailand
www.aihd.mahidol.ac.th

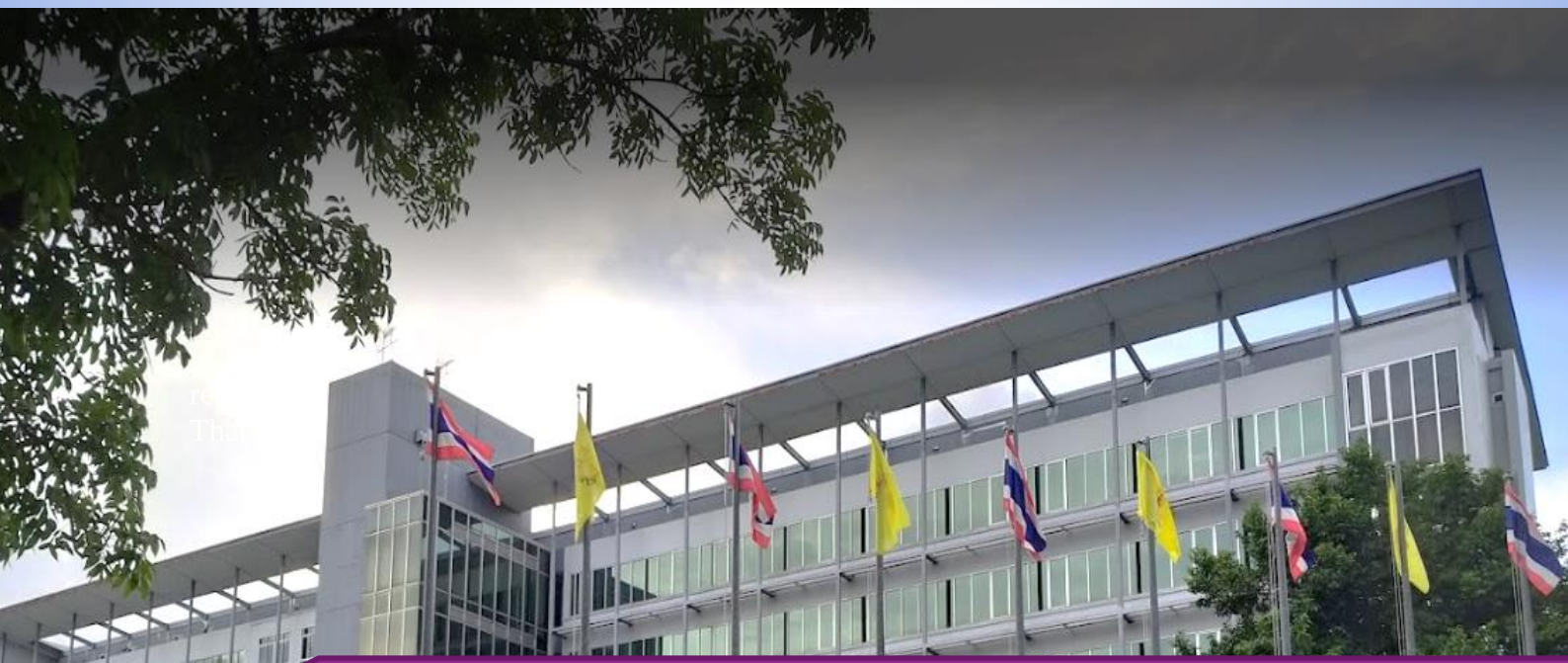
Dear Colleagues,

On behalf of the organizing committee, I am very honored to welcome you to the 13th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP). This international conference is jointly organized by the College of Public Health Sciences (CPHS), Chulalongkorn University, Institute for Population and Social Research (IPSR), and the ASEAN Institute for Health Development (AIHD) of Mahidol University. The collaboration between these three organizations has been strengthened by several positive outcomes. This annual conference is a wonderful platform for graduate students to exchange ideas, broaden their knowledge, meet new friends, expand their network, and strengthen the academic collaboration among the three partnering organizations. I would like to thank all participants for their contributions to the conference. I hope you will find the presentations and discussions today useful and interesting and will gain inspiration from them. Finally, I would like to thank CPHS for hosting this academic event and IPSR for co-organizing and supporting this remarkable conference.

With this, I sincerely hope that this conference will be an important step toward strengthening our knowledge in Population and Public Health Science.

WELCOME MESSAGE

Assoc. Prof. Aree Jampaklay, Ph.D.
Co-Chairperson, Executive Committee, 13th IGSCPP
Director
Institute for Population and Social Research, Mahidol University
https://www.ipsr.mahidol.ac.th/



Dear Colleagues,

Welcome, everyone. I am grateful to be part of the 13th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP), 2022. This annual conference has been continually organized for the past 12 years with a common goal of promoting academic activities, networking, and building partnerships. In these globally trying times, it is delightful to celebrate the success of the collaborative effort once again between these three exceptional Institutes:

- College of Public Health Sciences (CPHS), Chulalongkorn University
- ASEAN Institute for Health Development (AIHD), Mahidol University
- Institute for Population and Social Research (IPSR), Mahidol University

On behalf of the Institute for Population and Social Research (IPSR), Mahidol University, it is my honor to welcome everyone from diverse backgrounds and countries attending this conference. I am sure that by sharing your research, we will gain a deeper understanding and knowledge about different aspects of population and public health, including health care and reproductive health.

My sincere congratulations and gratitude go to the two fellow co-chairs and their excellent staff: Prof. Dr. Sathirakorn Pongpanich with the College of Public Health Sciences (CPHS), Chulalongkorn University, and Assoc. Prof. Dr. Phudit Tejativaddhana with the ASEAN Institute for Health Development (AIHD), Mahidol University, for putting so much effort into helping organize this conference. I am also thankful to all IPSR staff who actively contributed to making this conference happen. Your support is vital to our success.

The 13th International Graduate Students Conference on Population and Public Health Sciences (IGSCPP)

July 8, 2022
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 Chulalongkorn University MC: Prof. Chitlada Areesantichai, Ph.D.
9.00-9.30	Special Lecture: Impact of COVID-19 for Public Health Education in CLMV Professor Wongsa Laohasiriwong, Ph.D. Dean, Faculty of Public Health, Khon Kaen University Chairperson & Co-Chairperson Assoc. Prof. Wattasit Siriwong, Ph.D. / Asst. Prof. Montakarn Chuemchit, Ph.D
9.30-9.40	Photo Group / 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.
	1) Mortality Trend Analysis for Pneumonia in the Philippines from 1960 to 2019 (#01) by Angel Mae F. Luga
	2) Overweight Risk Factors among Adolescents in Indonesia (#02) by Purwo Setiyo Nugroho
	3) To be a Victim in Their Own Community: Experience to Violence Exposure among Adolescents in Makassar, Indonesia (#03) by Andi Ny Yudha
	4) Sexual and Reproductive Health Needs of Adolescents: A Case Study at Senior High School 2 Bantul, Yogyakarta-Indonesia (#04) by Ratu Matahari
	5) Menopause Healthcare and Women's Right to Health in Prison: A Global Scoping Review (#05) by Lizz Srisuwan
	6) Gender Identity, Sexual Orientation, and Pattern of Sexual Behaviors of LGBTIQAN+ in Thailand (#06) by Naphat Krutthai
	7) Factors Associated with Reproductive Health Agency Among Indonesian Young Women Aged 15-24 (#07) by Achmad Fauzan Maulana
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. Wakako Takeda, Ph.D. / Tepanata Pumpaibool, Ph.D. Committee: Asst. Prof. Somsak Wongsawass
	1) Barriers and Facilitators to Access Mental Health Services: Perspectives of People Living with Mental Illnesses in Indonesia (#08) by Lafi Munira
	2) Loneliness in Later Life and its Association with Physical and Mental Health: Findings from a Vietnam Aging Community Survey (#09) by Man Vo Thi Hue

	3) A Policy Simulation Impact of Tobacco Excise Tax Increase on Cigarette Consumption, Mortality, Medical Treatment Cost, Life-Years Gained, and Government Revenue in Indonesia (#10) by Ridhwan Fauzi
	4) Financial Burden Toward Out-Of-Pocket Expenditure on Health Care among Households with Members Suffering from NCDs in Vietnam (#11) by Nguyen Thi Phuong Linh
	5) Six Decades of Schistosomiasis Disease in the Philippines: Profile and Trend Analysis (#12) by Jamerah B. Sidic
	6) Factors Associated with Menstrual Hygiene Management among Female Students in Tangerang Municipality, Indonesia (#13) by Wihdaturrahmah
	7) Factors Associated with the Utilization of Antenatal Care Visits in Sylhet, Bangladesh (#14) by Moni Paul
Room 3 **(Host by AIHD)**	Track 2: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience
	Chairperson & Co-Chairperson: Asst. Prof. Aroonsri MongkolChati, Ph.D. / Assoc. Prof. Nutta Taneepanichskul, Ph.D. Committee: Asst. Prof. Marc Voelker, Ph.D.
	1) Evaluation of Self-purification Capacity of Gamasiab River in Nahavand Township in Iran using MATLAB Software (#15) by Mahdi Reyahi-Khoram
	2) Development of Lipidomics LC-MS/MS Method for Absolute Quantification of Targeted Polar Lipids in the Liver Sample of Zebrafish Model (#16) by Kajol Thapa
	3) Prediction of Pesticides Exposure and Human Health Risk among Rice Farmers in Ayeyarwady, Delta Region, Myanmar: A Cross-Sectional Study During COVID -19 Pandemic (#17) By Moe Thu Khin
	4) Health Impact Assessment of Short-term Exposure Particulate Matter (PM) 2.5 on Hospital Admission for Respiratory Diseases in Thailand (#18) by Friscilla Hermayurisca
	5) Geographical Distribution Improvement of Physicians in Thailand and Japan: A Comparative Longitudinal Secondary Data Analysis (#19) by Hiromichi Takahashi
	6) Myanmar Cross-border Patients' Health Seeking Behaviour in China and Determinants in the Decision-making Process (#20) by Chenhao Wang

	7) Sustainable Management of Facemask Waste Generated from COVID -19 Pandemic in Bhutan (#21) by Tshering Yangdon
Time	Program
12.00-13.30 (Host by CPHS)	Poster Presentation (room 1)
	Poster committees: Vo Man Thi Hue, Ph.D. / Assoc.Prof. Sutthida Chuanwan, Ph.D. Prof. Ratana Somrongthong, Ph.D. / Nipunporn Voramongkol, M.D. MPH./ Nuchanad Hounnaklang, Ph.D. / Onuma Zongram, Ph.D. Assoc. Prof. Kanchana Rungsihirunrat, Ph.D.
	1) The Prevalence and Factors Associated with Depression Among Lesbians in Chengdu, China by Linghong Liao
	2) Abstract on Evaluation of Risk Mother Tracking System (RMTS) at Shan(S) State by Sai Win Zaw Hlaing
	3) Association between Completed Suicide and Gender in Chaiyaphum Province, Thailand by Pattarachai Simaroj
	4) Association between Medical Insurance Choices and Healthcare Utilization among Diabetes Patients in The People's republic of China: A Secondary Data by Duohui Chen
	5) A Study of Perceived Stress among Adolescents Living in Slums of Dhaka, Bangladesh in the Times of Pandemic by S M Taslima Yasmin
	6) Exploring and Reducing Tuberculosis Stigmatisation and Discrimination in Thai High-Schools by Saowaluk Moonsarn
	7) Bioinformatics Analysis to Identify Key Cell Cycle-regulated Target Genes of Quercetin and Their Associations with a Disease-free Survival in Cholangiocarcinoma by Patthorn Jaikla
	8) The Prevalence of Probable Post-Traumatic Stress Disorder among Flood-prone Provinces in Thailand by Natakorn Ritbunyakorn
	9) Spatial Epidemiology of Pediatric Pulmonary Tuberculosis (Tb) Cases in Medan City 2016-2020 by Dini Pratiwi
	10) Determinant of Intra Uterine Device (IUD) Use in Public Health Center of Cangkringan, Sleman Regency, Yogyakarta-Indonesia by Ratu Matahari
	11) Relationship of Sense of Ownership and Trust to Community Engagement in the Community Health Worker Program, Karenni State, Myanmar: A Cross-Sectional Study by Mrs. Celyn

	12) Factors Associated with Comprehensive Knowledge of HIV among Adolescents Aged 15-19 in Zimbabwe by Gamuchirai Natasha Munjoma
	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/ Narumol Bhummapha, Ph.D, / Lecturer Dr. Dyah Anantalia Widyastari / Asst. Prof. Supaporn Songpracha, Ph.D
	13) The Stress among lecturers in the Universities with Online Teaching in Vietnam during COVID-19 Pandemic: A Preliminary Study by Anh Hoang Thi Ngoc
	14) Health Risk Assessment Related to Cadmium Exposure from Cigarette Smoking among Indonesian Smokers in Surakarta, Indonesia: A Cross-Sectional Study by Panji Mukti
	15) Factors Affecting Knowledge about HIV/AIDS in Women of Reliable Age in North Sumatera Province in 2017 (2017 Idhs Data Analysis) by Bebby Alfiera Riyandina Hardja
	16) Influential Factors of Thai Older Adults' Intent to Receive Short-term Stay Service by Ichikawa Mariko
	17) Demographic Changes and Economic Growth: Empirical Evidence from Macau by Tian Yingguihang
	18) Access and Use of Mobile Phone in Rural Mountainous Community in Nepal by Paudel S
	19) Case Analysis of Rabies Transmitting Animal Bites (GHPR) in North Tapanuli Regency, North Sumatra Province in 2016-2020: Spatio-Temporal Epidemiological Study by Saidah Fatimah Sari Simanjuntak
	20) Association between Loneliness and Related Factors among University Students during COVID-19 Pandemic in Bangladesh by Sanjida Sultana
	21) Prevalence of Food Insecurity and its Predictors amongst Adolescents Living in Urban Slum Settlements of Dhaka, Bangladesh during the Era of COVID 19 Pandemic by S M Taniya Yasmin
	22) Prevalence of Musculoskeletal Symptoms among Female Garment Workers in Khan Mean Chey, Phnom Penh city, Cambodia: A preliminary result from cross-sectional study by TRY Phally
	23) Outpatient Satisfaction with Community Health Service Center using Servqual-ipa in Shanghai, People's Republic of China by Enli Chen
	24) Shedding Light on the Opposite Standpoint: Determining the Contributing Factors Regarding the Anti-vaxxers' Refusal to Get Vaccinated Against COVID-19 by Charisha Buen
	25) Mortality Trends from Diabetes Mellitus in the Philippines, 1960-2019 by Ralf Benjo Goder Morilla

	26) A Conceptual Model for Ayushman Bharat 2.0: A Proposal for Universal Healthcare by Ritwika Verma
13.30-15.30	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: Asst. Prof. Montakarn Chuemchit, Ph.D / Assoc. Prof. Thunwadee Suksaroj, Ph.D Committee: Assoc. Prof. Piyawat Katewongsa, Ph.D
	8) Cancer in the Philippines from 1960 to 2019: A Time-Trend Analysis (#22) by Kathleen L. Cabanlit
	9) Seroprevalence of Dengue, Zika, and Chikungunya viruses among Human and Non-human Primates Living in Proximal in Laem Chabang, Thailand (#23) by Fanny Sae Wang
	10) Sociodemographic Correlates of Coming Out among U.S. Sexual Identity Minorities (#24) by Matthew Kusen
	11) TNF-α Treatment Decreased Progesterone Receptor-Mediated Transcription in Breast Cancer Cells (#25) by Kunjira Rojpaisarnkit
	12) Risk Factors and Outcomes of Intracranial Hemorrhages among Patients with Non-valvular Atrial Fibrillation Using Non-vitamin K Oral Anticoagulants (#26) by Shoon Lae Nandar
	13) Gender-based Violence Awareness and Access to Social, Legal, and Health Services among Women in Eastern Myanmar during the Military Coup (#27) by Pan Nu Zaw
	14) Husbands' Characteristics and the Unmet Needs for Family Planning among Married Women in Myanmar (#28) by Yar Zar Tun
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: Assoc.Prof. Jongjit Rittirong, Ph.D. / Asst. Prof. Seo Ah Hong, Ph.D. Committee: Pramon Viwattanakulvanid, Ph.D.

	8) Referral Patterns of Intermediate Care in Thailand (#29) by Nalinee Nakittipha Chukhamfoo
	9) Compilation, Explanation and Restoration of Moh Phon's Herbal Prescriptions for the Skin Conditions Caused by Viral, Bacterial, and Fungal Infections (#30) by Ye Qiaoling
	10) Determinants of Life Satisfaction among Older Persons in Myanmar (#31) by Myo Thandar
	11) Preventive Health Care and Health Care Services Utilization of Vietnamese Older Persons: Results from National Household Living Standards Survey 2018 (#32) by Thao Nguyen
	12) Associations between Sexual Orientation and Gender Identities (SOGI), and barriers to healthcare among LGBTQ+ people in Bangkok, Thailand (#33) by Lizz Srisuwan
	13) LGBTQ+ Healthcare Access in Nepal During the COVID19 Pandemic (#34) by Sushobhan Bhandari Il
Room 3 (Host by AIHD)	Track 2: COVID-19, Public Health, Public Health Sciences and Health Social Science, Digital Health and Technology Track 5: Environmental and Occupational Health, Sustainable Development Goal, Global warming, Disaster management, Resilience
	Chairperson & Co-Chairperson: Asst. Prof. Orapin Laosee, Ph.D. / Kraiwuth Kallawicha, Ph.D. Committee: Asst. Prof. Sirinya Phulkerd, Ph.D.
	8) Proof of Concept of Method for Evaluating Capacity Building for Health Literacy Responsive Practice (#35) by Hailey Bradley
	9) The Clinical Effects of Lysiphyllum strychnifolium (Craib) A. Schmitz Tea on Breastmilk Production (#36) by Suwanna Maenpuen
	10) The Determinants of Happiness among Food Delivery Riders in Bangkok and Metropolitan Area during the COVID -19 Pandemic (#37) by Yasuko Watanabe
	11) Prevalence and Associated Factors of Food Insecurity During COVID-19 Pandemic among Bangkokian (#38) by Wimonmanee Mekkhum
	12) Indonesian's Health Social Workers in Maternal and Child Program during COVID-19 Pandemic: How Were They Worked? (#39) by Tri Bayu Purnama
	13) Perception on Proper Used Face Masks Disposal in the COVID-19 Era among Nakhon Pathom Province Residents of Thailand (#40) by Aye Kyawt Khine
15.30-16.00	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.

List of Abstracts

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RISK FACTORS OF BEING OVERWEIGHT AMONG INDONESIAN ADOLESCENTS

Purwo Setiyo Nugroho[1,5],*
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ABSTRACT

Overweight adolescents are one of the more significant health problems facing Indonesia. The prevalence of overweight adolescents increased from 2013 to 2018. Not only does being overweight contribute to chronic diseases that can increase morbidity and mortality risk, but it also can affect adolescents psychologically, such as being less confident and bullied by their friends, which will be linked to depression. Using a cross-sectional design, this research examined the significant risk factors of overweight adolescents in Indonesia using secondary data from the Indonesian Global School-based Health Survey (GSHS) 2015. Logistic regression analysis was used to analyze the GSHS dataset. There were 11,142 respondents within the dataset; however, 9,772 participants were selected by data completeness. The result revealed that being overweight was significantly associated with education (AOR = 0.801; 95% CI = 0.704, 0.912; p = 0.001), smoking behavior (AOR = 1.252; 95% CI = 1.026, 1.528; p = 0.027), and sitting activities habits (AOR = 0.751; 95% CI = 0.663, 0.850; p = 0.000) and being overweight among adolescents in Indonesia. Adolescents have risk factors for being overweight; thus, they must be aware of their health. Researchers recommend that the Indonesian government add course material about adolescents' health in the school curriculum to prevent adolescents from becoming overweight, particularly in senior high schools. In addition, the Indonesian government must ratify a Framework Convention on Tobacco Control (FCTC) to minimize new adolescent smokers.

Keywords: *Adolescent, GSHS, Indonesia, overweight, risk factors, school-aged*

INTRODUCTION

Being overweight is a prevalent health problem in developed and developing countries. It can prevent people from implementing healthy behavior. However, being overweight is exponentially increasing among children and adolescents. Overweight children risk health problems that affect their health quality, such as leg growth disorder, sleep disorder, and breathing disorder [(1)]. Being overweight as a child can continue into adulthood. In that case, being overweight will cause metabolic syndrome and degenerative diseases such as cardiovascular disease, diabetes mellitus, arthritis, gall bladder abnormalities, cancer, and breathing disorder in adults [(2)].

Over 340 million children and adolescents (5–19 years old) are overweight worldwide. The prevalence of overweight adolescents increased exponentially from 1975 (4%) to 2016 (18%). Based on Indonesian Basic Health Research in 2018, overweight children and adolescents significantly increased from 8.3% in 2013 to 18.8% in 2018. The International Agency for Obesity, a part of the World Health Organization, revealed that overweight adolescents were caused by an environment dominated by lifestyle and unhealthy diet. Moreover, being overweight was also caused by genetics [(3)]. Being overweight among adolescents will affect leg muscles, such as loss of longitudinal foot arches that make the angle underneath the foot small, known as pes-planus. The condition can cause limited activity among adolescents, such as walking and running for a long time, which can make on becoming lazier to do physical activity and make being overweight worse [(1)].

In addition, being overweight among adolescents can affect asthma and is marked by breathing repeatedly stopping during sleep. It can affect adolescents psychologically, such as being less confident and bullied by their friends, which will cause depression. Many factors influence being overweight, such as physical activity, smoking, parental knowledge, parent's job, sedentary behavior, passive smoking, obesity in their family, etc. Being overweight among adolescents can be prevented when the risk factors can be reduced effectively using a proper program [(4)].

Many sectors, including government and policymakers, must prevent adolescents from becoming overweight to minimize other diseases when they become adult-aged. The prevention program based on the research can avoid becoming overweight effectively and adequately. Hence, based on evidence about being overweight, the authors analyzed the Global School-based Health Survey (GSHS) about the risks of being overweight in Indonesia to examine the significant factors associated with overweight adolescents. The government or other institutions can use this research to make policies for overweight intervention in Indonesia. Thus, the research question is, "What are the significant risk factors associated with overweight adolescents in Indonesia?"

METHODS

A cross-sectional design was used to analyze secondary data from the Global School-based Student Health Surveys (GSHS) 2015 [(5)]. The survey by the Indonesia Ministry of Health and the World Health Organization was conducted on students (junior and senior high school) in Indonesia aged 11–18 years old. The GSHS survey is a national representative survey for junior and senior high schools in Indonesia. The GSHS explores the risk factors of non-communicable diseases such as alcohol use, dietary behavior, drug use, hygiene, mental health, physical activity, protective factors, sexual behavior, tobacco use, violence, and unintentional injury. Respondents reported their health condition using a self-questionnaire and were guided by trained data collectors.

The survey dataset can be freely accessed on the World Health Organization's website [(6)]. Respondents were selected in this research based on the data provider's dataset. A total of 11,142 respondents were available on the dataset, but 9,772 respondents with complete data (no missing data in respondent's variables) were selected for further analysis. Missing data makes inappropriate information research results [(7)].

Data collection on respondents was conducted in two steps. The first step was choosing a school with probability in the area. The second step was choosing respondents with random sampling in each class [(8)]. The dependent variable in this research is being overweight. The independent variables are vegetable consumption, fruit consumption, insomnia, smoking, passive smoker, alcohol consumption, physical activity, attending physical exercise class, sitting activity, soft-drinks consumption, and fast-food consumption.

The survey was conducted on students who are in junior high and senior high schools in Indonesia. Being overweight was determined by sex-specific BMI-for-age > +1 SD. The Body Mass Index (BMI) was determined by weight and height. Weight was measured by asking respondents about their weight (in

kilograms) without shoes. In addition, the height was measured by asking respondents about their height (in centimeters) without shoes.

School register data collected information about sex and grade school. Vegetables, fruit, smoking, alcohol, and soft-drink consumption were collected by asking the respondents about doing any of these activities within 30 days before the survey was conducted. Passive smoker and fast-food consumption were collected by asking the respondents about doing these activities within 7 days before the survey was conducted [6].

The questionnaire also asked about insomnia within 12 months before the survey was conducted. Daily activity conducted by respondents measured physical activity, such as doing physical exercise, walking, running, etc., for at least 60 minutes per day within 7 days before the survey was conducted. Students attending physical exercise class were asked about the presence of the class every week during the school year. Sitting activities were measured by asking the respondents about daily activities such as playing games, watching television, talking with friends, and doing homework for at least 3 hours or more per day [6].

Chi-square was used for bivariate analysis, estimating crude odds ratio (COR) on overweight risk factors [9]. Binary logistic regression was used for multivariate analysis, calculating a significantly adjusted odds ratio (AOR) of overweight risk factors [10]. Adjusted odds ratios were obtained after considering other variables in one multivariate analysis, obtaining an accurate result [11]. The SPSS program was used to analyze the dataset for this research. Hypothesis testing was significant at .05 (CI 95%).

RESULTS

Table 1 Individual Characteristics of Participants (N = 9,772)

Background characteristic	n	%
Grade school		
- Junior high school	6,956	71.2
- Senior high school	2,816	28.8
Sex		
- Female	5,461	55.9
- Male	4,311	44.1

Table 2 shows respondents' frequency of being overweight and risk behavior by sex. There were 1,432 (14.7%) overweight adolescents out of 9,772. In addition, there were 648 (15%) overweight males out of 4,311 males and 784 (14.4%) overweight females out of 5,461 females. Descriptive results also obtained what respondents did not eat vegetables (2.9%), did not eat fruit (9.5%), insomnia(4. 5%), smoking (10%),

passive smoker (77.6%), alcohol consumption (3.9%), no physical activity (31.7%), not attending to physical exercise class (12.2%), sitting activities (26.9%), soft-drinks consumption (3.8%), and fast-food consumption (11.9%).

Table 2 Frequency of Being Overweight Risk Factors by Sex Among Participants

Variables	Male (%) n = 4,311	Female (%) n = 5,461	Total N (%) N = 9,772
Overweight	648 (15.0)	784 (14.4)	1,432 (14.7)
Not eating fruit	474 (8.7)	450 (10.4)	924 (9.5)
Not eating vegetables	140 (2.6)	140 (3.2)	280 (2.9)
Insomnia	233 (4.3)	204 (4.7)	437 (4.5)
Smoking	73 (1.3)	905 (21.0)	978 (10.0)

Variables	Male (%) n = 4,311	Female (%) n = 5,461	Total N (%) N = 9,772
Passive smoker	4,067 (74.5)	3,512 (81.5)	7,579 (77.6)
Drinking alcohol	87 (1.6)	298 (6.9)	385 (3.9)
No physical activity	1,784 (32.7)	1,315 (30.5)	3,099 (31.7)
Not attending physical activity class	592 (10.8)	603 (14.0)	1,195 (12.2)

Variables	Male (%) n = 4,311	Female (%) n = 5,461	Total N (%) N = 9,772
Sitting activity habit	1,460 (26.7)	1,172 (27.2)	2,632 (26.9)
Drinking soft drinks	166 (3.0)	205 (4.8)	371 (3.8)
Eating fast food	647 (11.8)	516 (12.0)	1,163 (11.9)

Table 3 shows overweight and behavioral risk factors by grade schools in Indonesia. There were 1,432 (14.7%) overweight adolescents out of 9,772. In addition, there were 1,081 (15.3%) overweight junior high school students out of 6,956 students and 371 (13.2%) overweight senior high school students out of 2,816 students. The analysis also revealed that junior high school students dominated risk behavior to being overweight adolescents. The behavioral risks of being overweight were not eating fruit (75.1%), not eating vegetables (68.6%), insomnia (66.4%), smoking (68.2%), passive smoker (70.7%), alcohol consumption (63.6%), no physical activity (82.2%), not attending physical exercise classes (78.7%), sitting activities habit (57.6%), soft-drinks consumption (79.8%), and fast-food consumption (71.6%).

Table 3 Comparison of Being Overweight Risk Factors Among Junior High School and Senior High School

Risk factors	Junior high school (%) n = 6,956	Senior high school (%) n = 2,816	Total N (%) N = 9,772
Overweight	1,081 (15.3)	371 (13.2)	1,432 (100)
Not eating fruit	694 (75.1)	230 (24.9)	924 (100)
Not eating vegetables	192 (68.6)	88 (31.4)	280 (100)
Insomnia	290 (66.4)	147 (33.6)	437 (100)
Smoking	667 (68.2)	311 (31.8)	978 (100)
Passive smoker	5,355 (70.7)	2,224 (29.3)	7,579 (100)
Drinking alcohol	245 (63.6)	140 (36.4)	385 (100)
No physical activity	2,548 (82.2)	551 (17.8)	3,099 (100)
Not attending physical activity class	940 (78.7)	255 (21.3)	1,195 (100)
Sitting activity habit	1,516 (57.6)	1,116 (42.4)	2,632 (100)
Drinking soft drinks	296 (79.8)	75 (20.2)	371 (100)
Eating fast food	833 (71.6)	330 (28.4)	1,163 (100)

Table 4 concludes a chi-square bivariate analysis that revealed the crude odds ratio of risk factors of being overweight. The result of the study was obtained only in grade school (COR = 1.186; 95% CI = 1.044, 1.347; p = 0.009,), smoking (COR = 0.814; 95% CI = 0.668, 0.993; p = 0.047), and sitting activities habit (COR = 1.268; 95% CI = 1.123, 1.433; p = 0.000) that correlated with overweight adolescents in Indonesia.

Table 5 is the result of the binary logistic regression that analyzes the adjusted odds ratio to being overweight. The result revealed significant correlation between grade school (AOR = 0.801; 95% CI = 0.704, 0.912; p = 0.001), smoking behavior (AOR = 1.252; 95% CI = 1.026, 1.528; p = 0.027), and sitting activities habit (AOR = 0.751; 95% CI = 0.663, 0.850; p = 0.000) to overweight adolescents in Indonesia. However, junior high school and often sitting activities were a protective risk to being overweight.

Table 4 Association Between Risk Factors and Being Overweight Among Participants (N = 9,772)

Risk factors	Overweight status		p value	COR	95% CI
	Overweight	Not Overweight			
Grade school					
Junior high school	1,061	5,895	0.009	1.186	1.044, 1.347
Senior high school	371	2,445		Ref.	
Eating fruit					
Eating	1,304	7,544	0.500	-	-
No eating	128	796			
Eating vegetables					
Eating	1,391	8,101	1	-	-
No eating	41	239			
Insomnia habit					
Insomnia	55	382	0.237	-	-
No insomnia	1,377	7,958			

Risk factors	Overweight status		*p* value	COR	95% CI
	Overweight	Not Overweight			
Smoking habit					
Smoking	122	856	0.047	0.814	0.668, 0.993
No smoking	1,310	7,484		Ref.	
Passive smokers					
Yes	1,110	6,469	0.993	-	-
No	322	1,871			
Drinking alcohol					
Yes	48	339	0.145	-	-
No	1,386	8,001			
Physical activity habit					
No physical activity	448	2,651	0.729	-	-
Yes, physical activity	984	5,689			
Attending physical activity class					
Not attending	168	1,027	0.563	-	-
Attending	1,264	7,313			
Sitting activities habit					
Often	445	2,187	0.000	1.268	1.123, 1.433
Rarely	987	6,153		Ref.	
Drinking soft drinks					
Yes	54	317	1	-	-
No	1,378	8,023			
Eating fast food					
Eating	182	981	0.328	-	-
No eating	1,250	7,359			
Sex					
Female	784	4,677	0.364	-	-
Male	648	3,663			

Notes: COR: Crude Odds Ratio; CI: Confidence Interval; Ref.: Reference

Table 5 Binary Logistic Regression Analysis of Being Overweight Risk Factors Among Participants (N = 9,772)

Risk factors	Overweight status		*p* value	AOR	95% CI
	Overweight	Not Overweight			
Grade school					
Junior high school	1,061	5,895	0.001	0.801	0.704, 0.912
Senior high school	371	2,445		Ref.	
Smoking habit					
Smoking	122	856	0.027	1.252	1.026, 1.528
No smoking	1,310	7,484		Ref.	
Sitting activities habit					
Often	445	2,187	0.000	0.751	0.663, 0.850
Rarely	987	6,153		Ref.	

Notes: AOR: Adjusted Odds Ratio; CI: Confidence Interval; Ref.: Reference

DISCUSSION

Smoking behavior influences being overweight among adolescents in Indonesia. It is shown by bivariate analysis (Table 4) that sitting activities (95% CI = 1.123, 1.433) and junior high school (95% CI = 1.044, 1.347) are risk variables for being overweight. After considering smoking behavior on multivariate analysis, sitting activities, and junior high school become protective variables for being overweight. Thus, smoking activities is the most substantial risk (AOR = 1.252; 95% CI = 1.026, 1.528; p = 0.027) of being overweight among other research variables according to multivariate analysis (Table 5).

Smoking has an association with being overweight, which can increase abdominal circumference. Smoking also has a risk factor for cardiovascular disease [12]. The abdominal circumference can estimate being overweight among people, especially males. Thus, it will become a problem in the world. Being overweight among adolescents will affect the adult stage, which has a risk factor for obesity [13]. Smoking,

overweight, and obesity are indicators of health quality in Europe [14].

Although it is known about adverse health effects, several countries ignore controlling tobacco and cigarettes in their countries; one of them is Indonesia. Indonesia is only one of Asia's regional countries that have not yet agreed to the Framework Convention on Tobacco Control (FCTC). The FCTC is an international agreement governing the control of cigarette production, consumption, and distribution [15]. The Indonesian government has implemented control over cigarettes, such as health promotion in mass media about the effect of smoking on themselves. Minimizing cigarette ads can decrease new smokers in childhood and adolescence [16].

However, the government implemented a program to prevent non-communicable diseases among Indonesian people, including being overweight, called *GERMAS (Gerakan Masyarakat Hidup Sehat).* This program is conducted based on unhealthy behavior this decade in Indonesia. As seen, GERMAS is a movement for Indonesian people to engage in physical activity, consume fruit and vegetables, reduce smoking and alcohol, improve a healthy environment, and reduce stress. As well, GERMAS encourages Indonesian people to screen health routinely, including blood pressure, height, weight, sugar blood, hearing and vision health, cholesterol, and waist size.

Sitting activities, watching television, playing video games, doing work in the office, reading, and driving in the car are sedentary behavior that can increase the risk of being overweight. However, the association between being overweight and sitting activities is unclear in elementary and junior high school. Sitting activities can reduce the systemic lipid oxidation and the expression of fatty acid transporter in skeletal muscle. Thus, it will increase being overweight. People need to manage their weight and lipids, reduce their sedentary activity, and improve their physical activity duration for a healthy weight [17].

Being overweight was related to the time spent watching television, browsing the internet, and having a private vehicle. Thus, if people sit for a short time, they do not have a risk of becoming overweight [17]. Moreover, sitting activities can be a protective risk factor for becoming overweight due to other significant variables strongly associated with being overweight. This research asked about the sitting activities seven days before the survey.

Junior high school students were at a protective risk of being overweight because other risk factors were not involved in GSHS, such as maturity in an adolescent. Senior high school is one level above junior high school which have older than junior high school. Maturity is characterized by female body fat buildup, which will prepare for pregnancy. Thus, females in senior high school are at risk of being overweight [15].

Potential bias may occur when respondents give unprecise information about themselves, such as recall bias [15, 16]. It can influence the quality of information that affects to significantly research results. The cross-sectional research design in this research can potentially lead to temporal ambiguity that results from a study explaining the causal correlation among risk variables to becoming overweight. However, the cross-sectional design can explain the association between variables [15, 17]. Multivariate analysis can reduce the result in an error that is caused by other variables and confounding variables. Thus, multivariate analysis can estimate the adjusted odds ratio on a significant variable [11]. In addition, this research can be generalized among adolescents aged 11–18 in Indonesia.

CONCLUSION

Smoking is the behavior that is a significant contributor to being overweight among adolescents, particularly in senior high school. Adolescents have risk factors of becoming overweight, including many factors, and they must be aware of their health for a better healthy body.

RECOMMENDATION

Researchers recommend the Indonesian government about health promotion through the course material in the school curriculum to prevent adolescents from becoming overweight in Indonesia. In addition, the Indonesian government must sign the FCTC to minimize new adolescent smokers. Adolescents are national assets for the construction of the country in the future.

ETHICAL DECLARATION

The ethical declaration was conducted by Ethic Research Commissions, Health Research and Development Agency, Indonesian Ministry of Health (LB.02.01/5.2/KE.158)

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BEING VICTIMS IN THEIR COMMUNITIES :EXPERIENCES TO VIOLENCE EXPOSURE AMONG ADOLESCENTS IN MAKASSAR, INDONESIA

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ABSTRACT

Violence is recognized as a global public health issue. The consequences of violence go beyond one's health and socioeconomic well-being. The practice severely violates human rights and security. Growing up in societal violence has impacted adolescents' social, emotional, behavioral, and cognitive development. This study examines the correlation among sociodemographic, perception of aggressive behavior, perception of problem behavior, towards the experience of self-victimization community violence exposure (SEVC) among adolescents in Makassar, Indonesia. This cross-sectional study measured experiences using an online questionnaire and a self-reported SEVC survey. The preliminary results were taken through multi-stage sampling from a sample of 159 adolescents aged 15–19 in Makassar, Indonesia. Out of 15 districts in Makassar, we chose three districts representing the low socioeconomic areas. There were two informed consents to participate distributed in this study; parental consent of those under 18 years old and individual consent for those above 18. The participants were approached in schools and the communities. Each respondent filled out the consent form and the questionnaire online. Most participants are female (57.9%), with a mean age of 16.73 (SD = 1.54). The perception of aggressive behavior (Fantasy measure, proheroic fantasy, and prosocial fantasy) in the three areas resulted in a median of 0.73 (IQR = 0.29), 0.55 (IQR = 0.22), 0.66 (IQR = 0.20), respectively. Perception of problem behavior resulted in a median of 3.00 (IQR = 5), and self-victimization of exposure to community violence resulted in a median of 11.965 (IQR = 3.42). The study found an association between self-victimization of exposure to community violence with the perception of problem behavior (ß = 1.513) and area of living (ß = 4.952) ($p < .05$). The research provided new insights into measuring the correlation between community violence exposure and other variables. As a result of these findings, preventative measures and recommendations for future programming were identified based on adolescent-centered and survivor-centered approaches.

Keywords: *Adolescents, Community Violence, Gender, Indonesia*

INTRODUCTION

Violence has become part of our life for a long time; it exists across generations and nations (1). Violence is inevitable in a productive society with codes of conduct that regulate individuals, such as religion, law, and community. Over the last decade, the number of violent behaviors have increased in both developed and developing countries.

The World Health Organization has reported that more than 1.6 million people lose their lives yearly because of violence. Violence has become the leading cause of death for those aged 14–44 and accounts for 7% of death among females and 14% among males (2).

The range of violence varies, and the typology of its existence varies (3). Violence can be physical, sexual, reproductive, and mental health problems. The World report on violence divided violence into three categories: self-inflicted, interpersonal violence, and collective violence. Community violence is intentional acts and parts of interpersonal violence. It encompasses what occurs within and outside of the family or home. Interpersonal violence places a considerable burden on public health because of the increase in lifelong risks and social problems, and even contributes to premature death. One death is only a façade to the extent that interpersonal violence risks health and consequences (4).

Adolescents are the most vulnerable group to expose violence, especially in the age group of 10–29 years, while foreseeing their views to engage in violent behavior, seeking thrills, and exploring bad or good experiences without overlooking the consequences (3). Living in a community where violence is prevalent can cause a heavy toll on adolescents' physical and emotional health. The lingering psychological impacts on children living with ongoing exposure to violence and trauma are immeasurable (5).

Self-victimization is the direct victimization of individuals experiencing violence. In this study, self-victimization focused on adolescents' exposure to community violence. The concept of the study was to find out whether experiencing violence in the community would impact their day-to-day life, thereby compromising their characteristics. Hence, we also investigated the perception of aggressive behavior and the perception of problem behavior of adolescents. Items on aggressive behavior are proheroic fantasy, prosocial fantasy, and aggressive fantasy measures. The bold fantasy and perception of problem behavior measured participants' thoughts on harmful activities such as smoking, stealing, etc. In contrast, the proheroic and prosocial fantasy measured participants' views on positive activities, such as helping people, daydreaming about being a leader in the community, etc.

Studies related to community violence are mainly focused on post-war and post-disaster situations. Only a few studies have been conducted in developing countries, such as exposure to community violence in Indonesia. At the same time, the impact of violence has been consistently seen in Indonesia (6). In the 2017 INSPIRE-WHO Report, there were 1.2 homicides per 100,000 in ages 0 to 17 in Indonesia. Among Southeast Asian nations, including India and Nepal, Indonesia is the highest after Thailand and Timor-Leste (7).

Research on exposure to community violence in Indonesia is still limited; however, the available literature indicates that Indonesian adolescents experience a high rate of violence. The research questions for this study are, therefore:

1. What is the percentage of community violence exposure to self-victimization in Makassar, Indonesia?
2. What are the sociodemographic perceptions of aggressive behavior and the perceptions of problem behavior among adolescents in Makassar, Indonesia?
3. Is there any association between sociodemographic, perceptions of aggressive behavior, perceptions of problem behavior, and community violence exposure to self-victimization in Makassar, Indonesia?

This study examines the prevalence of community violence exposure to self-victimization and other associations such as perceptions of aggressive behavior and problem behavior among adolescents in Makassar, Indonesia.

OPERATIONAL DEFINITIONS

Self-victimization of community violence is about how often people feel exposed to a different type of violence in their community. In this study, the specific events of violence are measured.

Perception of aggressive behavior is a characteristic of an individual in solving social problems. These characteristics usually emerge early in life. Genetic, physiological, and other constitutional factors undoubtedly play a role in many cases as "appropriate conditions and thoughts." This study measured the perceptions of aggressive behavior by fantasy measure, comprised of three categories: aggressive fantasy, proheroic fantasy, and prosocial fantasy.

Perception of problem behavior is about willingness to engage in problem behavior.

METHODOLOGY

STUDY DESIGN

This study was conducted from May–June 2022 through an online questionnaire using a cross-sectional survey design. Questions related to community violence exposure, sociodemographic aspects, perceptions of aggressive behavior, and perceptions of problem behavior were obtained during the surveys.

STUDY POPULATION, SAMPLING METHOD, AND SAMPLE SIZE

The research was conducted on adolescents in Makassar, Indonesia. Based on the data)2019(, South Sulawesi had one of the highest prevalence of violence compared to the other provinces in Indonesia. In consideration, this study used multi-stage purposive sampling. The purposive sampling was the first stage to determine the districts in Makassar. The districts were chosen of the area of living in low economic status based on the criteria; the urban-violence record, violence against women and children, and highest on receiving social welfare in Makassar from the Social Services office and Violence data from Integrated Services from the Center of Women's Empowerment and Child Protection in Makassar. Out of 15 districts in Makassar, we chose three districts for this study. The selected districts were Panakukkang, Tallo, and Ujung Pandang.

The second stage was convenience sampling schools and communities within the chosen districts. Research assistants selected schools or adolescent communities based on the inclusion and exclusion criteria. The inclusion criteria were the participants who are 15–19 years of age, have access to the internet, consented to participate in this study, and can use Google forms. The exclusion criteria were physically challenged)sight and motor impaired(and not mentally fit.

This study used the Cochran formula to find the sample size. The estimation of the sample was 325, including a 10% refusal rate. However, the data collection process was quite challenging to meet the sample size since the targeted participants were primarily underaged, and the precedented process to obtain consent was long. This study was able to gather preliminary surveys from 159 participants. Nonetheless, the study was meant to collect the data to meet the sample size.

DATA COLLECTION

As previously stated, adolescents in this study are in the group of 15-19 years of age, making most of the participants to be underaged. It is essential to collect the data based on this age group, considering that they are vulnerable to community violence exposure, while also finding that they are more than capable of getting better recollection and clearing their narrative on violence experience. Focusing on data collection, we approached schools and communities in the chosen area by bringing formal letters issued by the Education Office and Women Empowerment and Child Protection Office in Makassar. The process of obtaining permission was helped by Chulalongkorn University College of Public Health Sciences to provide necessary documents to the Official Authority in Makassar. Two research assistants were later coordinated with four enumerators about schools and communities. Before collecting the data, the informational notice of the study

and the informed consent was presented. There were two informed consents distributed in this study: parental or legal guardian consent to those under 18 years old and individual consent to fill out the questionnaire for those 18 and above. The approach to this study was face-to-face, with all data collected online using Google forms.

Those who gave the informed consent will be sent to the research assistants to continue the process. The research team acknowledged that questions about violence were sensitive, and the stigma around violence was still deep-rooted in the area. We provided the research assistants and experienced field enumerators with basic counseling skills and could handle the possible distress amongst respondents.

ASSESSMENT TOOL

The original questionnaire was developed by Richters and Saltzmann for the Survey of Community Violence Exposure)8(, constituting the set of 1. Sociodemographic, 2. Perceptions of Aggressive Behavior, and 3. Perceptions of Problem Behavior.

PERCEPTIONS OF AGGRESSIVE BEHAVIOR

The perceptions of aggressive behavior were measured using fantasy measures, with 17 questions, divided into three results: fantasy measure, proheroic fantasy, and prosocial fantasy. Items such as "Do you sometimes daydream about what would happen if you did badly in school even when this didn't happen?" or "When you are daydreaming, do you think about being a great astronaut, scientist, singer, or somebody like that who is very famous?" Items answered in the three subscales were scored on a three-point scale: no = 1, a little = 2, a lot = 3. A maximum score of three showed how often the respondent had fantasies about social behavior, and a minimum score of 1 demonstrates otherwise [9]. The higher the score indicates someone's perception of acquiring bad or good/hopeful thoughts. The cut-off point of each was decided by the median.

PERCEPTIONS OF PROBLEM BEHAVIOR / PERCEPTIONS OF PROBLEM BEHAVIOR PITTSBURGH YOUTH STUDY

The perceptions of problem behavior contained 15 items and measured willingness to engage in problem behavior .In the form of statements such as "Do you yell and argue to solve a conflict? or "Do you rebel against your parents? "Points were assigned 0 and 1 to each question, with a higher score indicating a willingness to engage in problem behavior (10). The cut-off point was decided by the results of the median.

SURVEY OF COMMUNITY VIOLENCE EXPOSURES (SECV)

The survey was adapted from a questionnaire previously published [11]. The Survey of Exposure to Community Violence (SEVC): Self–Report Version consisted of 54 items. Rosenthal and Wilson used their modified version for college students from various ethnicities (e.g., black, Latinx, Asian, white) [12]. Rosenthal and Wilson (2003) modified the version of the SECV among an ethnically diverse sample of 385 college students in New York City (aged 16–20 years). The modification demonstrated good internal consistency. This study focused on self-victimization questions and excluded questions on gun violence, considering that gun ownership is limited in Indonesia, with the lowest gun ownership rate being 0 to 100 people. It was necessary to adjust the questionnaire for the relevancy of the study setting. For the final version, there were 13 items in the questionnaire. The questionnaire also contained the frequency of exposure to being a victim of violence (e.g., "How many times have you been chased by gangs or individuals?), recording the event occurrence from never to almost every day.

Questions	Scale	Score
Being Chased		
Drug Activity	1–9	
Serious Accidents	Events Occurring More than Once	
Forced Entry	Never = 1,	
Threats	One time = 2,	
Arrests	Two times = 3,	
Slapping, hitting, and punching	Three or four times = 4,	9
Beatings and muggings	Five or six times = 5,	
Rape and Molestation	Seven or eight times = 6,	
Carrying Weapon	At least once a month = 7,	
Serious Wounding	At least once a week = 8,	
Knife Attacks	Almost every day = 9	
Other Types of Violence		
Total Given Score = 126 (9*13)		
Final Score = Total Score of Respondent / Total Given Score * 100		

VALIDITY AND RELIABILITY

The structured questionnaires were generated in English and reviewed by three experts from the College of Public Health Sciences, Chulalongkorn University. The questionnaire result was scored using the Item-Objective Congruence)IOC(Index, and the result of the index must be at least 0.5. A pilot test was conducted with 36 adolescents in Makassar. The reliability with Cronbach's Alpha coefficients was 0.731, resulting from perceiving the instrument's consistency. After the IOC, the questionnaire was translated to Indonesian)Bahasa(for the participants in Indonesia and back translated to English for content consistency.

STATISTICAL ANALYSIS

The analysis of this study used descriptive, bivariate, and multivariable analysis. The bivariate analysis used in this study was binary logistics regression for categorical data and Spearman correlation for continuous data. A p value < .05 was used to find the significance of the bivariate analysis between the dependent and each of the independent variables. Nonetheless, the study used p < .20 variables significance with no collinearity with others to run multivariable analysis after consideration of selecting a variable with p < .20 to include possible variables that were not significant to bivariate analysis. Multivariable analysis was conducted through multiple logistic regression, using binary logistics regression to determine which variables were strongly associated with the community violence exposure and which were the best predictor. The analysis runs on the SPSS 23.0 software program.

ETHICAL CONSIDERATION

Ethical approval for this study was obtained from the University of Muhammadiyah Jakarta Faculty of Medicine and Health Ethic Commission in Jakarta, Indonesia (No.075/PE/KE/FKK-UMJ/IV/2022).

RESULTS

UNIVARIATE ANALYSIS: SOCIODEMOGRAPHIC CHARACTERISTICS OF ADOLESCENTS

Table 1: Individual Characteristics of the Adolescents (*n* = 159)

Individual Characteristics	n (%)
Gender	
Male	58 (36.5)
Female	92 (57.9)
Rather Not Say	9 (5.7)
Age (M = 16.68, SD = 1.54)	
15	56 (35.2)
16	21 (13.2)
17	32 (20.1)
18	18 (11.3)
19	32 (20.1)
Grade	
Grade 8	17 (10.7)
Grade 9	34 (21.4)
Grade 10	8 (5.0)
Grade 11	39 (24.5)
University	7 (4.4)
Not in School	54 (34)
District	
Panakukkang	61 (38.4)
Tallo	41 (25.8)
Ujung Pandang	57 (35.8)

Table 1 shows the sociodemographic of the total sample of 159 participants. The sociodemographic table contains individual characteristics. The average age of the adolescents was 16 years old, with 57.9% of the participants being female. Only 5.7% of the participants would rather not say their gender, and 54 (24.5%) participants were not in school. Likewise, 38.4% of the participants lived in the Panakukkang districts, and almost 70% of adolescents lived with their parents.

Table 2: Family Characteristics of the Adolescents (*n* = 159)

Family Characteristics	n (%)
Living Arrangement	
Living with Parents	110 (69.2)
Living with One Parent	19 (11.9)
Living with Grandparents	23 (14.5)
Other	7 (4.4)
Father's Education	
Illiterate	6 (3.8)
Elementary School	25 (15.7)
Junior High School	20 (12.6)
Senior High School	59 (37.1)
University and Higher	49 (30.8)
Mother's Education	
Illiterate	11 (6.9)
Elementary School	26 (16.4)
Junior High School	1 (0.6)
Senior High School	56 (35.2)
University and Higher	43 (27.0)
Father's Occupation	
Unemployed	15 (9.4)
Blue Collar Sector	56 (35.2)
Government Officer/ Civil Servant	20 (12.6)
Entrepreneur and others	68 (42.8)
Mother's Occupation	

Family Characteristics	n (%)
Unemployed	29 (18.2)
Blue Collar Sector	2 (1.3)
Government Officer/ Civil Servant	15 (9.4)
Housewife and others	113 (71.1)
Family Income	
Above Minimum Wage	22 (13.8)
Minimum Wage	57 (35.8)
Below Minimum Wage	80 (50.3)

As shown in Table 2, 49 (30.8%) participants have fathers with university education and higher. For the mother's education, the mother's education with 35.2% of the participants was at the high school level. Unspecified work fields for fathers and mothers in this study covered most participants, with 42% and 71%, respectively. Eighty participants answered that their family income was under the minimum wage.

Table 3: Individual Perceptions of Education (n = 159)

Individual Perception of Education	n (%)
Easy to Understand Subject	
Neutral	97 (61.0)
Agree	51 (32.1)
Disagree	11 (6.9)
Adolescent's School GPA	
Above 80	81 (50.9)
Average 70	42 (26.4)
Below 60	8 (5.0)
Don't Know	28 (17.6)

The data presented in Table 3 shows that 81 (50.9) participants had a GPA above 80, albeit 97 (61.0) participants answered that understanding subjects in schools were neutral.

Table 4: Fantasy Measure and Perceptions of Problem Behavior Characteristics

Perception of Aggressive Behavior (n = 159) (%)	Median	IQR = (Q3–Q1)
Aggressive Fantasy	0.44 (0.28)	1.00–0.277
Lower than Median (n= 54) (34)		
Higher than Median (n = 159) (66)		
Active-Heroic Fantasy	0.55 (0.22)	1.00–0.333
Lower than Median (n = 71) (44.7)		
Higher than Median (n = 88) (55.3)		
Prosocial Fantasy	0.66 (0.20)	1.00–0.66
Lower than Median (n = 58) (36.5)		
Higher than Median (n = 101) (63.5)		
Perception of Problem Behavior	3.00 (4)	14
Lower than Median (n = 89) (56)		
Higher than Median (n = 70) (44)		

Note: interquartile range = IQR

Table 4 presents the perceptions of aggressive behavior measured by fantasy and perceptions of problem behavior. Fantasy measures contain aggressive, active, heroic, and prosocial fantasy, asking about good or bad social behavior. The higher median means the higher thoughts on good or bad social behavior. While the perceptions of aggressive behavior measured the thoughts on problem behavior. The higher the median, the higher the willingness to act on the problem behavior. The results are continuous with non-normally distributed, showing the median, maximum, and minimum presented in the table. The highest median perception of aggressive behavior in aggressive fantasy was 65% of adolescents having higher aggressive thoughts. For the perception of problem behavior, 56% of the participants were found to have low thoughts of bad behavior.

THE PREVALENCE OF SELF VICTIMIZATION COMMUNITY VIOLENCE EXPOSURE

Table 5: Self -Victimization of Community Violence Exposure (*n* = 159)

Dependent Variable (Self-Victimization) (Median = 11.965; IQR = 3.42) (max–min: 35.9–11.11)		
Items	Never (%)	Yes (%)
Being Chased	126)79.2(	33)20.8(
Drug Activity)Being asked to use(	147)92.5(	12)7.5(
Drug Activity)Being asked to sell(	149)93.7(	10)6.3(
Serious Injury	109)68.6(	50)31.4(
Forced Entry)While at Home(	134)84.3(	25)15.7(
Forced Entry)While Not at Home(	144)90.6(	15)9.4(
Threats	148)93.1(	11)6.9(
Arrests	154)96.9(	5)3.1(
Slapping, hitting, and punching	121)76.1(	38)23.9(
Knife Attacks	157)98.7(	2)1.3(
Beatings and muggings	147)92.5(	12)7.5(
Rape and Molestation	152)95.6(	7)4.4(
Other Types of Violence	150)94.3(	9)5.7(

Note: interquartile range = IQR

Table 5 presents the self-victimization of community violence exposure, with a median of 11.9)IQR(, maximum and minimum. A total of 13 questions were asked. The results varied from 9 to 1 and were scored on each item. The usage of scores was to carry out the analysis of bivariate and multivariable associations. The median was 11.97. Most of the participants answered the questions with "never." Albeit responding "never" to the questions of self-victimization, 20% answered to being a victim of being chased, serious injury, and slapping, hitting, and punching. Fifty)31%(participants responded that they had been a victim of serious injury, and 39)23.9%(were a victim of slapping, hitting, and punching. Moreover, 20.8% of the participants had been exposed to being chased.

Bivariate Analysis: Associated Factors of Self Victimization Against the Adolescents

Table 6: Correlation with Self-Victimization Community Violence Exposure

	Self-Victimization	Age	Fantasy Measures	Proheroic	Prosocial Fantasy	Perception of problem Behavior
Self-Victimization	1					
Age	0.029	1				
Aggressive Fantasy	0.359*	-0.144	1			
Active-heroic Fantasy	0.305*	-0.152	0.775	1		
Prosocial Fantasy	0.038	-0.006	0.496	0.643	1	
Perception of problem Behavior	0.434*	0.184	0.462	0.386	0.162	1

Note: *Significant at p = .01

Table 6 presents the continuous independent variables of self-victimization for adolescents. The results were also continuous variables. Fantasy measures, active, heroic fantasy, and perception of problem behavior were significant in correlating self-victimization. We decided that constant variables in this study must be carried out using the Spearman correlation, considering that every score and difference matters, and need to be counted. Nonetheless, all the results were found to have very weak correlations with self-victimization.

Bivariate Analysis: Associated Factors from Sociodemographic of Self-Victimization of Community Violence Against Adolescents

Table 7: Binary Logistics Regression of Sociodemographic towards Self-Victimization

Independent Variables (n = 159) Sociodemographic	ß = (95% CI)
Gender	
Male / Rather Not Say	Reference
Female	0.715 (0.360–1.420)
Districts	
Tallo	Reference
Panakukkang	3.454 (1.507–7.914)**
Ujung Pandang	5.288 (2.191–12.766)**
Grade	
8–10	Reference
11–12 and University	2.347 (1.032–5.336)**
Not in School	1.396 (0.640–3.048)
Living Arrangement	
Living with Parents	0.816 (0.401–1.662)
Living without Parents	Reference
Father's Education	
Illiterate	Reference
Basic Education	0.800 (0.140–4.570)
Higher Education	1.133 (0.187–6.876)
Mother's Education	
Illiterate	Reference
Basic Education	3.354 (0.921–12.220)*
Higher Education	3.635 (0.908–14.470)*
Father's Occupation	
Unemployed	Reference
Blue Collar / Informal	0.562 (0.159–1.989)
Government Officer	0.848 (0.191–3.770)
Others	0.625 (0.180–2.174)
Mother's Occupation	
Unemployed / Blue Collar	Reference
Government Officer/ Others	1.165 (0.519–2.615)
Family Income	
Above Minimum Wage	0.694 (0.235–2.052)
Minimum Wage	0.593 (0.209–1.678)
Below Minimum Wage	Reference
Easy to Understand Subject	
Easy	Reference
Neutral/ Not Easy	1.094 (0.548–2.184)
School's GPA	
Below 60	Reference
Average 70	0.542 (0.097–3.017)
Above 80	0.538 (0.102–2.833)
Don't Know	0.833 (0.138–5.032)

Note: **p < .05 * p < .20

Table 7 shows the 11 independent variables analyzed using binary logistics regression. Self-victimization was carried out in scores. To run the bivariate analysis using the multiple logistics regression, the continuous variables were changed into categorical by using the median as the cut-off point. The cut-off point of the median was 11.965, as presented in Table 5. With the category of higher than the median and lower than the median, in running the analysis, we found that the districts or area of living, grade, and mother's education were statistically significant with the self-victimization of community violence exposure (p < .05)

MULTIVARIABLE ANALYSIS: MULTIPLE LOGISTIC REGRESSION

Table 8: Final Model of Associated Factors towards Self-Victimization of Community Violence Exposure

Independent Variable	AOR (95% CI)
Fantasy Measure	6.517 (0.137, 309.0)
Perception of Problem Behavior	1.513 (1.227, 1.866)*
Districts	
Tallo District	Reference
Panakukkang	1.871 (0.660, 5.306)
Ujung Pandang	4.952 (1.569, 15.631)*
Grade	
8-10	Reference
11-12 and In University	1.484 (0.565, 3.901)
Not in School	0.428 (0.128, 1.428)
Mother's Education	
Illiterate	Reference
Basic Education	3.784 (0.538, 126.614)
Higher Education	2.356 (0.276, 20.077)

Notes: *p < .05; AOR: Adjusted Odds Ratio; CI: Confidence Interval

After choosing the significant independent variables analyzed by the bivariate analysis, using multiple logistics regression, binary logistic regression was performed to predict the probability of community violence exposure, using the Beta (ß) coefficients with p < .20. Further analysis of multiple logistics regression was used to show whether there was a strong relationship between two or more independent variables and dependent variables. As presented in Table 8, while adjusting for other independent variables, the perceptions of problem behavior and Ujung Pandang district were statistically significantly associated with self-victimization of community violence exposure.

DISCUSSION

COMMUNITY VIOLENCE TO SELF-VICTIMIZATION

The study found that most adolescents in Makassar, Indonesia, never have a victim of violence. The results cannot be overlooked. Participants in this study were adolescents. Where they must answer questions on violence, this was to be different and first-hand in Makassar, especially when it was given as a school-based approach. Most of the national survey scales in Indonesia were presented in a community setting. Trickett explained that the challenges of different definitions could create a separate construct from one study to another. This study used the Richters and Saltzman model, which was first introduced to whether or not adolescent was aware of the events, with the implications that constant violence exposure can cause stress)8(. While the findings in this study showed most families live under the minimum wage, it is worth noting that family income in Indonesia is not openly discussed. Their perception of their family income might be biased.

Area of living in relation to the exposure of community violence self-victimization to be significant has been found in previous studies. The findings of this study were consistent with Weist et al., who looked at the inner city of Baltimore, which has the most extreme violence cases in the United States)13(. Weist et al. found that low socioeconomic areas have a significantly higher cumulative violence rate. The adolescents from the Ujung Padang district were mainly not in school. This finding shows that the risk factors of having a lower education can play a role in someone's exposure to violence, either as a victim or as a witness.

Mother's education was significant in the self-victimization of adolescents in this study. Adolescents whose mothers had at least primary education and higher education are subjected to being the victim of violence. These results might be contradictory to other studies. However, the results might be due to adolescents' awareness of their situation within the impact of mothers being the primary caregiver in Indonesia. Even after earning an education, most mothers in Indonesia will choose to be stay-at-home moms. They have inner thoughts that they must be responsible for their children. Mothers who have better education will influence their children's perspectives.

The results showed that the adolescents in this study mostly lived in the presence of two parents, and living with family even during college was still common for most adolescents in Indonesia. A strong core of family values for Indonesian adolescents are still presented in Indonesian family household. These findings have supported the idea that family values will lessen exposure to community violence. As stated in the US Department of Health and Services report, family intervention against violence suggests a good direction that exerts the risk of influencing part of the disadvantaged communities)14(.

While the limitation of the study was that the sample size was not met due to the sensitive topic, and the sensitive questions being asked also affected the study results. The association in the study can still be found towards the perception of aggressive fantasies, perception of problem behavior, towards adolescent violence exposure to self-victimization. These findings are supported by Marsee and Fricks, showing that aggressive behavior can form an individual's perspective and social functioning)15(. In addition, Bellmore et al. supported the study by explaining that aggressive thoughts and attitudes to hypothetical scenarios can be connected to aggressive behavior. The present study does not find gender significantly related to violence exposure)16(. While still considered sensitive, protecting children and adolescents in Makassar from violence seemed more attentive. This study has shown that no matter how non-extreme the exposure to violence, the more significant long-term consequences still exist.

CONCLUSION

This study has shown the association between exposure to community violence, self-victimization, area of living, and perception of problem behavior. Increased awareness of violence is needed because the effects of fewer extreme events cannot be underestimated, even to the lower extreme of violence.

RECOMMENDATIONS

The research has provided new insights into measuring the association between community violence exposure and other measurements. In addition, this study tries to add thoughts and perspectives on how adolescents carry out their lives and how they interact with their environments. The study has shown that self-victimization of community violence is related to their perception, good or bad. One of the adolescents' strengths is their resilience toward hardship and challenges [17]. As a result of these findings, preventative measures and recommendations for future programming will be identified based on adolescent-centered and survivor-centered approaches. The followings are some of the recommendations for program implementation:

1. The enforcement of the perpetrators of the violence in the community should involve the community more, especially the victim or survivor of violence.
2. Having a program caters to being an agent of change and being a model student to end violence using a school-based approach.
3. Supporting parents to be more involved and develop positive-child interactions, especially with those at-risk youth, observing changes in their behavior and attention.
4. Addressing the restrictive and harmful values, such as gender stereotypes, and raising their concern about violence around the environment of adolescent life.
5. Education and social-life skills for the survivors of violence, addressing trauma and discussing healthy behavior, and support for adolescents.

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GENDER IDENTITY, SEXUAL ORIENTATION, AND PATTERN OF SEXUAL BEHAVIORS OF LGBTIQAN+ IN THAILAND

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ABSTRACT:

Background: Sexual behavior matters to sexual and reproductive health, especially the prevention and control of transmission of sexually contracted infection, including STIs, HIV, and HVB and HVC. The pattern of sexual behaviors among people with sexual diversity had been under periodical surveillance. Moreover, the issues are not well examined in some groups due to the assumptions that they may be at no or lower risk of such infections, for example, lesbian cisgender.

Objective: This cross-sectional study aimed to describe the sexual orientation and gender identity (SOGI) of LGBTIQAN+ and their pattern of sexual behaviors.

Methodology: This analysis employed the data of an online survey conducted from February to March 2022 and includes 220 samples of LGBTIQAN+ who reported being sexually active during the past 12 months. The chi-square test statistic is used to evaluate whether there is an association between pattern of sexual behaviors and sexual orientation and gender identity (SOGI).

Results: The mean age of these samples is 33 years old (range 18-55 years old), 47.7% living in Bangkok, and 50% graduated with a Bachelor's degree. Gay cisgender men, transgender men, and transgender women engaged in all patterns of sexual behavior, while 100% of lesbian cisgender women were doing only oral sex and non-penetrative sex. Transgender men also had penetrative vaginal and oral sex (16.67%), and transgender women had penetrative vaginal and oral sex (16.67%). A larger proportion of gay cisgender men and transgender women reported having penetrative anal and oral sex than other SOGI. A chi-square test of independence showed that there was a significant association between self-reported SOGI and pattern of sexual behaviors ($X2$ (8, $N = 220$) = 149.399, $p = .000$)

Conclusion: The results indicate that most lesbian cisgender women engaged in sex are least at risk of HIV compared to others, but oral and non-penetrative sex may pose some risk to other STIs. Transgender men and women need prevention for their vaginal and anal penetrative sex behavior, and interventions should address this behavior to provide comprehensive and consistent services to these population groups.

Keywords: *Sexual orientation and gender identity (SOGI), LGBTIQAN+, sexual behavior, Thailand*

INTRODUCTION

Sexual behavior is important for sexual and reproductive health, particularly the prevention and control of sexually transmitted infections such as STIs, HIV, and HVB and HVC. The pattern of sexual behaviors among people with sexual diversity had been monitored on a regular basis. Furthermore, some groups, such as lesbian cisgender people, are understudied because it is assumed that they are at no or low risk of contracting such infections.

Sexual act contact, particularly vaginal and anal sex, is one of the HIV transmission modes. Previous research has found that people with sexual diversity are more vulnerable to HIV because of their sexual behaviors. These are mostly gay men or men who have sex with other men (MSM). The majority of existing research has concentrated on transgender women's communities [(1)]. Transgender men, according to studies, have a low rate of condom use for their last sex and a high level of engaged sexual activities with a high risk of HIV [(2)].
These factors are correlated with greater HIV risk, but transgender men and other LGBTIQAN+ groups have even less knowledge about the HIV risks associated with their protected sexual behaviors. It appears to be so because most studies focus on the key HIV population identified by UNAIDS, which really is female sex workers, men who have sex with men (MSM), and injecting drug users [(3)]. Then transgender men and other LGBTIQAN+ groups might very well face a high risk for HIV due to the lack of information about their sexuality, a lack of education, difficulty having to meet their requirements for health services, and social connotations [(4)].

In regards to sexual behaviors, amongst those who identified as heterosexual females, 17 percent reported experiencing sex with a woman [(5)]. As a direct consequence of the variety of possible practices and sexual behaviors, and some cases which are not specific to gender identities, research on sexual behaviors is required to better understand STD transmission, especially HIV transmission.

There have been few studies on other LGBTIQAN+ minorities such as queer, intersex, asexual, nonbinary, and others. This could have been due to the difficulty in trying to distinguish the genders or to their sexual fluidity [(6)].

Previous studies used various definitions to determine LBTIQAN+ sexual orientation. Some study continues to use the binary system to identify sexual orientation by specifying homosexual or heterosexual [(2)]. While others use Sexual Orientation and Gender Identity (SOGI) to identify sexual orientation, which means that LBTIQAN+ orientations such as bisexual, queer, pansexual, and unsure can border explain (1-7).
These are the explanations why more study on HIV risks for transgender men and other LGBTIQAN+ groups are considered necessary [(2)].

However, irrespectively of whether it is research or activity on an LGBTIQAN+ health program, it may not yet reflect the specific situation of the small group in all groups of people with gender diversity until becoming a marginalized LGBTIQAN+ group [(8)]. For example, the Centers for Disease Control and Prevention in the United States uses sexual behavior as a framework for defining health issues. There is also a clear idea in the binary system of categorizing the dataset into categories for gay and bisexual men, lesbian and bisexual women, and transgender people, with HIV, sexually transmitted disease, as the health issue in each category.

As explained previously, concerning sexual practices in transmen and other LGBTQIAN+ is limited. The existing body of knowledge primarily focuses on gay men, MSM, and transwomen since these are the groups most at risk; however, there are gaps in reproductive health and sexual health policies for transmen and other LGBTQIAN+. With this gap, these groups are also at risk of contracting HIV though the unsafe sexual practices; causes could include a lack of awareness regarding sexually transmitted diseases and the misapprehension that they are risk-free. As a consequence, the primary objective of this research is to provide quantitative evidence on the risks related to sexual practices among LGBTIQAN+ in Thailand, such that the information can then be used to inform reproductive health and sexual health policies to further reduce future HIV cases in all LGBTQIAN+ groups.
The objective of this cross-sectional study was to describe LGBTIQAN+ sexual orientation and gender identity (SOGI), as well as their sexual behavior patterns.

OPERATIONAL DEFINITION

LGBTQIAN+: A colloquial term for the lesbian, gay, bisexual, transgender, queer, intersex, asexual, and non-binary communities. When used together, this term frequently refers to the entire community of queer- and trans-spectrum identities, not just those listed [9].

Gender Identity: Each person's deeply felt internal and individual experience of gender, which may or may not correspond with the sex assigned at birth, including personal sense of body (which may include, if freely chosen, modification of bodily appearance or function by medical, surgical, or other means) and other expressions of gender, such as dress, speech, and mannerisms [10].

Sexual Orientation: A person's ability to have profound emotional, good - natured, and sexual attraction to, and intimate and sexual relations with, people of a different gender, the same gender, or more than one gender [10].

METHODOLOGY

This is cross-sectional research that involves secondary data from the March 2022 research project "Online survey to explore sexual diversity and gender identity, health and sexual behaviors, and health service needs of people with sexual diversity in Thailand." The sample size has been 220 people who responded "YES" to the question "Have you had sex within the last 12 months?" out of a total of 323 participants who are currently living in Thailand and answer the questioner in Thai through their own.

MEASURE OF VARIABLES

Independent variables

Biological sex of respondents was collected from the question “Please identify your biological sex.” And in the answer list provide 3 choices as “’Female”, “Male” and “Intersex while the participants can select only single answer for this question. The divided the answer into three groups follow by the participant self-reported. These groups will be coded 1 for Female, 2 for Male, and 3 for Intersex.

Residency of the participants was collected from the question “What is your currently living province?”. The questionnaire provides all list of Thailand’s provinces and participants can selected single answer for this question. From the answer can divided into two groups 1 for those who answer that they are currently living in Bangkok and 2 for those who answer that they are currently living in other provinces.

Education of the participants was collected from 2 questions, “What is your currently education level? The answer list provides 6 answers for this question as 1) Primary School, 2) Junior High School, 3) High School 4) Vocational School, 5) Bachelor Degree and 6) Higher than Bachelor degree.

The second question was “What is your highest education level?” the answer list provides 7 answers as 1) Not any, 2) Primary School, 3) Junior High School, 4) High School 5) Vocational School, 6) Bachelor Degree and 7) Higher than Bachelor degree. For these two questions the participants can selected single answer for each question, then from all answer was divided into three categories. 1) Lower than Bachelor, 2) Bachelor, and 3) Higher than Bachelor. These groups will be coded 1 for those who reported that their highest education was less than a Bachelor's degree, 2 for those who have graduated with a Bachelor's degree, and 3 for those who hold an education level higher than a Bachelor's degree.

Participants who are currently studying in Bachelor and lower will be classified as "lower than Bachelor," while those who are currently studying posted graduated will be classified as "Bachelor."

Occupations were divided into four groups follow the answer from the question “What is your occupation at the moment?” the answer listed that provided were 1) Student, 2) Government employed, 3) Private or Business employed, 4) Merchants, 5) Own Business, 6) Freelance, 7) Daily Wage, 8) No income

The answer was categorized into 3 group, the first one for those who reported working in the government sector, the second for those who reported working in the private sector. The third group includes those who say they work for themselves, as merchants or freelancers, and the final group includes those who are studying or working in another capacity. These categories will be coded as 1 for government employees, 2 for private employees, 3 for self-employed individuals, and 4 for others.

Gender identities were divided into five groups. Gay cisgender men are biological men who report having an attraction to men and/or identify as gay or men. Lesbian cisgender women are biological females who report having feelings for women and/or identifying as

a tomboy, lady, or lesbian. Transgender men are those who have female or intersex biological sex and identify as men or transgender men. Some of them may be sexually attracted to women, men, or any gender identity. For this study, transgender women are those who were born male or intersex and nowadays identify as women or transgender women and might even be sexually attracted to women, men, or any gender identity. Other SOGI are defined differently relating to gender identity, including such queer, non-binary, asexual, and bisexual. Their sexual attraction would have been to either sexes or genders [10]. These classifications will be coded as 1 for Gay cisgender men, 2 for Lesbian cisgender women, 3 for Transgender men, 4 for Transgender women, and 5 for other gender identities.

Dependent variable

Sexual behaviors patterns of participants were collected from the question "Please identify for your sexual pattern in the past 12 months?" The participants can select multiple answer that provides from the list as 1) Perform Oral sex, 2) Receive Oral sex, 3) Penetrative penis via vagina sex, 4) Penetrative penis via anal sex, 5) non-Penetrative sex and 6) Using others sexual equipment. The answers were divided into four groups by selected coding 1 for those who reported that they have Oral, non-penetrative sex and using sexual equipment, coding 2 for those who have penetrative vaginal and Oral sex, coding 3 for those who have penetrative Anal and Oral sex.

Statistical analysis

The univariate analysis describes the frequency distribution of the dependent and independent variables. The result of the univariate analysis is presented as percentages)percent(for the categorical variables, while the numeric variables are presented using mean and standard deviation)SD(. The factors associated with sexual practice are presented using proportion with a 95 percent confidence interval)CI(to provide an estimation range.

The bivariate analysis investigates the relationship between each independent variable and protective sexual practice as the dependent variable. In this study, cross-tabulation with Chi-square analysis was used. The bivariate analysis results are presented with p-values to determine the level of significance. If the p-value is less than 0.05, it means that there is a statistically significant relationship between the independent variables and sexual behaviors pattern.

RESULT

Among the 220 samples, 45.91% was female at birth and 46.36% was male at birth. The remaining 7.73% reported the intersex as their biological sex. As the online survey was distributed to the community of intersex people in Thailand, so the number of respondents reporting themselves being intersex at birth was reliable. Intersex people are individuals born with any of several sexual characteristics, including Chromosome patterns, gonad or genital that "do not fit typical binary notions of male or female bodies" [11]. Unfortunately, the survey did not have further questions to explore about their intersexuality.

For their self-reported gender identity, it had 13 identities that the participants reported, the 3 majority are the group of participants who identify themselves as gay)25%(, transgender women)24.55%(and transgender men)20.91%(while the others gender identity are tomboy)11.36%(, male)7.73%(, agender)2.27%(, lady)2.73%(, women love women)1.82%(, non-binary)0.91%(, queer)0.91%(, female)0.91%(, bisexual)0.45%(, and others)0.45%(.

In general, majority of the samples are young people with 44.09% of them samples were under group of 25 – 34 years old. The survey eligibility criteria for age were 18 and above. The mean age for the samples was 33 years old, SD = 8.42 with the oldest was 55 years old.

For residency of the participants, 47.73% of participants reported they are currently living in Bangkok, while the rest were those who living in other provinces throughout the country. This survey got participants from 46 provinces and from every region.

The samples are well-educated. More than half of the participants hold Bachelor degree)50.45%(and higher)15.91%(. Almost half of the participants reported that they work under business employed)47.27%(

Regarding the sexual orientation and gender identity)SOGI(, the variable was reconstructed by combining the questions that asked the respondents to 'describe their current gender identity' and 'identify their current sexual attraction'. Considering the answer on gender identity and sexual attraction and also their biological sex, this study groups the samples into five categories of SOGI, including gay cisgender men, lesbian cisgender women, transgender men, transgender women, and other SOGI. The 24.55% in the gay cisgender men are those biological male reporting having attraction with men and/or identifying themselves as gay or men. Similarly, the 15% of samples who are lesbian cisgender women are biological female reporting having attraction with

women and/or identifying themselves as tomboy, lady, and lesbian.

In this study, being transgender is self-reported regardless whether the sex reassignment was completed or not. Among the samples, 27.27% were transgender men and 24.55% were transgender women. The transgender men are those with female or intersex as their biological sex and have identify themselves as men or transgender men. Some of them might attract sexually to women, men or any gender identity. Similarly, the transgender women group for this study are those who were born as male or intersex, and currently identifying themselves as women or transgender women and might attract to sexually to women, men or any gender identity.

Last but not least, the minority of 8.64% of the samples were categorized as other SOGI due to their gender identity are differently defined. They include queer, non-binary, asexual and bisexual. Their sexual attraction might be to any sex or gender.

Sexual pattern behavior from this study shows that 46.58% of the participants engaged in oral and non-penetrative sex only, 42.01% engaged in penetrative anal and oral sex and the last 11.42% of the participants engaged in penetrative vaginal and oral sex.

While looking in more details about self-reported SOGI and sexual behavior pattern, the results show that 11.11% of gay cisgender men engage in only oral and non-penetrative sex, 9.26% engage in penetrative vagina and oral sex and 79.63% engage in penetrative anal and oral sex. 100 % of Lesbian cisgender women in this study engaged only in oral and non-penetrative sex.

For transgender men 83.33% of the participants in this group engaged in oral and non-penetrative sex and 16.67% of them engaged in penetrative vagina and oral sex. There are none of the participant engaged in anal sex for this participants group.

In group of transgender women 7.41% of the participants engaged in non-penetrative and oral sex, 16.67% engaged in penetrative vagina and oral sex and the majority of this group are those who engaged in penetrative anal and oral sex (75.93%). A chi-square test of independence revealed a significant relationship between self-reported SOGI and sexual behavior pattern ($X2$ (8, $N = 220$) = 149.399, $p = .000$))

Table 1: Descriptive Statistics for Demographic Variables (N = 220)

Variables	Frequency	Percent
Female	101	45.91
Male	102	46.36
Intersex	17	7.73
Age		
18-24	36	16.36
25-34	97	44.09
0ver 35	87	39.55
Mean (SD)	33.20 (8.42)	
Min (Max)	18 (55)	
Residency		
Bangkok	105	47.73
Others Province	115	52.27
Education		
Lower than Bachelor	74	33.64
Bachelor	111	50.45
Higher than Bachelor	35	15.91
Occupation		
Government employ	24	10.91
Private employ	104	47.27
Self-Employ	64	29.09
Others	28	12.73

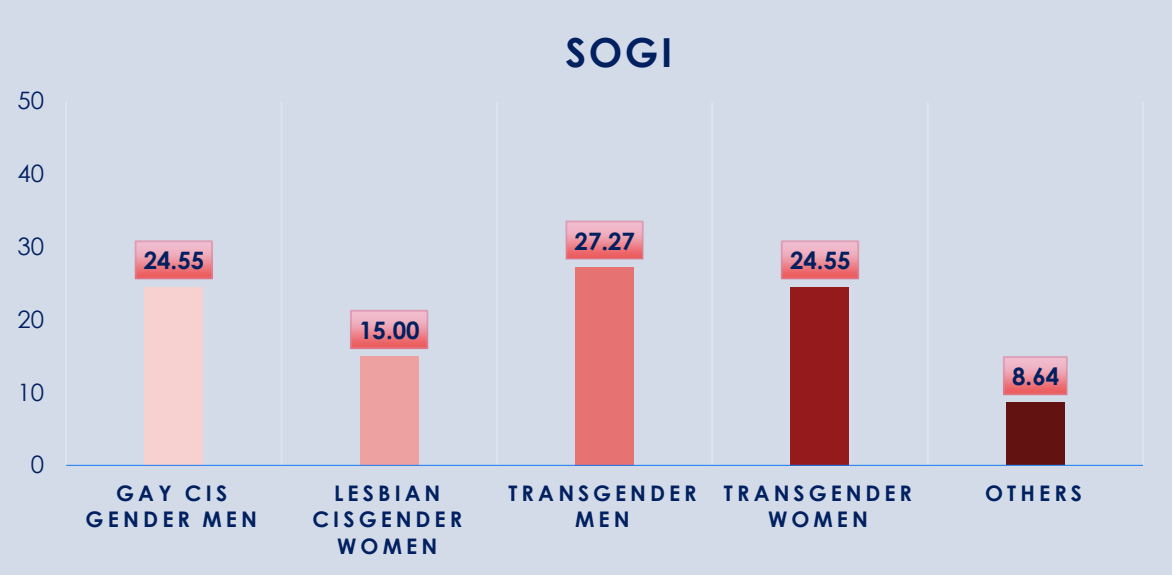

Figure 1: percentage of Participants Sexual Orientation and Gender Identity group.

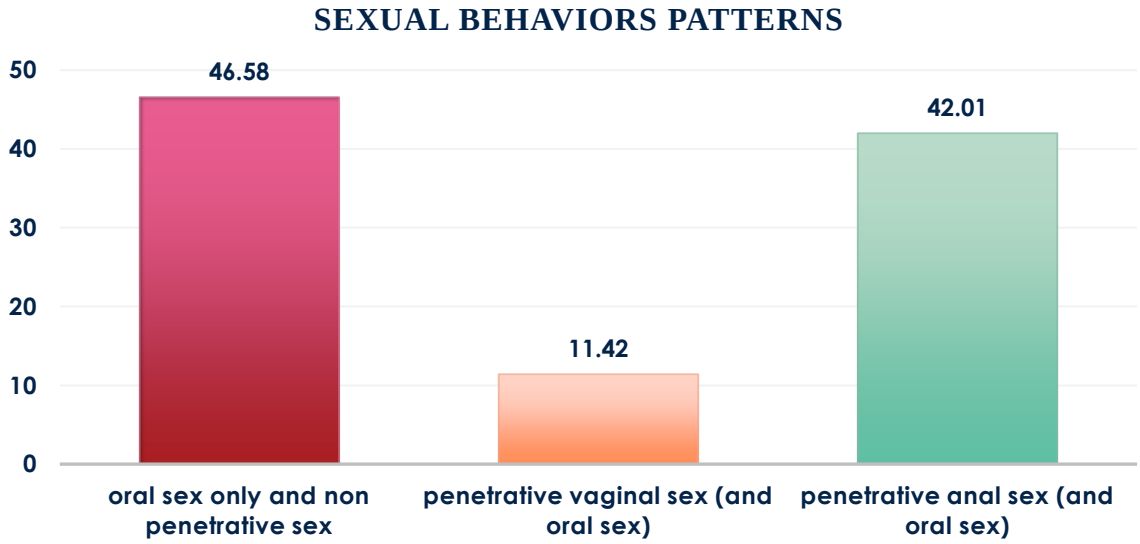

Figure 2: Percentage of Participants Sexual behavior pattern group

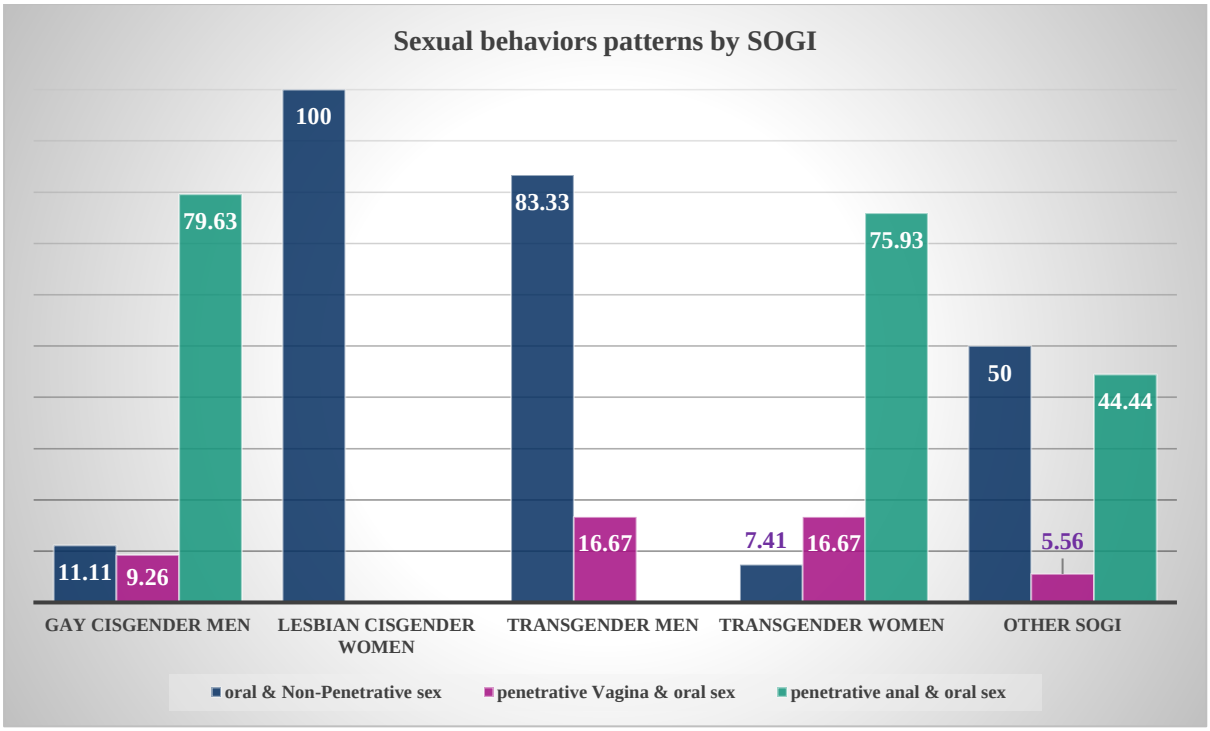

Figure 3: Percentage of Participants sexual behavior patterns by SOGI

Table 2: Relationship between self-reported SOGI and sexual behavior pattern

Sexual Behaviors Patterns	oral & non-Penetrative sex	penetrative Vagina & oral sex	penetrative anal & oral sex	Total
SOGI	Frequency (Percent)			
Gay cisgender men	6 (11.11)	5 (9.26)	43 (79.63)	54 (100)
Lesbian cisgender women	33 (100)	0.00	0.00	33 (100)
Transgender men	50 (83.33)	10 (16.67)	0.00	60 (100)
Transgender women	4 (7.41)	9 (16.67)	41 (75.93)	54 (100)
Other SOGI	9 (50)	2 (5.56)	8 (44.44)	18 (100)
Total	102 (46.58)	26 (11.42)	92 (42.01)	220 (100)

Pearson $chi2^{(8)} = 149.399$; $p = 0.000$

DISCUSSION

LGBTIQAN+ communities, this research may only reach participants who have internet access and participate in the communities. This is probably one of the reasons why the majority of participants are Bangkok residents with a bachelor's degree. For another reason, LGBTIQAN+ between the ages of 18 and 24 may be inaccessible to the LGBTIQAN+ community, resulting in fewer respondents in this age range than in other age groups. This study may not have access to some LGBTIQAN+ who did not connect with the community where the questionnaire link was posted. Due to small size of participants in this study the result might not represent for the whole LGBTIQAN+ community in Thailand.

In the research by Pinto, it is found that sexual behaviors significantly correlate with HIV transmission within the lesbian population more than the correlation between sexual orientation and HIV transmission. This is because 66% of those who identified as lesbians also have sexual relations with men. The research also found that women who both have sex with men and women have more risk than women who reported that they only have sex with men [(12)]. Moreover, the research by Lindley also highlights the significant data on other sexually transmitted diseases (STD) for women who reported only having sex with women [(13)].

To summarize, this study found that sexual orientation and gender identity influence different sexual behavior patterns. Gay cisgender men and transgender women engage in anal sex as well as other sexual behaviors. If they do not have any protection, their sexual behavior puts them at the highest risk for HIV and STDs. Meanwhile, lesbian cisgender women who only engage in oral sex may be at low or no risk of HIV, but oral and non-penetrative sex may pose some risk of other STDs [13].

In this study the result shows that 100% of the participants identified themselves as lesbian cisgender women, and 83.33% of transgender men performed only oral sex. It may cause by small sample size of this study. Ether oral sex has a low risk for HIV, but there is evidence of the highest risk for syphilis, chlamydia, and gonorrhea, which can be transmitted through oral sex [14].

It is important to note that sex, sexuality, and gender diverse groups are not mutually exclusive, nor are they homogeneous. People who are transgender or gender diverse can have any sexual orientation, and people who are lesbian, gay, bisexual, or intersex can have fluid or transgender identities. Many people in this diverse group share the experience of being a minority population, having faced discrimination and stigma throughout their lives. It is critical to recognize these vulnerabilities and recognize where diversity exists within diversity. Some of them may have lived in the period that sexual orientation and different gender identity were considered to be mental illnesses or criminal offences, thus they may have learned to hide their sexual and/or gender identity.

CONCLUSION

The average age of participants is 33 years old (range 18-55 years old), 47.7% live in Bangkok, 50% have a Bachelor's degree and 47.27 % are currently working under business employ. Gay cisgender men, transgender women, and others SOGI engaged in all patterns of sexual behavior, whereas lesbian cisgender women engaged in only oral and non-penetrative sex, while 16.67% of Transgender men had penetrative vaginal sex and 83.33% had oral and non-penetrative sex. A chi-square test of independence revealed a significant relationship between self-reported SOGI and sexual behavior pattern ($X2$ (8, N = 220) = 149.399, p =.000))

The findings of this study show that transgender men engage in oral and penetrative vaginal sex. However, it is unclear how many of this sample were having vaginal sex with their new male genitals.

Furthermore, due to oral sex is one of the most common sexual practices among LGBTIQAN+ in this study, future research should increase clarity on sexual practices behavior by raising clear questions about it, such as whether oral sex is contact between mouth-to-vagina, mouth-to-penis, or mouth-to-anal. In the case of other penetrative sex, to provide a clearer picture of this research, we should identify who is a performer or receiver regardless of gender identity (whether transgender male or transgender female).

The important thing to remember is that the sexual behavior of other SOGI, such as non-binary, agender, and queer people, can be more complicated. They engage in all types of sexual behavior. As a result of the variety of sexual practices and sexual behaviors, and some cases that are not specific to gender identities, research on sexual behaviors is required to fully understand STD transmission, particularly HIV transmission.

LGBTIQAN+ sexual behaviors may include vaginal and/or anal sex with non-transgender women, heterosexual men and other transgender persons [15-16]. The male partners of post-transition FTMs were more likely to be gay, bisexual or homosexual than heterosexual men. And sex with MSM could contribute to the high prevalence of HIV and STIs among FTMs in these communities [17].

Among those who identified as heterosexual females, 17 % reported having sex with a woman [5]. As a result of the variety of sexual practices and sexual behaviors, and some cases that are not specific to gender identities, research on sexual behaviors is required to fully understand STD transmission, particularly HIV transmission [18].

RECOMMENDATIONS

Health service provider perspectives

Health Services center may improve the environment of gender health clinics and encourage the LGBTIQAN+ to seek health advice without hesitation and save them from the harmful effects of avoiding medical treatment at a legitimate medical establishment by hiring educated and trained medics who are experienced in treating LGBTIQAN+ and are free from stereotypes and prejudices against them.

Dealing LGBTIQAN+ wisely by talking to them appropriately and not assuming anything about them without politely asking them about how they want to

be addressed and their preferred gender. Reforming the data collection process to allow transgender people pen down their biological physical conditions as well as their preferred gender to improve the quality of treatment. Taking any incidence of misconduct and derogatory behavior towards LGBTIQAN+ seriously and making sure that the offender gets punished for their mistake to gain the trust of community.

Information on transgender status in health surveillance. Standardized measures of LGBTIQAN+ status should be included in local and regional HIV and STI surveillance programs. Efforts should be made to develop a survey that can capture transgender identities in different languages, cultural context and geographical area.

Validate and standardize assessments of sexual risk behavior. Sexual risk behavior is inconsistently measured and conducted in HIV and STI research among LGBTIQAN+. This gap must be filled by creating a validated and standardized sex-specific risk assessment. It is recognized and tested cognitively in both transgender and non-transgender populations. Such assessments should inquire about specific sexual risk behaviors with male, female, and transgender partners, as well as the anatomy of participants and their partners' sexual identities.

SOGI and Sexual behaviors pattern

Sex and gender are widely acknowledged as the most important social determinants of health and well-being in a variety of settings and contexts)19(. Sex refers to biological differences between men, women, and transgender people, such as genetics, hormones, and secondary sexual characteristics, whereas gender anatomy refers to the cultural value of a pattern of behavior, experience, and personality identified as male or female. It is a multidimensional structure that is culturally dependent. Gender identity)internal sense of being male, female, or another gender(, sexual behavior)how a person expresses their gender identity through appearance and gestures(, and gender beliefs)cognitive beliefs about gender sex role consistency and sexualization(are all factors to consider)20(. The role of each gender-related dimension in the risk of HIV and STIs should be considered in LGBTIQAN+ health research. This is associated with the biological sex-related pathways that lead to HIV and STDs.

The last point is recommended for research in the future it should add qualitative method such as deep interview for more understanding about sexual behaviors pattern that may have differently between Thailand context and other countries and including more data collection for protective method would be more beneficially for health policy and intervention.

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FACTORS ASSOCIATED WITH REPRODUCTIVE HEALTH AGENCY AMONG INDONESIAN YOUNG WOMEN AGE 15-24

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ABSTRACT

Reproductive health agency is the ability to choose contraception and healthcare for women, and agency is essential for their health. Women may be unable to access healthcare services if they are unaware of their reproductive health rights. This may prevent them from exercising their agency in reproductive health decision-making. The aim of this study was to determine the factors associated with reproductive health agency among young women in Indonesia. This study utilized secondary data from the 2017 Indonesia Demographic and Health Survey (IDHS) from a total of 3,524 currently married women age 15-24 years. Women who decided independently or jointly with their husband about contraception and healthcare utilization were classified as having higher reproductive health agency, while those who did not were classified as having lower reproductive health agency. Descriptive statistics, Chi-square (χ^2) test, and binary logistic regression were employed for data analysis. The study found that 53.0% of Indonesian young women had lower agency in the family. Binary logistic regression showed that women with one or more children (Adjusted Odds Ratio [AOR] 32.6; p<0.001; 95% confidence interval [CI] 23.9-44.7), living in a nuclear family (AOR 1.2; p<0.05; 95% CI 1.0-1.5), living in Bali (AOR 3.5; p<0.01; 95% CI 1.5-8.4), living in Java (AOR 2.6, p<0.001, 95% CI 1.5-4.6), living in Kalimantan (AOR 2.1, p<0.01, 95% CI 1.1-3.7), living in the Sulawesi region (AOR 1.7; p<0.05; 95% CI 1.0-3.0), having a narrow age-gap with their husband (AOR 1.2; p<0.05; 95% CI 1.0-1.4), and being employed (AOR 1.2; p<0.01; 95% CI 1.0-1.5) were more likely to have higher reproductive health agency than those who had no children, lived in an extended family, lived in Western Papua, had a substantial age-gap with their husband, and were unemployed.

Keywords: *Reproductive health decision-making, Women's agency, Contraception, Healthcare services*

INTRODUCTION

As of 2000, maternal mortality around the world had been decreasing, however at a slower rate than anticipated when the Millennium Development Goals (MDGs) were established. Furthermore, the maternal morbidity burden remained high. In 2015, the five most common direct obstetric complications (eclampsia, pre-eclampsia, postpartum hemorrhage, puerperal infection, and abortion) caused an estimated 27 million morbidity episodes. These trends are still of concern, especially when women have more than one of these complications of pregnancy or childbirth. Indeed, the Sustainable Development Goals (SDGs), Global Strategy for Women's, Children's, and Adolescents' Health (2016-2030), and framework for the WHO Maternal Morbidity Working Group all include a woman-centered approach to health and empowerment.

Over the last decade, women's sexual and reproductive health (SRH) empowerment has become a centerpiece of reproductive health research and programs. Notable frameworks have been developed, such as those established by the Bill & Melinda Gates Foundation (BMGF), the International Center for Research on Women (ICRW), and CARE International, which identify SRH empowerment in broad terms. All these frameworks emphasize SRH as a critical indicator of women's life prospects, while also emphasizing power structures at the social and family levels that prevent women from deciding, expressing, and acting on their SRH priorities. The implementation of these frameworks portrays women's ability to dictate their sexual and reproductive preferences, such as contraceptive use, and healthcare preferences [(1)].

Women's reproductive health agency includes self-determination in their sex life, the ability to prevent unwanted pregnancy, the ability to take care of themselves during pregnancy, and the ability to control their reproductive health, whether it is pregnancy-specific or non-pregnancy-specific [(2)]. Women have the right to choose the number of children they have, the timing of their pregnancies, and to participate in household decision-making. When women's rights are violated, they may encounter several adverse health outcomes.

The poor implementation of family planning has become a key contributor to unintended pregnancy and unsafe abortion, both of which can lead to maternal morbidity and mortality [(3)]. According to the 2017 IDHS, the unmet need for access to contraception was 10.6% in Indonesia [(4)], and that is short of the reduction target of 9.9% as specified in the 2015-19 National Medium-Term Development Plan. In addition, the proportion of women who received their first antenatal care (ANC) visit before the fourth month of pregnancy was 82% in 2017 [(4)]. That result exceeded the target of 76% in 2017 [(5)]. Nevertheless, between 2007 and 2017, the proportion of Indonesian women who received two or more tetanus toxoid injections throughout their latest pregnancy fell from 50% to 35% [(4)].

Despite the development of family planning programs, many countries continue to limit women's ability to use contraception and seek the healthcare they need. Women are subordinated to patriarchal norms, and they are left further behind with regard to access to resources, freedom of movement, and economic self-determination [(6)]. As an example, the 1974 Indonesian Marriage Law assumes that the husband is the primary breadwinner in the family, and the wife is a secondary provider [(7)].

Nevertheless, women's reproductive health agency in the household increases as they grow older. A study conducted in Bale Zone suggested that women age 35-39 had greater autonomy to control their maternal and child health (MCH) care compared to women under age 20 years [(8)]. As a result, younger women are more likely to have less agency. To avoid bias in comparing the agency of women in different age cohorts, the analysis in this study was limited to only younger women, since they are already more likely to have less agency in the family in the Indonesian socio-cultural context.

Because there haven't been many studies on women's agency in Indonesia, the situation and patterns in this vast country are limited. Indonesia's diverse cultural tradition illustrates how women's agency is expressed in the household. Indonesia's five-year strategic plan attempted to improve women's empowerment in order for them to gain access to essential services and job opportunities. However, the attempt to enhance women's agency may only be a token gesture. The 1974 marriage law stated that the husband is to assume the role of head of household while the wife's role is to take care of the family [(7)]. This gender bias is embedded in the Indonesian family structure. Women are often expected to do housework and care for their husband and children. According to Aisyah and Parker [(9)], Indonesian women, particularly working women, carry a double burden in the family. In addition, the absence of more studies of women's agency could be attributed to the patriarchal norms that are prevalent in some Indonesian ethnic groups [(10)]. Patrilineal culture reinforces the father's power which manifests in the inferior status of women and the expectation that a daughter would go to live with her husband's family immediately after marriage [(10, 11)].

Only recently have several research studies addressed women's reproductive health agency in Indonesia [(10, 12-14)]. However, those studies did not assess agency in terms of the healthcare utilization [(15)], and agency is not

treated as the dependent variable [14]. Hence, this study measured reproductive health agency, including women's family planning decision-making, and healthcare utilization as the outcome variable.

Agency is not static; it is flexible, and can vary depending on the characteristics of the individual and the context. Socio-demographic characteristics (e.g., age of marriage, parity, domicile, religion, region of residence, etc.) and socioeconomic characteristics (e.g., education, employment status) are significant variables that can lead to significant change in a woman's agency, and they can form the basis for shaping the bargaining power of the woman within a marriage [8, 16-18]. The advancement of women's socioeconomic and socio-demographic status combined with the responsibilities of motherhood, allows them to expand their reproductive health agency in such negotiation processes [17-20]. More specifically, women may propose that they require more reproductive health rights in order to complete their domestic obligations, maintain a highly functional home life, and provide proper care for dependent children. Hence, the purpose of this study was to explore the determinants of women's agency in relation to contraceptive use and healthcare utilization among young women in Indonesia.

METHODS

DATA AND SAMPLE

The data for analysis was obtained from the 2017 Indonesia Demographic Health Survey (IDHS). Statistics Indonesia, the National Population and Family Planning Board, and the Ministry of Health collaborated for the field data collection, which was conducted during July to September, 2017. The IDHS is a nationally-representative sample of households, and the data that are collected relate to fertility, family planning, marriage, and sexual activity, MCH, HIV/AIDS, and other demographic and health data. The IDHS also contains information on several dimensions of women's agency. This research utilized the data set in which the woman was the respondent to the questionnaire, and that includes information on husband's education, employment status, and household wealth [4].

This study's target population was currently married women age 15 to 24 who had only been married once. The 2017 IDHS dataset included 49,627 women age 15-49 years old, with a 98% response rate. Out of 39,926 ever-married women, 3,524 were age 15-24 years and in their first marriage. That subset comprises the sample for analysis of agency in this study [8, 21].

MEASURES OF REPRODUCTIVE HEALTH AGENCY

The IDHS contains data on reproductive health dimensions of SRH agency: (1) family planning; and (2) healthcare decision-making. Two questions were used to assess reproductive health decision-making involvement. Women were asked who has the primary say regarding the following decisions: (1) Contraception; and (2) Seeking medical treatment or advice for themselves. All items had the following response options: "respondent alone," "her husband," "respondent and her husband jointly," "someone else," and "others."

The scale for reproductive health agency was recoded into a binary variable for each item as a proxy indicator for higher agency of the woman in the family. Cases were coded "1" as denoting higher agency and "0" as denoting lower agency. Women who decided independently or jointly with their husband about contraception use and healthcare utilization were classified as having a higher reproductive health agency, while those who did not were classified as having a lower reproductive health agency. In Indonesia, making a decision jointly with the husband is regarded as just a powerful as if the woman made the decision herself, since a joint decision implies women's bargaining power in the family. Rammohan and Johar [10] argued that joint decisions can be regarded as the norm in Indonesia since only 7% of Indonesian women reported making independent decisions over the ten household decision-making variables defined in their study. In the current study, only 18.7% of respondents had sole decision-making power regarding contraceptive use, while 40.9% had sole decision-making power regarding healthcare utilization.

CONTROL VARIABLES

The model accounted for possible predictors to be closely linked to reproductive health agency. These variables include the following: Age at first marriage (early marriage: < 18 years; delayed marriage: : ≥18 years), the age gap between spouses (less than 5 years/5 years or more), the number of children (zero/1 or more

children), area of residence (urban/rural), regions, family structure (extended family/nuclear family), education (junior high school or lower/senior high school or higher), work status employed/unemployed), and household wealth status (poorest/ poorer/ middle/richer/richest). Region of residence was categorized into eight geographical group: Sumatra, Sulawesi, Western New Papua, Bali, Nusa Tenggara, Maluku Islands, Kalimantan, and Java.

DATA ANALYSIS

In this study, binary logistic regression analysis was performed to examine the influence of socioeconomic and socio-demographic factors on reproductive health agency among young women in Indonesia. The findings are presented as Odds Ratios with a 95% confidence interval, and pseudo-R-square to find the model fit, with p-value (α <0.05) to assess the level of statistical significance of the findings.

RESULTS

Table 1 shows the characteristics of this sample of young women in Indonesia. More than one-third of the respondents had married early (37.4%). The majority (82.7%) were in the 20-24 age group, while there was only a slight difference between women who had a narrow age gap with their husbands and those who had a wide age gap. As the total fertility rate in Indonesia was 2.2 per woman from 2015-20, the proportion of women who had at least one child (73.6%) still outnumbered women with no children (26.4%).

Most of these young women had much lower educational attainment (9.8% attained senior high school or higher) than their husbands (52.0% completed senior high school or higher). Lower women's educational attainment corresponds with a lower level of employment among women (e.g., only 34.6% of women in this sample were employed outside the home at the time of the interview). Further, over half (53.0%) of the sample had lower agency regarding contraception and healthcare utilization.

Table 1: Characteristics of the Indonesian Women Age 15-24 (N=3,524)

Characteristics	Number	Percent
Early or delayed first marriage		
Early	1,318	37.4
Delayed	2,206	62.6
Woman's age (years)		
15-19	611	17.3
20-24	2,913	82.7
Age difference between spouses (years)		
< 5	2,102	59.6
5 or more	1,422	40.4
Number of living children		
Zero	930	26.4
1 or more	2,594	73.6
Area of residence		
Rural	2,004	56.9
Urban	1,520	43.1
Family structure		
Extended	2,299	65.2
Nuclear	1,225	34.8
Region of residence		
Java	1,180	33.5
Sumatra	842	23.9
Bali	47	1.3
Nusa Tenggara	197	5.6
Kalimantan	350	9.9
Sulawesi	617	17.5
Maluku Islands	209	5.9
Western Papua	82	2.3
Women's educational level		
Junior high school or lower	3,177	90.2
Senior high school or higher	347	9.8
Husband's educational level		

Characteristics	Number	Percent
Junior high school or lower	1,691	48.0
Senior high school or higher	1,833	52.0
Women's employment outside the home		
Unemployed	2,303	65.4
Employed	1,221	34.6
Household wealth status		
Poorest	1,015	28.8
Poorer	828	23.5
Middle	724	20.5
Richer	590	16.7
Richest	367	10.4
Reproductive health agency		
Low	1,867	53.0
High	1,657	47.0

Table 2 shows the bivariate analysis of factors and reproductive health agency. There was a significant relationship between early or delayed marriage with reproductive health agency)p-value = 0.001(. The proportion of women with high reproductive health agency was higher among women who married early)52.5%(than those who delayed marriage)43.7%(. Based on age group, high agency in reproductive health was more prevalent among women age 20-24)49.2%(compared to their younger counterparts age 15-19 years)36.7%(.

There was a significant relationship between the number of living children and reproductive health agency)p-value = 0.001(. The proportion of women with high reproductive health agency was higher among those with at least one child)62.0%(than those who had no children)5.2%(. Further, there was a statistically strong relationship between family structure and reproductive health agency. Women living in a nuclear family had higher reproductive health agency)55.6%(than those living in an extended family)42.5%(.

There was a significant relationship between education level and reproductive health agency, both the woman's and her husband's educational level. High reproductive health agency was higher among those women (48.5%) or their husband (51%) who had completed junior high school or lower, compared to their counterparts with higher educational attainment.

Table 2: Bivariate Analysis (Chi-square) (N=3,524)

Variables	**Reproductive health agency**				**p-value**
	Low		**High**		
	n	**%**	**n**	**%**	
Early/delayed first marriage					
Early	626	47.5	692	52.5	0.001
Delayed	1,241	56.3	965	43.7	
Women's age (years)					
15-19	387	63.3	224	36.7	0.001
20-24	1,480	50.8	1,433	49.2	
Age difference between spouses (years)					
< 5	1,107	52.7	995	47.3	0.673
5 or more	760	53.4	662	46.6	
Number of living children					
Zero	882	94.8	48	5.2	0.001
1 or more	985	38.0	1,609	62.0	
Area of residence					
Urban	826	54.3	694	45.7	0.168
Rural	1,041	51.9	963	48.1	
Family Structure					

Variables	Reproductive health agency				p-value
	Low		High		
	n	%	n	%	
Nuclear	544	44.4	681	55.6	0.001
Extended	1,323	57.5	976	42.5	
Region of residence					
Sumatra	477	56.7	365	43.3	
Java	584	49.5	596	50.5	
Bali	16	34.0	31	66.0	
Nusa Tenggara	113	57.4	84	42.6	0.001
Kalimantan	177	50.6	173	49.4	
Sulawesi	318	51.5	299	48.5	
Maluku Island	129	61.7	80	38.3	
Western Papua	53	64.6	29	35.4	
Women's education level					
Junior high school or lower	1,637	51.5	1,540	48.5	0.001
Senior high school or higher	230	66.3	117	33.7	
Husbands' education level					
Junior high school or lower	829	49.0	862	51.0	0.001
Senior high school or higher	1,038	56.6	795	43.4	
Women's work status					
Unemployed	1,210	52.5	1,093	47.5	0.495
Employed	657	53.8	564	46.2	
Household wealth status					
Poorest	538	53.0	477	47.0	
Poorer	406	49.0	422	51.0	
Middle	361	49.9	363	50.1	0.001
Richer	339	57.5	251	42.5	
Richest	223	60.8	144	39.2	

As shown in Table 3, binary logistic regression analysis found that the number of living children, family structure, age gap between spouses, and region of residence had a significant relationship with women's reproductive health agency. Women's work status also had a significant relationship with women's reproductive health agency.

As expected, women who had at least one child were 32 times as likely to have greater agency over family planning and healthcare utilization as those without children. In addition, women who resided in a nuclear family were 1.2 times as likely to have higher agency in deciding family planning and healthcare utilization as those living in an extended family.

Moreover, women with less than a 5-year age difference with their husband were 1.2 times as likely to have higher agency for reproductive health than those with a wider age gap. Women who lived in Java, Bali, Kalimantan, and Sulawesi were more likely to experience greater control over family planning and healthcare utilization than women in Western Papua. Employed women were 1.2 times more likely to have greater control over their family planning and healthcare utilization than their unemployed counterparts.

The R squared of 0.369 implies that the independent variables in the model can explain 36.9% of the variation in reproductive health agencies among young women in Indonesia.

Table 3: Binary Logistic Regression of Factors with Reproductive Health Agency among Women Age 15-24 Years in Indonesia)N=3,524(

Variables	Adjusted OR (95% CI)
First marriage (ref: early)	
Delayed	0.976 (0.815-1.169)
Women's age (ref: 15-19)	
20-24	0.862 (0.672-1.106)
Number of living children (ref: zero)	
1 or more	32.698 (23.900-44.734) ***
Type of residence (ref: rural)	
Urban	0.873 (0.730-1.044)
Family structure (ref: extended)	
Nuclear	1.277 (1.079-1.512)*
The age gap between spouses (ref: 5 years or more)	
Less than 5 years	1.205 (1.026-1.416)*
Region of residence (ref: Western Papua)	
Sumatra	1.561 (0.912-2.673)
Bali	3.509 (1.460-8.432)**
Nusa Tenggara	1.314 (0.723-2.390)
Kalimantan	2.100 (1.187-3.716)**
Sulawesi	1.798 (1.045-3.092)*
Maluku Island	0.965 (0.535-1.740)
Java	2.690 (1.563-4.629)***
Women's education level (ref: junior high school or lower)	
Senior high school or higher	0.988 (0.730-1.338)
Husband's education level (ref: junior high school or lower)	
Senior high school or higher	0.904 (0.761-1.073)
Women's work status (ref: unemployed)	
Employed	1.251 (1.054-1.483)**
Household wealth status (ref: poorest)	
Poorer	1.078 (0.861-1.349)
Middle	1.103 (0.860-1.415)
Richer	0.900 (0.677-1.196)
Richest	0.900 (0.641-1.265)
Constant	0.001
-2 Log likelihood	3734.421
R-squared	0.369
Number of observations	3524

Notes: OR: Odds Ratio, CI: Confidence Interval, *Sig. <0.05, **Sig. <0.01, ***Sig. <0.001

DISCUSSION

This study found that more than half the sample had low reproductive health agency in their household (53.0%). This was a somewhat unexpected finding since spousal communication and joint decision-making is considered a norm in Indonesia and regarded as an indicator of relatively higher women's agency in the household.

Binary logistic regression analysis found a positive relationship between the number of living children and

women's agency. This is consistent with the findings of another study in Indonesia by Rammohan and Johar [10], who found that parity had a strong positive relationship with women's autonomy when bilateral decisions were taken into account. It is expected for women to have a child relatively early in marriage in order to demonstrate fecundity [18]. In that study, women who had only one child were more likely to use contraception and were more concerned about the possibility of having another child [18]. In this study, women with one or more children had more agency than women without children.

Living under the same roof with extended family members (.e.g., parents, parents-in-law, siblings, siblings-in-law) may expose women to potential conflict, and restrict their agency in attempting to control their own reproductive health issues. Being in a nuclear family lessens the potential for interference from other family members, and assigns the responsibility to make decisions about one's life, especially reproductive health issues, to women and their spouse [20]. Thus, it is logical that women who lived in a nuclear family were more likely to have higher agency compared to those who lived in an extended family.

Moreover, this study also confirmed that the age difference between spouses is influential for women's agency in reproductive health matters. A plausible explanation for this might be that women may have more bargaining power within the household if they were closer in age with their husband [22, 23].

Due to the bilateral context in Java, Kalimantan, and Sulawesi, most married couples shared the same household responsibilities, including health care, education for children, and control over household finances [10, 24]. The cultural norms in Java and some parts of Kalimantan and Sulawesi confer higher women's reproductive health agency, which may be attributable to better socioeconomic development of those regions [24, 25]. By contrast, Papuan women may have reduced reproductive health agency due to the political unrest attributed to the resistance of Organisasi Papua Merdeka (OPM), an unauthorized agitational movement since 2000s [26]. In 2019, the contraceptive prevalence rate (CPR) was 73.5% in South Kalimantan compared to 11.9% and 35.0% in Papua and Western Papua, respectively [27]. Additionally, women living in Bali had the highest reproductive health agency. Balinese women are esteemed by men religiously as well as socially [28]. Thus, Balinese women had a stronger voice in important decisions regarding household matters [28, 29].

Binary logistic regression showed that employed women had higher levels of agency than unemployed women in terms of contraception use and healthcare utilization. This finding is in line with previous studies that women who worked outside the home had more opportunities to broaden their connections, which, in turn, led to increased negotiating power in the household and stronger voice in the household decision-making process, especially regarding family planning [30-32].

Although women's and their husbands' education were not significantly associated with women's reproductive health agency in the multivariate analysis, the bivariate analysis captured the patterns of relationship between the two variables. Reproductive health agency was higher among those who themselves or their husband had completed only junior high school level, compared to their counterparts with higher educational attainment. This finding could be related to the fact that the gender gap for higher educational attainment was substantial. More than half of husbands completed senior high school or higher level while less than 10% of wives had done so. The education gap may result in less communication between husbands and wives. Another possible explanation is that education of husbands and wives does not necessarily improve reproductive health agency, particularly when the women come from less prejudiced families [33].

The proportion of women with high reproductive health agency was higher among women who married early than those who delayed marriage, but this was not statistically significant in the multivariate analysis. A plausible explanation for this might be due to the fact that reproductive health agency in this study was assessed at a relatively young age of sample respondents, and a woman's agency can be expected to evolve over the duration of her marital life [34].

While wealth status was not significantly associated with women's reproductive health agency in the multivariate analysis, the bivariate analysis revealed patterns of relationship between the two variables. However, it was not clear why women in the richest or richer quintiles had a higher proportion of low reproductive health agency. Future research should probe this anomaly.

CONCLUSIONS

This study identified determinants of women's agency in decision-making regarding their family planning and health within their household. The definition of reproductive health agency in this study was based on the dimensions of decision-making, including contraceptive use and healthcare utilization for themselves. The findings in this study suggest that socioeconomic factors, such as women's employment status, are positively associated with reproductive health agency among a national sample of younger

Indonesian women. Women who were employed outside the home demonstrated greater agency in reproductive health than their unemployed counterparts.

The analysis also found that parity, family structure, age gap between spouses, and region of residence were significantly associated with reproductive health agency among the sample.

The findings of this study might help the government in strengthening its policy on reproductive health and family planning programs for young women in Indonesia.

At the same time, it should be noted that there are some limitations of this study. First, this study was unable to investigate the impact of religion and husband's work status on women's reproductive health agency due to the unavailability of religion data in the IDHS public dataset. In addition, husband employment was nearly universal at the time of the survey. Finally, the analysis did not include other key variables that may affect reproductive health agency, such as sexual autonomy and ethnicity.

RECOMMENDATIONS

Reproductive health agency provides numerous benefits to economic growth and well-being of women. As a result, increasing women's agency through promotion and training is critical. More gender justice programs must be implemented, particularly in terms of providing assistance and training to empower women -- economically and socially -- in order to improve women's agency, particularly in reproductive health matters. According to this study, women's employment outside the home, the number of living children, family structure, age gap between spouses, and region of residence were powerful factors that can boost women's agency within the household. Optimizing female labor force participation may give women more power in the home. Thus, women's empowerment programs should focus on strengthening female labor-force participation in order to improve their bargaining power within the household. It should also be noted that women who have high agency may also have a higher chance to work outside the house.

This study used secondary data from the IDHS, which is cross-sectional study that estimated women's reproductive health agency at a single point in time. As a result, a longitudinal study may be needed to better understand the evolution of women's agency through the course of her married life. In addition, a qualitative study on women's agency is necessary to develop a more comprehensive understanding of the setting of women's agency among young women in Indonesia. Finally, as this study measured reproductive health agency among women age 15-24, a comparative study with women in the older age groups, using the same dataset, would be useful to explore the patterns of women during different cohorts of the reproductive ages.

ETHICAL DECLARATION

The 2017 Indonesia DHS protected participants' privacy and ensured voluntary informed consent. Before the survey, informed consent was obtained, and the privacy of the data was strictly maintained, as the data would not be shared with anyone outside the survey team. The researchers obtained permission to use the 2017 Indonesia DHS dataset in December 2021. Then, The Institutional Review Board (IRB) of Mahidol University's Institute for Population and Social Research approved this research proposal with Certificate of Exemption (COE) No. 2022/05-114.

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LONELINESS IN LATER LIFE AND ITS ASSOCIATION WITH PHYSICAL AND MENTAL HEALTH: FINDINGS FROM A VIETNAM AGING COMMUNITY SURVEY

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ABSTRACT

With the rapidly growing aging population, social isolation and loneliness has become a significant health concern and are likewise associated with adverse health consequence among older adults living in a community. There is limited evidence about associated factors of loneliness among the aging population in Vietnam. This study aimed to identify the prevalence of loneliness among older adults, its risk factors, and the association between loneliness and physical and mental health among Vietnamese older adults. A cross-sectional, face-to-face community survey was conducted in Thua Hue Province, Vietnam, in 2018 with a sample size of 725 older adults aged 60 and above. The survey instrument consisted of self-reported questions about socio-demographic information, physical and mental health status, fear of falling)FOF(, cognitive function, and perceived social support. Loneliness was measured using a single-item direct question. Moreover, FOF was assessed using the Fall Efficacy Scale International)FES-I(. Cognitive function was measured by the Mini-Mental State Examination. Binary logistic regression was used to determine the association between loneliness and health outcomes variables. Multivariate logistic regression analyses adjusted for covariates was used to explore the relationship between loneliness and physical and mental health with a significance level of $p < .05$. Among the 725 participants, 30.1% were feeling lonely or distant from others. After adjustment for age, gender, marital status, residency and living arrangement, multivariate logistic regression showed that the participants who were feeling lonely were more likely than their counterparts to experience cognitive impairment)AOR = 1.83; 95% CI]1.18, 2.82[(, high FOF)AOR = 1.89; 95% CI]1.32, 2.71[(, limitation in basic activities of daily living)AOR = 2.24; 95% CI]1.45, 3.44[(, feeling worthless)AOR = 7.47; 95% CI]5.09, 10.98[(, feeling very nervous)AOR = 5.58; 95% CI]5.86, 12.56[(, and less likely to perceive high social support)AOR = 0.62; 95% CI]0.43, 0.88[(. Loneliness is significantly associated with health outcomes of older Vietnamese adults, both physically and mentally. Targeting interventions, including healthcare and social care programs for social-isolated older adults living in the community, could effectively reduce their adverse health outcomes.

***Keywords**: loneliness, physical health, mental health, older adults, aging.*

INTRODUCTION

By 2050, Asia is projected to be home to more than 60% of the older adults in the world)1(. This aging trend also plays a significant role in shaping the population structure of Vietnam. Vietnam officially entered an aging society in 2015 and has been projected to be an aged society in 2035)2(. The proportion of Vietnamese older adults above 60 increased from 8.68% in 2009 to 11.86% in 2019)3(.

As the population ages, the change in the intergenerational structure of society, family household size, and social connections are unavoidable. Loneliness among older people has become an increasing public health concern)4(and deserves more attention due to its adverse effects on older adults. In literature, loneliness is commonly defined as a subjective feeling of distress from being isolated or alone due to the perception of a lack of social interaction or poor social relationships)5-7(. Loneliness could comprise two distinct concepts: emotional dimension and social dimension, which indicate a lack of close emotional attachment and an inadequate social network)8(.

The prevalence of loneliness varies across regions, populations, and measurement tools. A review of community studies in 1996 reported severe loneliness prevalence was between 2% and 16%, and moderate loneliness ranged from 7% to 42%)9(. Until recent years, in 2020, the prevalence of loneliness was reported to be higher, ranging from 31% to 100% for moderate levels and 9% to 81% for severe loneliness)10(. Additionally, a review in 2022 that considered the COVID-19 pandemic reported up-to-date pooled estimates of the prevalence of loneliness among the older population, at 28.6%)11(. Care home residents were reported to have a higher mean prevalence of moderate and severe loneliness than the general older population)10(. In high-income countries, 1 in 4 older adults experienced some degree of loneliness at least some time)12(. In 2012, 43% of the United States felt lonely)13(. The situation of loneliness in Asian countries is wide-ranging. A study in 2001 presented that roughly 60% of older Taiwanese adults residing in the community had a moderate to high level of loneliness)14(. In Singapore, a Southeast Asia country similar to Vietnam, 22.6% reported loneliness in 2009 and 2011 surveys)15(. Thailand was similar, with 24% moderate levels of loneliness and 76% low levels of loneliness)16(.

Aging research shows robust evidence that loneliness may lead to negative health-related consequences. Lonely and socially isolated older adults have an increased risk of physical functional decline)17, 18(, particularly the decline in performing activities of daily living and, in turn, has been reported to be associated with the fear of falling)19(. As the prevalence of loneliness is observed to be higher among people with mental issues than the general population)20, 21(, feeling lonely is also widely reported to be closely related to psychological well-being like depression)18, 22(, social support)23(, and negative emotions)24(. A report also indicated that loneliness negatively influences the mental and physical quality of life)25(. High blood pressure, coronary artery disease, a decline in cognitive function, and Alzheimer's disease were also reported to be associated with loneliness)26, 27(.

Despite a variety of studies, it is notable that most existing studies on loneliness among the aging population have been found in developed societies, while studies about loneliness in the Southeast Asian population remain scarce. To the best of our knowledge, there is little available research evaluating loneliness among older adults in Vietnam, even though Vietnam has been an aging society for several years. A previous aging study in Vietnam mentioned loneliness; however, loneliness was used interchangeably with the living arrangement status of living alone)28(. Therefore, this present study was conducted primarily to identify the prevalence of loneliness among older adults, its risk factors, and the association between loneliness and physical and mental health among Vietnamese older adults. Accordingly, recommendations for lonely older adults in the community will be formulated.

METHODS

Study design

The cross-sectional community survey was conducted in Thua Thien Hue Province within the North Central Coast region of Vietnam. Community-dwelling adults residing in Hue City and Phu Vang district of the Thua Thien Hue Province, Vietnam, were selected as the representatives for urban and rural areas. The community survey was conducted from June to July 2018.

Study population

The participants were selected by two-stage random cluster sampling. According to the sample estimation formula, 730 participants were selected. Three communes in Phu Vang district and two quarters in Hue city were randomly chosen in the first stage. In the second stage, 146 households with older adults over 60 were randomly selected from a household list of the chosen quarters and communes. The inclusion criteria were older adults aged 60 years old and above residing in their households in the community. The participants

who refused to answer or could not communicate were excluded from the study.

This survey collected data using a self-reported questionnaire and a face-to-face interview to gather information on the participants' socio-demographic characteristics, physical and functional status, and cognitive function. Older adults who refused to participate or could not speak were excluded from this study. The response rate was 99%, which led to a final sample size of 725 for data analysis.

Measurements of variables

Loneliness - Independent variable

Loneliness was assessed by one single Yes/No question: "In the past month, did you ever feel very lonely or distant from others?" which was later categorized as "feeling lonely." This measurement is simple to use, could reflect loneliness as understood by the participants, and has been widely used in previous reports)29, 30(.

Dependent variables/ Outcome variables

Cognitive function was measured by the Mini-Mental State Examination)MMSE( )31(. The MMSE score for the 11 questions ranged from 0 to 30, with a higher score indicating higher cognitive function. A score of 23, a well-accepted cutoff point to indicate cognitive impairment, was used)32(.

Fear of falling)FOF(was assessed using the Falls Efficacy Scale International)FES-I( )33(. This tool measures the concern for falling while performing basic and physically demanding activities in daily life. This tool includes 16 items, and each item is scored on a 4-point Likert scale with 1 as not concerned at all and 4 as very concerned. The FES-I scores of 16–19 represented low FOF, 20–27 represented moderate FOF, and 28–64 represented high levels of FOF.

The Barthel index)34(, a 10-item instrument with a total score ranging from 0–20, was used to evaluate functional independence in personal activities of daily living)ADL(, which was later coded as "Limitation in BADL" in the results section. Total ADL independence was categorized as "no limitation," and partial/ total AID dependence was classified as "limitation")35(.

"Feeling worthless" was measured with the 4-point Likert question: "In the past month, did you ever feel worthless?" The answers ranged from "None of the time," "Some of the time," "Most of the time," to "All of the time." "None of the time" was classified as "No." The rest of the choices were grouped as "Yes" in data analysis.

"Feeling very nervous" was measured by asking the participants the 4-point Likert question: "In the past month, did you ever feel very nervous that nothing could calm you down?" The answers were: "None of the time," "Some of the time," "Most of the time," and "All of the time." "None of the time" was later classified as "No." The rest of the choices were grouped as "Yes."

Perceived social support was measured using the self-reported instrument Multidimensional Scale of Perceived Social Support)36(. The scale consisted of 12 items, four for each category. It was rated on a seven-point Likert scale from "very strongly disagree" to "very strongly agree," with seven being the strongest agreement. Scores range from 12 to 84 overall. A total mean score of 1.0–5.0 represented low and moderate levels of perceived social support, and 5.1–7.0 points represented high levels of perceived social support.

Covariates

Information on socio-demography includeed age)three age groups: 60–69 years, 70–79 years, and 80–89 years(, gender)Male/Female(, marital status)Married/Single or previously married(, residency)Rural/urban(and living arrangement)Live alone/Live with others(were collected as the covariates for the associations between loneliness and the outcome variables.

Ethics and informed consent

Prior to participation in the survey, a written informed consent form was signed by the participants or by the participants' guardians. The study was approved by the Ethical Review Committee of Hue University of Medicine and Pharmacy, Vietnam)COA No: Ethics ID H2018/148(.

Data analysis

All categorical variables were described using descriptive statistics presenting frequency and percentage. Multivariate logistic regression analysis, adjusted for gender, age, residential area, and marital status, was used to examine the association between loneliness and the health outcome variables. The covariates considered for adjustment were based on the previous literature about loneliness. Data were imported and analyzed using SPSS Statistics version 22 for Windows where a p value $\geq .05$ was regarded as statistically significant.

RESULTS

Characteristics of the participants

A total of 725 older adults aged 60 and above completed the questionnaires. The majority of the participants were female)58.3%(, in the 60–69 age group)46.9%(, lived in urban areas)61.1%(, married)72.3%(, and were living with other people)91%(. Nearly a third)30.1%(of the participants reported

feeling very lonely or isolated from other people. Almost half)49%(experienced visual difficulty, and a third experience walking difficulty)30.6%( )Table 1(.

Table 1 Baseline characteristics of older adults)n = 725(

Characteristics of older adults		All (*n* = 725)	Feeling very lonely or distant from other	
			No (*n* = 507) *n* (%)	Yes (*n* = 218) *n* (%)
Gender	Female	423	273 (64.5)	150 (35.5)
	Male	302	234 (77.5)	68 (22.5)
Age group, years	60–69	340	254 (74.7)	86 (25.3)
	70–79	209	145 (69.4)	64 (30.6)
	≥ 80	176	108 (61.4)	68 (38.6)
Residential area	Rural	282	190 (67.4)	92 (32.6)
	Urban	443	317 (71.6)	126 (28.4)
Marital status	Single or previously married	201	103 (51.2)	98 (48.8)
	Married	524	404 (77.1)	120 (22.9)
Limitation in BADL	Yes	127	64 (50.4)	63 (49.6)
	No	598	443 (74.1)	155 (25.9)
Living arrangement	Alone	65	29 (44.6)	36 (55.4)
	With others	660	478 (72.4)	182 (27.6)
Visual ability	Have difficulty	355	231 (65.1)	124 (34.9)
	No difficulty	370	276 (74.6)	94 (25.4)
Walking ability	Have difficulty	222	128 (57.7)	94 (42.3)
	No difficulty	503	379 (75.3)	124 (24.7)
Level of social support	Low and moderate	423	272 (64.3)	151 (35.7)
	High	302	235 (77.8)	67 (22.2)
Cognitive function	Impairment	123	65 (52.8)	58 (47.2)
	Normal	602	442 (73.4)	160 (26.6)
Level of fear of falling	High	296	174 (58.8)	122 (41.2)
	Not high	429	333 (77.6)	96 (22.4)
Feel worthless	Yes	195	73 (37.4)	122 (62.6)
	No	530	434 (81.9)	96 (18.1)
Feel very nervous	Yes	275	118 (42.9)	157 (57.1)
	No	450	389 (86.4)	61 (13.6)

ASSOCIATION BETWEEN LONELINESS AND HEALTH-RELATED OUTCOME VARIABLES

Table 2 presents the association between loneliness and health-related outcome variables. In univariate logistic regression, feeling lonely was significantly associated with cognitive impairment)OR = 2.47; 95% CI]1.66, 3.6[(, high level of FOF)OR = 2.43; 95% CI]1.76, 3.36[(, limitation in BADL)OR = 2.8; 95% CI]1.90, 4.17[(, feeling worthless)OR = 7.56; 95% CI]5.25, 10.88[(, feeling very nervous)OR = 8.49; 95% CI]5.92, 12.17[(, and high social support)OR = 0.56; 95% CI]0.37, 0.72[(.

In the multiple logistic regression model, after adjusting for covariates, feeling lonely remained significantly associated with cognitive impairment)AOR = 1.83; 95% CI]1.18, 2.82[(. Older adults who were feeling lonely were more likely than their counterparts to experience a high level of FOF)AOR = 1.89; 95% CI]1.32, 2.71[(. Similarly, the participants who were feeling lonely were more likely than their counterparts to have limitation in BADL)AOR = 2.24; 95% CI]1.45, 3.44[(, feeling worthless)AOR = 7.47; 95% CI]5.09, 10.98[(, and feeling very nervous)AOR = 5.58; 95% CI]5.86, 12.56[(. Unsurprisingly, lonely older adults were less likely to perceive high social support)AOR = 0.62; 95% CI]0.43, 0.88[(regardless of their gender, age group, residential area, marital or living arrangement status. Feeling lonely was significantly associated with adverse health outcomes, physically and mentally, among older Vietnamese adults.

Table 2. Association between loneliness and health-related outcomes)n = 725(

Univariate logistic regression						
	Cognitive impairment OR (95% CI)	High fear of falling OR (95% CI)	Limitation in BADL OR (95% CI)	Feel worthless OR (95% CI)	Feel very nervous OR (95% CI)	High social support OR (95% CI)
Feeling very lonely and distant from others						
No	1	1	1	1	1	1
Yes	2.47 (1.66, 3.67)***	2.43 (1.76, 3.36)***	2.81 (1.90, 4.17)***	7.56 (5.25, 10.88)***	8.49 (5.92, 12.17)***	0.51 (0.37, 0.72)***
Multivariate logistic regression						
	Cognitive impairment AOR (95% CI)	High fear of falling AOR (95% CI)	Limitation in BADL AOR (95% CI)	Feel worthless AOR (95% CI)	Feel very nervous AOR (95% CI)	High social support AOR (95% CI)
Feeling very lonely and distant from others						
No	1	1	1	1	1	1
Yes	1.83 (1.18, 2.82)**	1.89 (1.32, 2.71)**	2.24 (1.45, 3.44)***	7.47 (5.09, 10.98)***	8.58 (5.86, 12.56)***	0.62 (0.43, 0.88)**
Gender						
Male	1	1	1	1	1	1
Female	1.90 (1.17, 3.09)**	3.31 (2.29, 4.80)***	1.77 (1.10, 2.85)*	1.52 (1.02, 2.29)*	1.52 (1.04, 2.20)*	0.78 (0.56, 1.08)
Age group						
60–69 years	1	1	1	1	1	1
70–79 years	2.11 (1.20, 3.70)**	2.08 (1.50–3.08)***	2.66 (1.50, 4.72)**	1.57 (1.01, 2.43)*	1.10 (0.73, 1.66)	0.62 (0.43, 0.90)*
≥ 80 years	6.79 (3.93, 11.72)***	5.83 (3.74, 9.10)***	8.73 (4.99, 15.25)***	1.44 (0.89, 2.33)	0.89 (0.56, 1.40)	0.70 (0.47, 1.04)
Residential area						
Urban	1	1	1	1	1	1
Rural	0.48 (0.31, 0.74)**	0.60 (0.43, 0.85)**	0.73 (0.47, 1.13)	0.62 (0.43, 0.91)*	0.71 (0.50, 1.01)	1.13 (0.83, 1.55)
Marital status						
Married	1	1	1	1	1	1
Single or previously married	1.35 (0.82, 2.24)	0.84 (0.55, 1.29)	1.22 (0.74, 2.01)	0.80 (0.50, 1.28)	1.17 (0.75, 1.84)	0.70 (0.46, 1.06)
Living arrangement						
Live with others	1	1	1	1	1	1
Live alone	1.18 (0.59, 2.35)	1.70 (0.92, 3.16)	0.98 (0.48, 1.98)	0.91 (0.48, 1.75)	0.53 (0.27, 1.01)	0.74 (0.39, 1.38)

Notes: OR: odds ratio; AOR: adjusted odds ratio; CI: confidence interval; ***p value < .001; **p value < .01; *p value < .05

DISCUSSION

Our study discovered the prevalence of loneliness and its association with health outcomes of older adults in the central area of Vietnam. Loneliness was noticeably prevalent in this sample. Approximately a third)30.1%(of the participants were feeling very lonely or isolated from others. Furthermore, lonely individuals had a higher likelihood of experiencing adverse health outcomes, particularly, cognitive impairment, high FOF, limitation in BADL, feeling worthless, feeling very nervous, and were less likely to perceive high social support compared to their counterparts.

Our results suggested that loneliness was associated with cognitive impairment, consistent with previous findings in Western)37, 38(and Asian)39(societies that loneliness correlated with lower cognitive functioning. It suggests that public health workers and related stakeholders should coordinate to detect isolated older adults with declined cognition early in the community. Lonely participants were more likely to have a high FOF. It has been reported that loneliness was positively associated with falls)27, 40(, and in an additional data analysis of our study, a fall history was associated with high FOF)OR = 5.75; CI]2.97, 11.12[(, which could explain for this finding. Moreover, a study in 2017 presented that FOF among lonely older adults was higher than in the other groups)41(.

Also, the participants who were feeling lonely were more likely to experience a limitation in their BADL, which corresponded with literature that loneliness is linked with poorer physical performance in older age)17, 18, 42(. Therefore, older adults who are socially isolated and dependent on performing their daily basic activities should be monitored closely.

Unsurprisingly, the participants in our study who were feeling lonely had a higher likelihood of feeling worthless and nervous and less likely to perceive high social support. This could be because when one feels lonely and disconnected from others for a particular time, their psychological health will be affected)43(. As discussed in a research article in 2006, loneliness can shape one's personality ratings and socioemotional states by increased perceived stress, fear of negative evaluation, anxiety, and diminished optimism and self-esteem)44(. A theoretical framework of loneliness)45(also strengthened that social isolation and loneliness interact, which may eventually reinforce one another.

Interestingly, it was notable from the findings that marital status and living arrangement were not associated with the health outcomes in the multiple logistic regression model, which contrasted with many previous studies)46, 47(. This might be the case since loneliness was not considered in earlier investigations. Our results may also highlight the distinction between loneliness and living alone, as loneliness can impact one's health whether they are single or live independently.

The results of this present study should be interpreted in the context of several limitations. As this study was cross-sectional than interventional or longitudinal, causality cannot be assumed. Although the sample is well-representative of Vietnam's older adults, and standardized measurements of variables were adopted, the results should not be generalized to other populations. Further longitudinal studies are required to better understand other candidate factors contributing to loneliness.

These results are vital since it has not yet been established from reports in Vietnamese aging studies that loneliness is linked to poor health outcomes in the older population. Our analysis brought attention to screening and identifying older persons more likely to experience loneliness to prevent negative health-related consequences. While our findings generally supported most of the publications we were aware of on this topic, they came from developed cultures, which are different from a middle-income country like Vietnam. There is a need to promote additional research in low- and middle-income nations, where fewer resources are available for the isolated and lonely population, to more genuinely reflect the isolated older people in these settings. Our focus on loneliness also serves as a further reminder to us as public health workers of how significant and irrefutable their impact on older adults' health.

CONCLUSION

Among older Vietnamese people, loneliness is associated with both mental and physical health, including cognitive impairment, high FOF, limitations in BADL, a sense of worthlessness, feeling nervous, and less perceived high social support, regardless of gender, age, place of residence, marital status, or type of living arrangement. Therefore, it is crucial to prevent loneliness promptly so that older adults' physical and mental health is maintained, especially in a rapidly aging society like Vietnam.

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FINANCIAL BURDEN TOWARD OUT-OF-POCKET EXPENDITURES ON HEALTH CARE AMONG HOUSEHOLDS WITH MEMBERS SUFFERING FROM NCDS IN VIETNAM

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ABSTRACT

While evidence from studies indicated that household members suffering from non-communicable diseases)NCDs(are at risk of financial hardship, little information about this issue is available in Vietnam. Thus, this study examines the magnitude of financial burden due to out-of-pocket)OOP(expenditure among households with NCD patients in Vietnam. This study uses secondary data from a cross-sectional household survey on health service accessibility and utilization conducted in six provinces in Vietnam in 2015. The selection criteria are households having at least one member suffering from hypertension or diabetes. The final sample size of 1,736 households and 1,955 patients was analyzed using STATA software with descriptive analysis. The financial burden was measured using catastrophic health expenditure)CHE(and impoverishment. The CHE occurs when a household's total OOP health payments equal to or exceed 40% of the household's capacity to pay. Impoverishment occurs when a non-poor household is pushed under the poverty line after paying for health services. In this study, 63.2% of households were in the urban area, 85% of patients had health insurance, and most of the patients suffered from NCDs for 15 years or longer. There was 85.6% of households had to pay OOP expenses with an average of US$ 488 in one year. There were 8.7% and 3.6% of households that incurred CHE and impoverishment, respectively. A high proportion of household members suffering from NCDs have to pay OOP for health care. These households are more likely to incur financial hardship. Policies and national programs on health service accessibility and financial support through health insurance and basic benefit packages at primary health care targeting this population should be considered. Further research with the collection of patterns of health services' costs should be implemented.

Keywords: *NCDs, non-communicable diseases, financial burden, catastrophic health expenditure, impoverishment*

INTRODUCTION

Currently, non-communicable diseases (NCDs) are a growing issue that burdens many countries' health systems and societies. According to the World Health Organization (WHO), NCDs cause about 41 million deaths annually, equivalent to 71% of worldwide deaths [(1)]. In Vietnam, hypertension and diabetes are the most common chronic diseases. The proportion of hypertensive patients aged 25 to 64 in Vietnam has increased from 15.3% (2010) to 20.3% (2015) [(2)]. For diabetes, in 2016, 4.9% of the Vietnamese population, or approximately 3.53 million people, were diagnosed with high blood sugar [(3)]. This number is projected to increase to 6.3 million by 2045 [(4)].

This rapid rise in NCDs might contribute to increasing household expenses on health care among households having members with NCDs. A systematic review of 64 studies conducted in 2014 on the global economic impact of NCDs on households indicated that NCDs imposed a significant and growing global impact on households and impoverishment in all continents and levels of income [(5)]. The probability of incurring CHE was higher by 6.7 percentage points compared to the households with no reported conditions [(6)]. In low- and middle-income countries, health care costs for chronic diseases can drain household resources since patients with NCDs must adhere to lengthy treatment. This means that their family must pay more for medicines and other fees for treatment like examination or tests in the long-term; Vietnam is not the exemption. Besides, in Vietnam, according to the national guidance on treatment for patients with NCDs, patients are required to visit health facilities monthly to receive medicine and health check-ups. Therefore, they must pay more for direct non-medical costs such as transportation. As a result, patients with NCDs and their families tend to have a higher risk of experiencing financial hardship due to health care.

In such a situation, many studies were implemented worldwide to better understand the magnitude and related factors of financial hardship faced by NCD patients and their families. According to a systematic review of 64 studies conducted in 2014, the financial catastrophe due to NCDs was seen in all countries and at all income levels. Financial catastrophe occurred from 6% to 84% of the households depending on the threshold to define catastrophic spending [(5)]. In Vietnam, though there have been several studies on OOP payments, the subjects of these studies were patients with specific demographic characteristics [(7)], or the general population [(8-10)] instead of patients with NCDs. The only research assessing the household financial burden associated with NCDs was conducted in one rural district in a small province of Vietnam in 2012 [(11)], which was almost 10 years ago. Thus, the evidence was not strong and might not be relevant to the changing situation. A new analysis based on more up-to-date data is needed. In this context, this study using more recent data was conducted to answer the question of the magnitude of the financial burden faced by households with NCD members in Vietnam.

METHODS

STUDY DESIGN

This data is derived from the Vietnam Health Strategy and Policy Institute (HSPI) named "*The difference in health, accessibility to health, health service utilization and related factors in Vietnam*." The HSPI is a unit that operates under the Vietnam Ministry of Health (MoH). Its functions are doing research to provide scientific evidence and consultations for the MoH to build and modify health policies [(12)].

SAMPLING STRATEGY

The HSPI household survey used a multistage and probabilities proportional to size sampling strategy to collect data from six provinces that are representative of six distinct geographical regions. The provinces include Dien Bien, Hanoi, Binh Dinh, Dak Lak, Dong Nai, and Dong Thap [13].

In this study, the analysis used data obtained from all six provinces. However, the study aimed to measure the financial burden among households whose members are patients with NCDs. The research team was only focused on hypertension and diabetes, the two most common chronic diseases in Vietnam. Thus, from the initial database, only the sub-group of households with hypertensive or diabetes members were included in the data analysis. The final sample size was 1,791 households and 2,016 patients.

Figure 1. Map of Vietnam: The red provinces were chosen as study areas

THE DATA COLLECTION INSTRUMENTS AND PROCEDURES

The information of all household members was gathered by using a structured interview questionnaire. In each household, an adult considered the most knowledgeable person regarding the household's general information and health care issues was invited to answer. The survey collected information on five key domains: (i) demographic background; (ii) healthcare-seeking and health services utilization; (iii) self-reported NCDs and NCDs management; (iv) lifestyle; and (v) household's food expenditure, environment, and housing conditions.

ETHICAL CONSIDERATIONS

This study was approved by the Institutional Review Board, Institute for Population and Social Research, Mahidol University, with the certificate of approval number 2021/06-139.

STUDY VARIABLES

OOP expenditure refers to the payments made by households when they receive health services, including direct and indirect medical costs for outpatient and inpatient services, money for self-treatment, buying medical equipment, preventive services such as immunization, etc. OOP spending is net of any insurance reimbursement, and the time unit for this expenditure is one year.

Capacity to pay (CTP) refers to "a household non-subsistence spending," which equals the amount of money a household has after paying for subsistence.
Catastrophic health expenditure (CHE) was defined as the situation when a household's total OOP health payments equal to or exceed 40% of the household's CTP or non-subsistence spending [14].

Impoverishment occurs when a non-poor household is impoverished by health payments after paying for

health services. The threshold used to define poor status is the poverty line. The poverty line was constructed as the average food spending of households whose food spending share (as a percentage of total household consumption) was in the 45th to 55th percentile range [14].

ANALYSIS METHODS

To assess the magnitude of the financial burden of OOP expenditures on health care, the required information is the total household expenditure, food expenditure, CTP, and OOP payments for health care. Due to the lack of variables required to calculate total household expenditure, this study used the data from Vietnam Household Living Standard Survey (VHLSS) 2014 [15]. Initially, data from the VHLSS was used to develop the linear regression model. The dependent variable was the total household expenditure, and independent variables were sorted from questions shown in both VHLSS and HSPI surveys. Then, this model was applied to the HSPI survey to calculate the total household expenditure. Since the VHLSS and HSPI surveys were carried on in two different years, the Consumer Price Index (CPI) was used to avoid inflation.

According to WHO guidelines, a household is classified as impoverishment due to health spending if the total household consumption expenditure is equal to or higher than the household subsistence spending, and the total household consumption expenditure net of OOP spending on health care is lower than the household subsistence spending. The household subsistence spending is calculated by multiplying the equivalent household size with the poverty line [14].
The statistical package Stata/IC 15.1 was used to analyze the data.

RESULTS

DEMOGRAPHIC

Most of the households in this study were in the urban area, which accounted for 63.2% of the total sample. The percentage of households located in the north, the central, and the south were relatively equal. Half of the households belong to the 4th and 5th quintiles, with about 43.0% of the households having five or more five family members living together. Two-thirds of the households had older persons 60 and above, while only one-third had children. Most of the households had only one member suffering from hypertension (HTN) or diabetes (DM), and 69.7% of households had more than two-thirds of the members in the family having health insurance (HI) (Table 1).

Table 1 Socio-demographic characteristics of households with NCDs members

Socio-demographic characteristics	**Total Number of households (*n* = 1,791)**	**Percentage (%)**
Living area		
Urban	1,132	63.2
Rural	659	36.8
Total	1,791	100.0
Geographical region		
North	634	35.4
Central	473	26.4
South	684	38.2
Total	1,791	100.0
Household wealth index		
1st quintile (poorest)	192	10.7
2nd quintile	328	18.3
3rd quintile	363	20.3
4th quintile	394	22.0
5th quintile (richest)	514	28.7
Total	1,791	100.0
Household size		
1 – 2	417	23.3
3 – 4	604	33.7
> = 5	770	43.0
Total	1,791	100.0

Socio-demographic characteristics	Total Number of households (*n* = 1,791)	Percentage (%)
Having older people [(a)]		
Yes	1,149	64.2
No	642	35.8
Total	1,791	100.0
Having children [(b)]		
Yes	544	30.4
No	1,247	69.6
Total	1,791	100.0
Number of members having HTN/DM		
1	1,570	87.7
>= 2	221	12.3
Total	1,791	100.0
Shares of household members having health insurance		
Up to one-thirds	198	11.1
One to two thirds	344	19.2
More than two thirds	1,249	69.7
Total	1,791	100.0

Notes: (a) People whose age ≥ 60; (b) Children whose age < 6; HTN: Hypertension, DM: Diabetes

At the patient level, 2,016 members suffered from HTN and/or DM. The mean age of NCD members was 63.4, with a standard deviation of 12.7 years. The youngest NCD member was only 3, and the oldest was 102. In general, more than 90% of the patients are Kinh, and aged 45 and above. The number of female patients accounted for 58.5%, and 31.1% of the patients were illiterate. About three-fourths of NCD members were married, and 85% of the patients had health insurance. Most patients had experienced hypertension and/or diabetes for 15 years or longer**.**

Table 2 Socio-demographic characteristics of patients with NCDs

Socio-demographic characteristics	Total Number of people (*n* = 2,016)	Percentage (%)
Age groups		
< 45	124	6.2
45 – <60	651	32.3
> = 60	1,241	61.6
Total	2,016	100.0
Gender		
Male	836	41.5
Female	1,180	58.5
Total	2,016	100.0
Ethnic		
Kinh	1,888	93.7
Others	128	6.3
Total	2,016	100.0
Educational level		
Illiterate/ No schooling	627	31.1
Primary school	422	20.9
Secondary school	451	22.4
High school	243	12.1
College, University and Post-university	273	13.5
Total	2,016	100.0

Socio-demographic characteristics	Total Number of people (*n* = 2,016)	Percentage (%)
Employment status		
Employed	815	40.4
Unemployed	1,201	59.6
Total	2,016	100.0
Marital status		
Single	66	3.3
Married	1,468	72.8
Widowed	451	22.4
Divorced	31	1.5
Total	2,016	100.0
Health insurance		
Yes	1,713	85.0
No	303	15.0
Total	2,016	100.0
Duration of diseases[a]		
< 5 years	825	42.4
5 – <10 years	632	32.4
10 - <15 years	265	13.6
>=15 years	226	11.6
Total	2,016	100.0

Note: [a] If the patients were comorbidities, the longer duration would be reported

FINANCIAL BURDEN DUE TO OOP EXPENDITURES FOR HEALTH CARE AMONG HOUSEHOLDS WITH NCDS MEMBERS

In this study, 85.6% of household members suffering from NCDs had to pay OOP expenses for health care services. Among those households, the mean amount of OOP expenditure was about 10.456 million Vietnam dong, which was approximately US$482 (The estimation is based on the State Bank of Vietnam exchange rate in 2015 [1 USD = 21,673 Vietnam dong]). The average amount households had to pay OOP for outpatient services was 5.321 million Vietnam dong, which was approximately US$246. The mean amount for direct medical costs and the direct non-medical costs were 344,000 Vietnam dong (~US$16) and 65,000 Vietnam dong (~US$3), respectively. In comparison with other categories of direct medical costs, the mean cost for medicine was the highest, with about 88,000 Vietnam dong (~US$4). For the direct non-medical expenses, the transportation fee was recorded as the highest, which was 42,000 Vietnam dong (~US$2).

For inpatient services, households' mean amount to pay OOP was almost 3.180 million Vietnam dong or approximately US$147. The average amount for direct medical costs was 2.328 million Vietnam dong (~US$107), while for direct non-medical costs was about 850,000 Vietnam dong (~US$39).

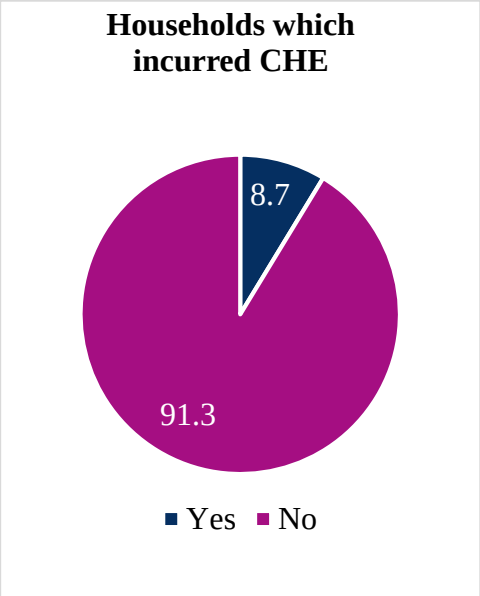
Table 3 Direct medical cost and direct non-medical cost among households paying OOP for health care in one year

Type of cost (USD)	Health service in general (*n* = 1,533)	
	Mean (SD)	Min-Max
For outpatient services [a]	247.2 (1287)	0 – 42,590.2
Direct medical cost	16 (94.4)	0 – 3,275.2
Examination	0.6 (5.6)	0 – 149.1
Tests, X-ray, etc.	0.8 (6.5)	0 – 130.5
Medicine	4.1 (15.9)	0 – 186.4
Others	0.6 (6.6)	0 – 145.4
Direct non-medical cost	3 (20.6)	0 – 512.6
Gifts	0.4 (0.6)	0 – 23.3
Transportation	2 (10.5)	0 – 282.4
Others	0.4 (6.2)	0 – 226.0
For inpatient services	148.1 (724.4)	0 – 15,006.1

Type of cost (USD)	Health service in general (n = 1,533)	
	Mean (SD)	Min-Max
Direct medical cost	108.5 (627.5)	0 – 13,048
Examination, etc	27.8 (198.5)	0 – 5,475.5
Others	6.8 (60.2)	0 – 1,864.1
Direct non-medical cost	39.6 (185.3)	0 – 5,732.1
Gifts	4.2 (43.9)	0 – 1,165.1
Transportation	8.6 (57.5)	0 – 1,957.3
Others	18.9 (132.7)	0 – 4,660.3

Notes: [a] The cost for outpatient services in one year was calculated by multiplying the amount for OP services in 4 weeks by 13 times, except for accidents, birth delivery, operation, etc.; SD: Standard Deviation

With the threshold of 40% CTP, 8.7% of households with NCD members incurred CHE due to OOP spending on health care. For impoverishment, 3.6% of households were pushed under the poverty line after paying for health care.



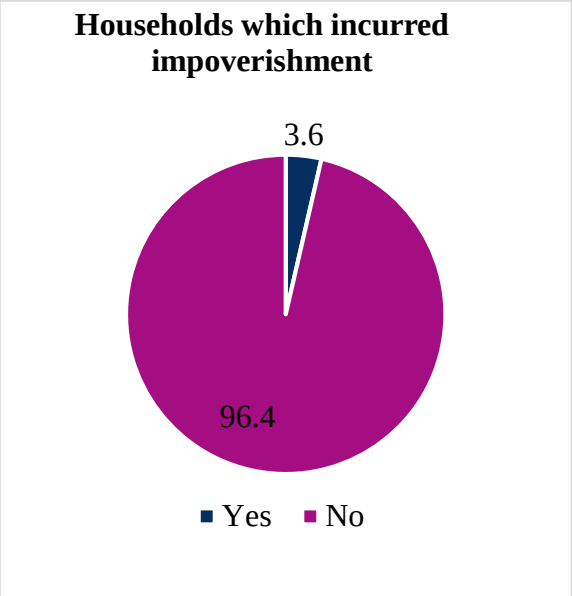


Figure 1 Frequencies and percentages of households incurring financial burden due to out-of-pocket expenditure for health care

The research team assumed that if a household experienced a financial burden, including catastrophic spending and/or impoverishment, each member in that household also faced this financial burden. The table below was developed based on this assumption.

Table 4 Association between NCD patients' characteristics and the financial burden due to OOP expenditures

Patient's characteristic	**Catastrophic spending (n = 2,016)**		**Impoverishment (n = 2,016)**	
	Yes (n = 1836) n (%)	**No (n = 180) n (%)**	**Yes (n = 1939) n (%)**	**No (n = 77) n (%)**
Age groups		**		*
< 45	107 (86.3)	17 (13.7)	118 (95.2)	6 (4.8)
45 – <60	608 (93.4)	43 (6.6)	637 (97.8)	14 (2.2)
> = 60	1,121 (90.3)	120 (9.7)	1,184 (95.4)	57 (4.6)
Gender				
Male	751 (89.8)	85 (10.2)	809 (96.8)	27 (3.2)
Female	1,085 (91.9)	95 (8.1)	1,130 (95.8)	50 (4.2)
Living area		***		***
Urban	1,193 (92.7)	94 (7.3)	1,258 (97.7)	29 (2.3)

Patient's characteristic	Catastrophic spending (n = 2,016)		Impoverishment (n = 2,016)	
	Yes (n = 1836) n (%)	No (n = 180) n (%)	Yes (n = 1939) n (%)	No (n = 77) n (%)
Ethnicity		*		
Kinh	1,726 (91.4)	162 (8.6)	1,820 (96.4)	68 (3.6)
Others	110 (85.9)	18 (14.1)	119 (93.0)	9 (7.0)
Educational level				***
Illiterate	561 (89.5)	66 (10.5)	587 (93.6)	40 (6.4)
Primary school	378 (89.6)	44 (10.4)	405 (96.0)	17 (4.0)
Secondary school	417 (92.5)	34 (7.5)	439 (97.3)	12 (2.7)
High school	227 (93.4)	16 (6.6)	238 (97.9)	5 (2.1)
College, univ	253 (92.7)	20 (7.3)	270 (98.9)	3 (1.1)
Employment status				
Unemployed	1,088 (90.6)	113 (9.4)	1,147 (95.5)	54 (4.5)
Employed	748 (91.8)	67 (8.2)	792 (97.2)	23 (2.8)
Marital status				
Single	57 (86.4)	9 (13.6)	62 (93.9)	4 (6.1)
Married	1,333 (90.8)	135 (9.2)	1,416 (96.5)	52 (3.5)
Widowed	419 (92.9)	32 (7.1)	433 (96.0)	18 (4.0)
Divorced	27 (87.1)	4 (12.9)	28 (90.3)	3 (9.7)
Health insurance				
Yes	1,559 (91.0)	154 (9.0)	294 (97.0)	9 (3.0)
No	277 (91.4)	26 (8.6)	1,645 (96.0)	68 (4.0)

Note: *: p < .05; **: p < .01; ***: p < .001

Age group ($p < .01$) and ethnicity (0.05) of the NCD members were significantly associated with their chance of incurring catastrophic health expenditure. Table 4 indicates that NCD patients aged 45 to 59 (6.6%) or Kinh people (8.6%) had a lower percentage of experiencing catastrophic spending. The table shows that the living area **($p < .001$)** is significantly associated with the chance of incurring catastrophic health expenditure**.** The percentage of NCD patients in rural households who experienced catastrophic spending for health (**11.8%**) was higher than those in urban areas (**7.3%**)**.** The proportion of NCD patients facing catastrophic expenses differed among groups of NCD members having other employment, marital, or health insurance statuses, but these differences were not significant ($p > .05$).

For impoverishment, the age groups ($p < .05$), living area ($p < .001$), and educational levels ($p < .001$) of NCD members were related factors. The groups of patients whose households were in rural areas **(6.6%)** had a higher proportion of being impoverished than those with households located in urban areas (**2.3%**). The NCD patients aged between 45 and 59 years old (2.2%) or had higher levels of education, such as those who graduated college, university, and post-university (1.1%), had a lower rate of being impoverished.

DISCUSSION

For demographic information, most households are in urban areas, which account for 63.2% of the total households. Many studies also indicated that the proportion of NCD patients in urban areas is usually higher than in rural areas. In a study in Vietnam, the percentage of households with at least one NCD member reported in urban areas was 25**.8%**, which was significantly higher than that in rural areas with only 15**.1%** [16]**.** This high proportion of households in urban areas could partly explain the ratio of household wealth index in each quintile. In particular, 50.7% of households were in quintiles 4 (22.0%) and 5 (28.7%), the two richest quintiles. Another interesting finding is that two-thirds of households in this study have older persons who are 60 and older. This result is in line with many studies and reports that most NCD patients are normally older people [2]. In addition, Vietnam is also facing an aging population issue [17]. Thus, the proportion of NCD patients who are older persons also witness an increase. High health insurance coverage among households as well as among NCD patients was found in this study. In Vietnam, the government and the MoH promulgated many laws and policies to increase health insurance coverage [18-20]. Besides, as mentioned above, most of the NCD patients in this study were older persons. Thus, they might receive

support from the government to be partly or wholly subsidized to join the social health insurance scheme according to the Revised Health Insurance Law, which was enacted in 2014—one year before this study conducted data collection [19].

In the present study, more than 86% of the households with NCD members had to pay OOP for health care. In comparison with a survey conducted in Myanmar, the result from our study is two times higher, although both studies had similar methods to calculate OOP expenses [21].

The different health care systems and socioeconomic characteristics between the two countries might contribute to this difference. In addition, as mentioned above, a high percentage of NCD members had health insurance in the present study, but more than 80% of households still had to pay OOP expenses. It was implied that although financial protection is the most critical aspect of health insurance coverage, there was little impact of health insurance on protecting people from catastrophic payment and impoverishment. This was consistent with some studies and reports conducted in Vietnam on the general population [22] and particular groups such as ethnic minorities [7]. To ease this problem, essential health benefits packages covered by health insurance should be redesigned to target and prioritize the needs of NCD patients, and primary health care facilities should be strengthened so that care can be provided closer to home at lower costs.

In our study, households with NCD members had to pay OOP approximately US$488 for health services in one year. This was higher in comparison with another study in Vietnam. In that study, Vu Duy Kien et al. reported that the average monthly OOP expenses for health care only ranged from US$13.2 to US$26.0 [16].

As most of the NCD patients in our study were living in urban areas and belonged to quintile 5, the mean amount that households could afford and be willing to pay OOP could be higher than NCDs patients who lived in rural areas of a small province as in Vu Duy Kien's study site. For outpatient services, the amount of money for medicine was the highest, at about US$4 in the present study. A study conducted in India also had similar results, with the average amount for medicine being the highest among all direct medical costs, at US$6.4 [23]. For the direct non-medical cost, the transportation fee was recorded as the highest, which was US$2. According to the treatment guidelines published by the Ministry of Health (Decision 5904/QD-BYT on guiding the treatment for patients who suffer from common NCD), patients with NCDs require medicine monthly [24]. Thus, the amount for direct non-medical costs such as transportation was relatively high. Besides, as NCD patients need regular health check-ups to prevent complications, they need to travel to a higher level, such as district or provincial hospitals, to receive the diagnostic tests that generally were not provided at lower levels of care such as commune health stations. This also led to a higher amount of OOP expenses for traveling. For inpatient services, the mean amount of money that households had to pay OOP was almost US$150 for one year. This figure was lower than Hoang Van Minh et al., which concluded that the mean OOP expenses for inpatients were US$268.4 [11]. As the definition of NCD in that research included not only hypertension and diabetes but also other chronic diseases such as cancer, etc., the amount of money for inpatient care might be higher.

Our results show that 8.7% and 3.6% of households with NCD members incurred CHE and impoverishment. This figure is slightly higher than the results from VHLSS in 2010 (8.3%), whose study subjects were the general population. This suggests that more policies supporting household NCD members should be promulgated. When compared to a study by Hoang Van Minh et al. on a similar population (NCD patients), the percentage of households incurring catastrophic spending for health care in our study is much lower. In particular, Minh et al. concluded that the CHE and impoverishment rates among households with NCD members were 14.6% and 7.6%, respectively [11]. An explanation for this might be related to differences in time, study site, and study participants. Our study used data collected in six provinces in 2015. It focused only on households with hypertension and diabetes members, while the study of Minh et al. was only conducted in a district of a province in 2010. It included patients with hypertension, diabetes, and other NCDs. Moreover, most of our sample was households in the urban area, and the sample of Minh's study was a rural district, so the economic status, the availability of health services, and the accessibility of patients were quite different.

With related factors, our results are consistent with the conclusion of other studies. In our study, age group, living area, and educational level are factors associated with financial risk. In a study in Vietnam, Vu Duy Kien et al. concluded that the shares of OOP expenses for health care to household capacity to pay and total health expenditure were significantly higher among rural households than in urban areas [16]. Another study in China also reported that households in rural areas (17.7%) tended to suffer a higher risk of catastrophic health expenditure than urban areas (13.1%) [25]. Another characteristic of patients that is also a determinant of incurring financial burden that was pointed out is educational levels. The analysis showed that NCD patients with higher educational levels had lower risks of financial hardship. This was in line with a study conducted in Korea, which indicated that patients whose highest level of education was middle school and below have a 2.02 times higher risk of facing economic burden than people who graduated college and over [26].

In the present study, there was a high percentage of NCD members with health insurance, but more than 86% of households still had to pay OOP, and 8.6% incurred CHE. This finding might suggest that although financial protection is the most crucial aspect of health insurance coverage, there was little impact of health insurance on protecting people from catastrophic payment and impoverishment. This was consistent with some studies and reports conducted in Vietnam on the general population [22] and particular groups such as ethnic minorities [7]. The authors pointed out that although the health insurance coverage of ethnic minority people is relatively high since they were greatly supported by the government as well as the Vietnam Social Security, there was a certain percentage of patients still forgo treatment, and 24% of them had to borrow money, sold assets, etc. for health care service payments.

LIMITATIONS OF THE STUDY

The cross-sectional nature of the data only allowed us to examine the short-term impacts of household direct OOP payments. In addition, since the study used secondary data, there is some limitation on the availability of the data. The research team could observe the general OOP payments for health, CHE, and impoverishment proportions among the households with at least one member with a chronic disease. It is uncertain whether the payments of the households with chronic disease patients were for chronic disease care or other health services since the secondary data did not provide enough information for analysis. Another limitation is that the secondary data only captured the knowledge of patients with hypertension and diabetes, which are the most common NCDs in Vietnam, and lack information on patients with other NCDs. Thus, this study only measures the financial burden of OOP spending on health care among patients with hypertension and diabetes. However, currently, hypertension and diabetes are the most common NCDs in Vietnam, which makes hypertensive and diabetic patients receive much attention from the government. In addition, the MoH issued several policies to enhance the treatment and management of hypertension and diabetes in primary health care. Thus, the results from this study still meet the need of the government.

CONCLUSIONS AND RECOMMENDATIONS

Households with NCD members risk financial hardship due to payment for lengthy periodic treatment. In the present study, the percentage of households with NCD members who had to pay OOP for health care services was relatively high, at 86.5%. Among those, there were 8.7% and 3.6% of households incurred CHE and impoverishment, respectively, due to OOP spending on health care. Besides, although the proportion of people having health insurance is relatively high, many households still have to pay OOP and incur a financial burden. Therefore, the reform also needs to be considered the health financing mechanism aspects.

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FACTORS ASSOCIATED WITH MENSTRUAL HYGIENE MANAGEMENT AMONG FEMALE STUDENTS IN TANGERANG MUNICIPALITY, INDONESIA

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ABSTRACT

Introduction: The lack of proper guidance, facilities, and tools for girls to manage their menstruation is a neglected public health, social, and educational issue that needs to be prioritized, coordinated, and invested in. Menstrual hygiene management (MHM) is a challenging for adolescent girls in Indonesia since social norms and cultural practice do not always provide them with accurate information of MHM. The objective of this study was to assess factors that influence MHM among female students.

Methods: The quantitative cross-sectional study was conducted among menstruating female students age 12-15 years. A self-administered online questionnaire was used to collect the data in one junior high school by using multistage sampling. Statistical analysis was performed using univariate and bivariate statistics to identify any significant associations between MHM and factors such as socio-demographic characteristics of the sample, sources of information on MHM, and knowledge, attitudes, and enabling factors related to MHM.

Results: The study enrolled 240 junior high school female students, who had mean age of 13.7 years (SD = 0.96). Commonly, their mother was usually the first source of information related to menstruation (37.4%). Over half of the sample self-reported good practice of MHM. However, just over one-third (35.8%) had "*high*" knowledge of MHM. About one in eight (12.1%) felt that menstruation was a disease, just over half (51.2%) believed that menstrual blood contains dangerous substances, and 82.1% were not aware how to properly dispose a sanitary pad. Only one out of six (16.7%) of students had a "positive" attitude toward MHM, while two-thirds were "indifferent." Most of the respondents often felt ashamed and uncomfortable when menstruating, and still believed that they needed to avoid some foods during menstruation. The majority of students reported that they had adequate wash facilities. However, nearly four out of five students reported that school did not provide hand washing soap, a hook, or a mirror. The study revealed that attitude ($p = 0.001$) and wash facilities ($p = 0.033$) were significantly associated with practice of MHM.

Conclusion: The analysis found that attitude and wash facilities influenced the practice of MHM. In addition, socio-cultural factors, e.g., beliefs, myths, and misconceptions, still exist among adolescent Indonesian girls, and that influences their attitudes toward menstruation and practice of MHM. However, wash facilities at school are also an essential factor to enable girls to practice proper MHM. Therefore, the authors recommend improvement of wash facilities in schools with adolescent female students in order to meet the need for MHM. Moreover, schools need to provide comprehensive reproductive health education with the existing school health program (UKS) and primary health care in order to address knowledge and attitude gaps regarding socio-cultural norms and the practice of MHM.

Keywords: *adolescence, female students, menstruation, menstrual hygiene management*

INTRODUCTION

According to the World Health Organization (WHO), adolescence is the stage of life during when an individual transitions from childhood to adulthood. The ages of ten to 19 years are crucial for healthy development and establishing a foundation for good health in adulthood. Adolescents experience rapid growth in physical, cognitive, and psychosocial dimensions, and the vast majority of human females start menstruation during this period. Menstruation is a natural process of releasing blood and tissue from the uterus through the vagina as part of the normal menstrual cycle. Most women experience first menstruation (menarche) between the age of eight to 15 years [1, 2].

Menstrual hygiene management (MHM) is a challenge for adolescent girls even though it is essential for good physical and mental health. The lack of proper guidance, facilities, and tools for girls to practice MHM is a neglected public health, social, and educational issue that needs to be prioritized, coordinated, and invested in.
According to UNICEF guidelines, proper MHM refers to a process whereby "Women and adolescent girls use a clean material to absorb or collect menstrual blood, and this material can be changed in private as often as necessary for the duration of the menstrual period by utilizing water and soap to clean their body and access cleaning facilities safely and conveniently…and without fear and inconvenience." Proper practice of MHM requires a certain basic level of knowledge and skill, social support, and hygiene facilities, and this is particularly important for girls in lower- and middle-income countries [3].

Adequate knowledge and constructive attitudes toward MHM are important for adolescent girls, especially before they begin menstruating. Without the requisite knowledge, girls may be prone to believing myths or acquiring harmful misunderstandings about menstruation and MHM [4]. False ideas and dangerous myths are handed down from one generation to the next, and these vary among cultures, e.g., in sub-Saharan Africa, Middle East, and Asia [5]. Consequently, insufficient knowledge and negative attitudes about menstruation and puberty might cause stress, self-stigma, and anxiety about a bodily function that is perfectly natural and important for female reproductive health [6].

A study in Ethiopia found that most of the adolescent female school students already knew that menstruation was natural process, however, some students considered it as curse from God, a disease, or of unknown origin. This ignorance about menstruation is directly linked to poor MHM [7]. Across societies, a girl's mother is usually the first source of information about menstruation, but that sharing of information may occur only after menarche. One harmful myth is that a girl should use the least invasive sanitary pad or piece of cloth to absorb vaginal blood in order to protect her virginal status. Another common belief is that a girl must wash a used sanitary pad or cloth before disposal, otherwise they would be followed by the devil. Some cultures have food and behavioral taboos for menstruating girls and women [4, 8, 9].

A survey in Tangerang (a suburb of Jakarta) found that many adolescent students had inadequate knowledge about puberty and menstruation, and subscribed to myths and taboos about eating and behaviour during menstruating [10]. There are also structural factors which can enable or inhibit a girl's practice of proper MHM, such as wash facilities in schools, and availability and affordability of MHM materials. The Tangerang study also found that the majority of public schools did not have adequate facilities such as tissue, soap, and water, as well as a trash bin to hygienically dispose of used MHM materials. Indonesian public schools do not typically provide menstrual pads in the girls' restroom [10]. Thus, this study further explored factors associated with MHM among female students in one school in Tangerang Municipality, Indonesia.

METHODS

This research used a quantitative cross-sectional design, and data were collected from April to May, 2022. The study population was 240 menstruating female students, age 12 to 15 years old, in one junior high school in Tangerang Municipality. At the time of data collection, the study school had not yet received an MHM intervention from UNICEF and had wash facilities that were inadequate for proper MHM. The survey was conducted online, using a self-administered questionnaire on a unique, confidential platform. All participating students provided voluntary, online consent before filling out the questionnaire.

The questionnaire was adapted from previous studies and UNICEF guidelines. The questionnaire content included socio-demographic characteristics, source of information on menstruation, knowledge and attitudes about menstruation, and practice of MHM. The validity of questionnaire was measured by three public health experts using the Item-Objective Congruence (IOC) Index. The items which scored > 0.5 were included in the study. A pre-test of the questionnaire was conducted to assess internal reliability. Cronbach's alpha coefficient was 0.781, and that is an acceptable level.

The data were analyzed by descriptive statistics, and Bloom's cut-off point was applied for classifying knowledge, attitude, and wash facilities. Bivariate analysis used the Chi-square test to identify significant associations between practice of MHM as the dependent variable and factors influencing MHM (e.g., socio-demographic characteristics, source of information on menstruation, knowledge, attitudes, and enabling factors related to MHM). Statistical significance of associations was set at p-value < 0.05.

RESULTS

SOCIODEMOGRAPHIC CHARACTERISTICS AND SOURCE OF INFORMATION ON MENSTRUATION

Table 1 shows that among the 240 participants, almost 60% were 14-15 years old, with mean age of 13.7 (SD = 0.96). The girls were split roughly evenly between grades 7, 8, and 9. Nearly all (97.1%) were Muslim. Over 90% of respondents said their parents did not have a bachelor's degree, and three out of five estimated their household income as less than $300 per month. Average age of menarche was 12.3 years, and most (88.3%) experienced more than four days of menstrual bleeding per cycle. Fully 85.4% said they had known about menstruation before menarche, and three out of five were first told by a female relative (e.g., mother, sister, other female relative). Over three-fourths had received information about menstruation at school.

Table 1 Socio-demographic Characteristics; Knowledge and Experience of Menstruation (N=240)

Socio-demographic Characteristics; Knowledge and Experience of Menstruation	**Frequency**	**%**
Sociodemographic Characteristics		
Age (Mean ± SD; 13.72 ± 0.96) (Min-Max; 12-15)		
12-13 years old	104	43.3
14-15 years old	136	56.7
Education Grade		
Grade 7	87	36.3
Grade 8	81	33.8
Grade 9	72	30.0
Religion		
Islam	233	97.1
Catholic	2	0.8
Protestant	3	1.3
Hinduism	1	0.4
Buddhism	1	0.4
Mother's Educational Level		
Low Level < bachelor degree	224	93.3
High Level ≥ bachelor degree	16	6.7
Father's Educational Level		
Low Level < bachelor degree	221	92.1
High Level ≥ bachelor degree	19	7.9
Household Income (Indonesian Rupiah/month)		
Low < 4,230,000	141	58.8
High ≥ 4,230,000	99	41.3
Receive personal monthly allowance (pocket money)		
No	2	0.8
Yes	238	99.2
Source of Information and Variable on Menstruation		
Age at Menarche (years) (Mean ± SD; 12.3 ± 0.55) (Min – Max; 11-15)		

Socio-demographic Characteristics; Knowledge and Experience of Menstruation	Frequency	%
8-11	2	0.8
12-15	238	99.2
Duration of Menstruation (days)		
≤ 4	28	11.7
> 4	212	88.3
Knew about menstruation before menarche		
No	35	14.6
Yes	205	85.4
First source of information about menstruation		
Mother	163	37.4
Sister	40	9.2
Female Relative	50	11.5
Teacher	45	10.3
Friends	91	20.8
Health workers	6	1.4
Internet source	38	8.7
Others	3	0.7
Ever got information of menstruation at school		
No	56	23.3
Yes	184	76.7

KNOWLEDGE OF MENSTRUAL HYGIENE MANAGEMENT

Table 2 presents data on knowledge of MHM based on response to 20 true/false statements. The majority of students answered correctly regarding the definition of menstruation and biological aspects of menstruation. The majority of students (87.9%) understood that menstruation is not a disease, however over half believed incorrectly that menstrual blood contained dangerous substances. More than two-fifths considered that physical activity is dangerous for a girl during menstruation, while 91.3% correctly answered that taking a bath is good MHM. However, three out of five students did not know that they should wash their genitalia daily with plain water at least once a day during menstruation. The vast majority (92.9%) knew they should change their sanitary pads every 3-4 hours during menstruation, however 82.1% did not know how to properly dispose of used pads. Taken together, the authors rate the level of MHM knowledge of this sample of students at a "*moderate*" level for half, while more than one-third had a "*high*" level of MHM knowledge (Table 3).

Table 2 Knowledge of Menstrual hygiene management (MHM) (N=240)

True or False Statements	Correct Answer n (%)
Menstruation is a bleeding from the woman's womb because of thickening of the uterine wall	212 (88.3)
Normal interval between first menstruation with the next menstruation is 28 days	129 (53.8)
Normal duration of menstruation is 2-7 days	209 (87.1)
Menstruation is a normal process	236 (98.3)
Menstruation is a disease*	211 (87.9)
A girl normally experiences menstruation once every month	234 (97.5)
Menstruation commonly starts between age 10 and 15 years, though sometimes earlier or later	228 (95.0)
Menstruation is controlled by hormones	200 (83.3)
Menstrual blood contains dangerous substances*	117 (48.8)
Menstrual blood comes from the uterus/womb	209 (87.1)
Menstruation signifies that a girl is biologically able to get pregnant	158 (65.8)
Menstruation is a sign that a girl has already reached the puberty	238 (99.2)
Older women eventually will stop menstruating	213 (88.8)
Pregnant women menstruate*	174 (72.5)

True or False Statements	Correct Answer n (%)
It is dangerous for a girl to engage in vigorous physical activity during menstruation*	128 (53.3)
It is good for a girl to take a bath regularly during menstruation	219 (91.3)
During menstruation, a girl should wash their genitalia using water only at least once a day	96 (40.0)
During menstruation, a girl should wash the genitalia by using feminine cleansing soap*	33 (13.8)
The menstrual material should be changed every 3-4 hours	223 (92.9)
Disposable sanitary pad is properly disposed in a trash bin after wrapping it with plastic without being washed	43 (17.9)

*Incorrect statement

Table 3 Level of Knowledge of Menstrual hygiene management (MHM)

Variables	Frequency	%
Low	20	8.3
Moderate	134	55.8
High	86	35.8

ATTITUDE TOWARD MENSTRUAL HYGIENE MANAGEMENT

Table 4 presents data on attitudes of these female junior high school students towards MHM based on level of agreement with 32 statements. The statements probe belief in myths and misconceptions which can be socio-cultural in origin. The findings show that 27.1% of students agreed that a girl is '*dirty*' during menstruation, and approximately two-fifths thought that menstruation should be kept secret. A large majority agreed that hand hygiene was important before and after changing pads, but 45.8% incorrectly thought that sanitary pads only need to be changed when they are full. Almost all students agreed with the need to take a daily bath during menstruation. Three out of four (73.3%) students preferred not to talk openly about menstruation, and most (62.5%) thought that girls felt uncomfortable during menstruation, and 47.5% felt that girls feel ashamed during menstruation.

Three out of five of the sample believed (incorrectly) that some foods should be avoided during menstruation. Inexplicably, 72.1% of these students believed that they could be followed by evil spirits after disposing of used sanitary pads. Notably, nearly all the sample knew (correctly) that, according to Islamic teaching in Indonesia, they should not pray, fast, or touch the Koran during menstruation. Indeed, four out of five believed that they should not enter a place of religious worship during menstruation. When taking all these responses into consideration, the authors rate the level of attitudes toward MHM among these female students as "*neutral*" for three out of five (65.8%), while only 16.7% had a "*positive*" attitude toward MHM (Table 5).

Table 4 Attitudes toward Menstrual hygiene management (MHM) (N=240)

Statement	Agree n (%)	Neither Agree nor Disagree n (%)	Disagree n (%)
I believe a girl is dirty during menstruation*	65 (27.1)	65 (27.1)	110 (45.8)
I think menstruation should be kept secret*	94 (39.2)	81 (33.8)	65 (27.1)
I believe that washing the genitalia using the water is important	240 (100.0)	0 (0)	0 (0)
I think drying the genitalia with tissue/towel is important after washing genitalia	167 (69.6)	47 (19.6)	26 (10.8)
I believe that washing hands using soap before and after changing the pads is not important*	18 (7.5)	29 (12.1)	193 (80.4)
I believe that keeping hygienic during menstruation is unnecessary and troublesome*	18 (7.5)	20 (8.3)	202 (84.2)
I think changing the pads is done when only the pads are full*	110 (45.8)	43 (17.9)	87 (36.3)
I think changing the underpants is done if it is only already dirty*	63 (26.3)	43 (17.9)	134 (55.8)
I think washing hair during menstruation is necessary	101 (42.1)	85 (35.4)	54 (22.5)

Statement	Agree n (%)	Neither Agree nor Disagree n (%)	Disagree n (%)
I think taking a bath is needed during menstruation	224 (93.3)	7 (2.9)	9 (3.8)
I think it is okay to talk freely about menstruation	42 (17.5)	69 (28.7)	129 (53.8)
I would prefer not to talk openly about menstruation*	176 (73.3)	43 (17.9)	21 (8.8)
I think it is uncomfortable for girls to talk about menstrual periods*	150 (62.5)	52 (21.7)	38 (15.8)
I think a girl often feels ashamed about menstruation*	114 (47.5)	58 (24.2)	68 (28.3)
I think it is embarrassing to be seen when buying menstrual material*	93 (38.8)	48 (20.0)	99 (41.3)
I think menstruation does not affect my usual activities	186 (77.5)	26 (10.8)	28 (11.7)
I believe cutting the nails/hair is not allowed during menstruation*	142 (59.2)	56 (23.3)	42 (17.5)
I believe washing hair during menstruation is not allowed*	89 (37.1)	66 (27.5)	85 (35.4)
I believe using sanitary napkins will cause infertility*	2 (0.8)	29 (12.1)	209 (87.1)
I believe swimming is not allowed during menstruation*	110 (45.8)	68 (28.3)	62 (25.8)
There are some foods that girls should avoid during menstruation*	154 (64.2)	70 (29.2)	16 (6.7)
I believe eating pineapple will trigger painful menstruation*	44 (18.3)	159 (66.3)	37 (15.4)
I believe eating chocolate can hasten duration of menstruation*	10 (4.2)	163 (67.9)	67 (27.9)
I believe drinking iced beverages can freeze menstrual blood*	134 (55.8)	53 (22.1)	53 (22.1)
I believe drinking soda can hasten duration of menstruation*	51 (21.3)	134 (55.8)	55 (22.9)
I believe girls are potentially followed by evil spirits during menstruation when throwing away/not washing the menstrual material used*	173 (72.1)	49 (20.4)	18 (7.5)
I believe taking naps can increase menstrual bleeding*	45 (18.8)	146 (60.8)	49 (20.4)
I believe praying is not allowed during menstruation	235 (97.9)	2 (0.8)	3 (1.3)
I believe fasting is prohibited for girl during menstruation	233 (97.1)	5 (2.1)	2 (0.8)
I believe touching and reciting Quran/Holy book is not allowed during menstruation	229 (95.4)	7 (2.9)	4 (1.7)
I believe entering a mosque/church/temple/ religious place is not allowed during menstruation	192 (80.0)	39 (16.3)	9 (3.8)
I believe girl is not allowed to go to a cemetery during menstruation*	129 (53.8)	99 (41.3)	12 (5.0)

*Incorrect statement

Table 5 Level of Attitude toward Menstrual hygiene management (MHM)

Level	Frequency	%
Negative	42	17.5
Neutral	158	65.8
Positive	40	16.7

FACTORS ASSOCIATED WITH MENSTRUAL HYGIENE MANAGEMENT

Table 6 presents the results of the analysis of factors associated with MHM among the sample of 240 female junior high school students. With regard to the practice of MHM, just over half the respondents claim to

practice "*good*" MHM. Additionally, the majority of students had "*moderate*" knowledge and a "*neutral*" attitude toward MHM (55.8% and 65.8%, respectively). Two-thirds (68.8%) reported that their school had "*adequate"* wash facilities, while almost all (94.6%) reported that their parents provide them with MHM supplies. Significant proportions of students reported that a storage box with free sanitary napkins (86.7%) or commercial menstrual pads (77.9%) were not available at school. Fully 88.8% said that there is a shop within 20 minutes walking distance from the home or school where they could purchase MHM supplies, and 80.3% say they had done so in the past. However, one in ten said they felt too embarrassed to buy menstrual pads from a shop by themselves. Nearly all respondents said they could afford to buy MHM supplies at school if they were available.

Table 6 Practice of Menstrual Hygiene Management (MHM) and Enabling Factors for MHM (N=240)

Variables	**Frequency**	**%**
Practice		
Poor Practice	195	47.7
Good Practice	214	52.3
Wash Facilities (home & school)		
Inadequate	75	31.3
Adequate	165	68.8
Menstrual material provided by parents		
No	13	5.4
Yes	227	94.6
Storage box available for sanitary pads at school		
No	208	86.7
Yes	32	13.3
Commercial menstrual pads available at school		
No	187	77.9
Yes	53	22.1
There is a shop within 20 minutes walking distance to purchase MHM supplies		
No	27	11.3
Yes	213	88.8
Ever bought MHM supplies from the local shop (N=213)		
No	42	19.7
Yes	171	80.3
Reason not buy MHM supplies in local shop (N=42)		
Someone else purchases them for me	33	78.6
Expensive	1	2.4
Poor quality	2	4.7
Embarrassed	4	9.6
Prefer to use non-commercial material	2	4.7
Ever paid to get sanitary pads at school		
No	87	36.3
Yes	153	63.7
Can afford to buy sanitary pads at school (N=153)		
No	4	2.6
Yes	149	97.4

ASSOCIATED FACTORS OF PRACTICE ON MENSTRUAL HYGIENE MANAGEMENT AMONG FEMALE STUDENTS

Table 7 presents the results of the analysis of factors by association with practice of MHM. Only two variables were statistically-significantly associated with MHM practice, namely, attitude toward MHM and availability of wash facilities at school.

Table 7 Factors Associated with Menstrual Hygiene Management (MHM) Practice (N=240)

Independent Variables	Practice of MHM				P-value[1]
	Poor		Good		
	n	%	n	%	
Age (years)					
12-13	49	47.1	55	52.9	0.727
14-15	61	44.9	75	55.1	
7	46	52.9	41	47.1	0.105
8	38	46.9	43	53.1	
9	26	36.1	46	63.9	
Religion					
Islam	107	45.9	126	54.1	1.000[a]
Other	3	42.9	4	57.1	
Mother's educational level					
Low level	101	45.1	123	54.9	0.387
High	9	56.3	7	43.8	
Father's educational level					
Low	103	46.6	118	53.4	0.412
High	7	36.8	12	63.2	
Household monthly income					
Low	63	44.7	78	55.3	0.669
High	47	47.5	52	52.5	
Personal monthly allowance (Pocket money)					
No	2	100.0	0	0.0	0.209[a]
Yes	108	45.4	130	54.6	
Age at menarche (years)					
8-11	2	100.0	0	0.0	0.209[a]
12-15	108	45.4	130	54.6	
Duration of menstruation (days)					
≤ 4	16	57.1	12	42.9	0.201
> 4	94	44.3	118	55.7	
Received MHM information					
No	14	40.0	21	60.0	0.454
Yes	96	46.8	109	53.2	
Ever got MHM information at school					
No	29	51.8	27	48.2	0.307
Yes	81	44.0	103	56.0	
Level of knowledge of MHM					
Low	12	60.0	8	40.0	0.090
Moderate	66	49.3	68	50.7	
High	32	37.2	54	62.8	
Attitude toward MHM					
Negative	14	33.3	28	66.7	0.001
Neutral	86	54.4	72	45.6	
Positive	30	75.0	10	25.0	
Wash facilities (school & home)					
Inadequate	42	56.0	33	44.0	0.033
Adequate	68	41.2	97	58.8	
MHM supplies provided by parents					
No	8	61.5	5	38.5	0.243
Yes	102	44.9	125	55.1	

Independent Variables	Practice of MHM				P-value[1]
	Poor		Good		
	n	%	n	%	
School has storage box for MHM supplies					
No	98	47.1	110	52.9	0.309
Yes	12	37.5	20	62.5	
Commercial menstrual pads available at school					
No	84	44.9	103	55.1	0.594
Yes	26	50.9	27	49.1	
There is a shop within 20 minutes walking distance to purchase MHM supplies					
No	14	51.9	13	48.1	0.505
Yes	96	45.1	117	54.9	
Ever bought MHM supplies from the local shop (N=213)					
No	19	45.2	23	54.8	0.981
Yes	77	45.0	94	55.0	
Ever paid for sanitary pads at school					
No	41	47.1	46	52.9	0.762
Yes	69	45.1	84	54.9	
Can afford to buy sanitary pads at school (N=153)					
No	3	75.0	1	25.0	0.223
Yes	66	44.0	83	56.0	

Notes: [1] P-value < 0.05 are in bold; [a] P-value by Fisher's exact test

DISCUSSION

With regard to sociodemographic characteristics including age, education grade, mother's and father's educational level, household income, and pocket money, the analysis found that those variables were not significantly associated with the practice of MHM. These findings are contrary to other studies that found significant associations between those variables with the practice of MHM [11-16]. It is possible that there are cultural and structural differences among countries around the world that would produce different results for the same variables. With regard to religion, this study is in line with other studies that found no significant association between religion and the practice of MHM [17].

Regarding knowledge of MHM, the analysis found that 55.8% of students had a "*moderate*" level of knowledge, while nearly a half had "*poor*" MHM practice. Even though the majority of students answered correctly regarding the definition and biological aspects of menstruation, slightly over a half still perceived that menstrual blood contains dangerous substances, and one out of eight believed that menstruation is a disease. A comparable study in Ethiopia found that, while most students knew that menstruation is a natural process, they still considered it as a disease [7]. Additionally, a significant proportion of students in the present study reported that they wash their genitalia using feminine cleansing soap, and they still did not know how to properly dispose the used MHM supplies. Nearly all knew that the pads should be change replaced every 3-4 hours. Another study in

Indonesia also found that female students still used special soaps and feminine cleansing liquids when, in fact, washing with plain water is enough to clean the genitalia [18]. The usage of feminine cleansing soap is not recommended to clean the genitalia because it can disrupt the natural vaginal flora which protect against reproductive tract infection [19]. Overall, the current study indicates that this sample of adolescent girls in one school outside Jakarta still did not have sufficient knowledge of proper MHM. Thus, there is a need for more comprehensive health education and supportive resources in the schools, even at younger grade levels than junior high school. While nearly all the students said they knew about menstruation before they experienced menarche, the most common initial source of information was a close female relative, not the school.

This study found that the summary attitude toward MHM was significantly, *but inversely*, associated with the practice of proper MHM, and that finding is consistent with previous research [20]. Most of the respondents had a "*neutral"* attitude toward MHM

(i.e., indifferent), while less than a fifth had "*positive*" attitude. Indeed, out of 40 respondents who had a "*positive*" attitude toward MHM, three-fourths had "*poor*" MHM practices. There were similar proportions of *poor* and *good* practice of MHM among the sample with a *neutral* attitude toward MHM. Many of the students still believe that menstruation is "*dirty*" and it should be kept secret. Moreover, the majority of students in this study preferred not to talk openly about menstruation, and they believe that other girls feel ashamed and uncomfortable when they are menstruating. Those findings were similar with other studies conducted in Indonesia and other countries which found that there are significant proportions of students who adhere to social-cultural norms which are not always consistent with good MHM or include harmful myths and misconceptions about menstruation [8, 21, 22]. Supportive resources in terms of informational, emotional, and tangible support are essential for adolescent girls in order to practice proper MHM [3].

This study found that accessibility of wash facilities was significantly associated with the practice of MHM, and that is consistent with a comparable study conducted in Myanmar [23]. The findings showed that three out of five students reported that their school and home had "*adequate*" wash facilities, and that was significantly associated with "*good*" practice of MHM. This illustrates that this factor is facilitating influence to enable a desired behavior [24]. It is notable that another study in Indonesia found insufficient wash facilities at school (such as soap, trash bins), and that caused girls to feel ashamed and uncomfortable when trying to practice MHM at school. However, further research is needed to establish the relationship between accessibility of wash facilities at school and proper MHM.

Most of the students reported that the school did not provide a storage box of sanitary napkins, but there was availability of commercial pads at school. Although the students had to pay for the commercial the pads, they all reported that the cost was affordable. In Indonesia, the price of a sanitary pad is around Rp 4,000 (± USD 0.30). Still, public schools should ensure that there are no barriers to accessing sanitary pads for students, and provision of a free supply should be mandatory.

CONCLUSIONS

This study found that 52.3% of students had "*good*" practice of MHM in the sampled junior high school. Meanwhile, only 35.8% and 16.7% of students had "*high*" knowledge and "*positive*" attitudes toward MHM, respectively. The first source information about menstruation among these students was usually their mother. However, there should be involvement of other sources of information to ensure standardized and accurate content. Our study also revealed that the attitudes toward MHM and wash facilities were significantly associated with the practice of MHM.

RECOMMENDATIONS

Based on the findings from this study, the authors recommend the integration of comprehensive reproductive health education with both existing school health program (UKS) and primary health care. It is important that all Indonesian female youth have a positive attitude toward MHM, and properly practice MHM. This requires a base of knowledge of accurate information, and dispelling of myths that might discourage correct MHM. More importantly, there needs to be a supportive environment for MHM, such as improving wash facilities at school in order to meet the needs of menstruating students. There should be a storage box with school-subsidized sanitary napkins as well as availability of commercial pads. Future studies should use qualitative data collection methods to probe barriers to more positive attitudes and MHM behavior. Observational studies are also important to assess the MHM-enabling factors at school and the home. Larger sample sizes and a greater variety of schools would provide more robust data and improve statistical analysis.

ETHICAL DECLARATION

The protocol for this research was approved by the Institutional Review Board of Faculty of Medicine and Heath Science at University of Muhammadiyah Jakarta. The certificate of ethical exemption is No.062/PE/KE/FKK-UMJ/IV/2022. Before collecting data, the researchers explained the study to the respondents and obtained written consent from both parents/guardians and the respondents.

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FACTORS ASSOCIATED WITH THE UTILIZATION OF ANTENATAL CARE SERVICES IN SYLHET, BANGLADESH

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ABSTRACT

Introduction: Antenatal Care (ANC) is considered as an essential element for a pregnant woman to reduce maternal mortality and neonatal death. However, a national survey of Bangladesh found that, in Sylhet Division, the percentage of women receiving the recommended four ANC check-ups by a trained practitioner is less than one-third (31.8%), and that rate is the lowest among all eight divisions in the country (Bangladesh Demographic and Health Survey 2017-18). Moreover, there is an increasing tendency of anxiety burden among pregnant women in the Covid-19 era, and that is having a discouraging effect on ANC utilization. There are limited studies that explore low ANC coverage and anxiety burden among pregnant women in the Sylhet region.

Objectives: To estimate the ANC service utilization rate, and examine the association of personal characteristics of pregnant women and Covid-related anxiety with ANC utilization in Sylhet Division of Bangladesh.

Methodology: This was a cross-sectional study, and respondents were selected by purposive sampling in three health service units in two districts of Sylhet Division. The measurements included an assessment of ANC service, accessibility, anxiety, and socio-cultural factors. Simple random sampling was employed to recruit the pregnant women during the waiting time at each ANC service unit. Face-to-face interviews using a structured questionnaire were performed during April-May, 2022. Descriptive statistics, Chi-square test, and binary and multiple logistic regression were applied to determine the statistically-significant factors associated with ANC utilization.

Results: The study found that 50.8% of pregnant women had adequate ANC utilization, and more than half had difficulty of affording the prescribed ANC medicine and ultrasound (52.1% and 51.1% respectively). Just under one-fourth (24.3%) of the sample indicated moderate-to-severe anxiety related to Covid-19. Multiple logistic regression identified that factors associated with ANC utilization include income (AOR: 2.09; 95% CI: 1.12-3.90), and social media usage (AOR: 1.74; 95% CI: 1.02-2.98). The majority of pregnant women who had no savings, had no access to social media, did not receive folic acid supplement, and had difficulty affording ANC medicine and ultrasound were prone to not achieving adequate ANC utilization.

Conclusions: Family planning and maternal & child health (MCH) programs should reach out to young married women to emphasize the importance of ANC, should they become pregnant. Local government agencies should provide more support for essential ANC services and related medicines or diagnostics, especially to help lower-income pregnant women in rural areas receive the pre-natal care they are entitled to.

Keywords: *Antenatal Care (ANC) visits, Utilization, Sylhet*

INTRODUCTION

Antenatal care)ANC(refers to the series of check-ups for pregnant women to ensure optimal health for both mother and fetus during pregnancy and up to delivery. The components of ANC comprise risk identification, prevention and management of pregnancy-related or concurrent diseases, health promotion, and education)1(. In this context ANC should reduce preventable maternal and perinatal morbidity and mortality, both directly and indirectly, by detection of anomalies, treatment of complications, and referral to the appropriate level of care. In this way, ANC is considered as an essential element for maternal healthcare during pregnancy)2(. Globally, during the period 2007–14, only 64% of pregnant women received the minimum level of ANC as recommended by the World Health Organization)WHO( )1(. While ANC utilization has increased significantly over the last two decades, the quality of ANC is less than optimal)3(.

In reducing maternal and neonatal mortality among Southeast Asian countries, Bangladesh has showed remarkable progress. National data indicate that the maternal mortality rate)MMR(decreased by 40%, or from 322 to 194 per 100,000 live births between 2001 and 2010)4(. The 2017-18 Bangladesh Demographic and Health Survey)BDHS(demonstrated that the percentage of women receiving ANC from a trained practitioner increased sharply since 2014, from 64% to 82% at the time of the survey. There has also been an increase in the percentage of women with four or more ANC visits during the latest pregnancy, from 31% to 47%)5(. However, the latest figure for the MMR in Bangladesh is 176 per 100,000 live births, and the neonatal mortality rate was 25 per 1,000 births, which is high compared to other countries. National data indicate that only 8% of pregnant Bangladeshi women received all eight recommended ANC check-ups)6(. In Sylhet Division, the proportion of pregnant women who received four ANC check-ups by a trained practitioner was only 31.8%, which is sub-par compared to the national average of 44.0% among all eight divisions. The coverage of quality ANC services is still critically low in urban)26.8%(and rural)14.3%(areas, and there are regional disparities, notably in the north-eastern region around Sylhet Division, where the coverage of quality ANC was estimated to be only 10.8%)5(. This figure indicates the fragile status of maternal and neonatal health)MNH(in that part of Bangladesh. Furthermore, the 2016 Bangladesh Maternal Mortality Survey)BMMS(reported that essential MNH service utilization was critically low)7(. After the Covid-19 pandemic struck, this threat further compromised the people's physical and mental health, starting in early 2020.

The mental health impacts of Covid are already well-documented by researchers around the world. A study in Turkey found that Covid-related anxiety and depressive symptoms were reported by up to 28% of pregnant women. The adverse psychological effects included anxiety, stress, depression, emotional dis-stability, and these may exacerbate a person's already fragile mental condition)8(. It has been observed that vulnerable groups like pregnant women are more prone to adverse secondary psychological impacts of Covid-19, and they require special attention. A study conducted in Wuhan, China by Ding et al found that prenatal anxiety had increased slightly during the Covid-19 era, and was affecting one in five pregnant women in 2020. That study also found that concern about being potentially exposed to Covid-19 was a significant deterrent to seeking ANC)9(. A 2021 study in northwest Ethiopia found that 44.8% of pregnant women in Gondar City practiced "good" Covid-19 preventive practices, and seeking ANC was significantly associated with good adherence to Covid prevention practice)10(.

In Bangladesh, research on ANC utilization found that education, wealth, place of residence, religion, and husband's employment were significantly associated with ANC contacts by a trained provider)5, 11(. Socio-cultural factors such as traditional beliefs, cultural practices, level of autonomy in decision-making, and perception of medical interventions, were also significant predictors of a woman's ANC behavior in rural Bangladesh)12(. There are a number of other studies which have documented factors associated with use of ANC in Bangladesh)6, 11, 12(. However, there is limited information on the low ANC coverage in the Sylhet Division and the anxiety burden among pregnant women during the Covid pandemic. Therefore, this study tried to identify some of the significant factors associated with the utilization of ANC services among pregnant women for promoting ANC in this part of Bangladesh.

METHODS

STUDY DESIGN

A cross-sectional study was conducted to explore the utilization of ANC service. There are four district-level cities in Sylhet Division, and two (Sylhet and Sunamgonj) were selected for this study. Cases were sampled from the ANC units in the public hospital/clinics in the two cities.

STUDY POPULATION

The study population was ANC clients in one public hospital in Sylhet and two public hospital/centers in Sunamgonj. The sites are as follows: (1) Model clinic of Sylhet M. A. G. Osmani Medical College Hospital; (2) Sunamgonj District Sadar Hospital; and (3) Mother and Children Welfare Center of Sunamgonj. The prescribed sample size was determined using the following formula:

Sample size determination
Where n = sample size
Z = 1.96 standard normal deviation set as corresponding 95% confidence interval
p= (the prevalence of ANC utilization in Sylhet Division, 31.8%)
d = precision (margin of error)

$$n = \frac{z^2 \times P(1-P)}{d^2}$$

$$n = \frac{(1.96)^2 \times .32(1-.32)}{(.05)^2}$$

n = 334.37 + 10%, = 367.8, = 368

According to sample size determination, a total of 374 pregnant women who ranged in age from 15-49 years, and who had registered for ANC, were selected through simple random sampling.

STUDY INSTRUMENT

All participants who voluntarily agreed to participate in the study were interviewed using a structured questionnaire, consisting of the following five sections: (1) Personal factors (e.g., age, area of residence, religion, occupation, education, household income, and whether the current pregnancy was planned; (2) Socio-cultural related issues (e.g., autonomy in decision-making, social media usage, husband's assistance in travelling to the ANC provider); (3) Factors related to ANC (e.g., gestational age at first ANC visit, total number of ANC visits including this one; whether received folic acid supplements and tetanus toxoid vaccination, affordability of prescribed medicines, affordability of prescribed ultrasound); (4) Covid-related issues (e.g., masking, hand hygiene); and (5) Generalized anxiety disorder measurement questions (GAD 7 scale). GAD7 has a four-point Likert scale with seven questions measuring anxiety level and one question related to the woman's daily workload. The seven questions covered emotions such as feeling nervous, inability to stop worrying, worrying too much, having trouble relaxing, being restless, feeling irritated, and fearing something dreadful is going to happen. The GAD7 scale score of 0-4 indicates minimal anxiety, 5-9 indicates mild anxiety, 10-14 indicates moderate anxiety, and 15-21 indicates severe anxiety [13]. A pretest of the questionnaire was conducted after obtaining approval from the Mahidol Institutional Review Board on Ethics and Human Research.

In this study ANC visit refers to a check-up of the status of the pregnant woman by an ANC provider (doctor, nurse, trained/untrained practitioner). ANC utilization was measured by the number and timing of ANC check-ups during the current pregnancy. Adequate ANC utilization is defined as the combination of having a timely first ANC visit (i.e., during the first trimester of pregnancy) and timeliness of all subsequent ANC visits. In this study, "adequate ANC utilization" was defined as having four ANC check-ups throughout the pregnancy, where at least one was

provided by a trained practitioner, and the first check-up was in the first trimester of pregnancy.

DATA COLLECTION PROCEDURES

Data was collected by trained interviewers during April – May, 2022. The interviewers obtained informed, written consent from all participants before starting the interview. Consent from the guardian, husband, or sister-in-law was also required if the participant was under age 20 years. Standard Covid-19 prevention protocol was maintained throughout the interview (e.g., social distancing, masking, hand hygiene, etc.).

DATA ANALYSIS

Data was analyzed using SPSS version 25. Univariate analysis was applied to describe the proportion with adequate ANC utilization. The Chi-square test and binary logistic regression were employed to examine the factors associated with adequate utilization of ANC. The "enter method" was used to develop the multivariate model. The associations among factors in the multivariate and bivariate analysis are presented with Crude Odds Ratio (COR), and Adjusted Odds Ratio (AOR). Statistical significance was determined by a 95% confidence interval (CI), i.e., a *p-value < 0.05* was considered statistically significant.

ETHICAL APPROVAL

Ethical clearance for the study protocol was obtained from the Committee for Research Ethics (Social Science), Mahidol University (No.2022/054.2804).

RESULTS

ADEQUATE ANC UTILIZATION

As noted in the methodology section "adequate ANC utilization" was measured by a combination of the number and timing of the ANC visit by gestational age. Since the sample comprised pregnant women at different stages of pregnancy, it was not possible to know what the complete number and timing of the ANC check-ups would be before delivery for the entire sample. If a respondent had her first ANC check-up in the first trimester of pregnancy)i.e., first 12 weeks(, and her total number of visits were in accordance with the recommended timing of check-ups up to her gestational age at that time)regardless of the number of check-ups(, then that case was coded as having "adequate ANC." For the purpose of this study, a four-visit focused ANC)FANC(model was treated as the standard for interpretation and analysis. The following table describes the level of adequate ANC for the sample of pregnant women in the study sites. Approximately half the sample)50.8%(had received adequate ANC at the time of their latest check-up in April-May, 2022.

Table 1Prevalence of "Adequate ANC Utilization" of Currently-Pregnant Women (*n*=374)

Adequate ANC utilization	Number	Percentage
Yes	190	50.8
No	184	49.2

INDIVIDUAL CHARACTERISTICS OF RESPONDENTS

Table 2 presents data on sample characteristics. Three out of five of the pregnant women)61.7%(were age 15-24. The range of age was from 17 to 40 years. More than half of the women)55.0%(lived outside the main city area, and almost all)92.7%(were Muslim. Nearly all)91.9%(listed their occupation as homemaker)i.e., housewife(. Over two-fifths of the women)44.9%(had completed primary school, while 16.8% had completed high school, and 17.6% had completed college or higher education. Only one in 15)7.4%(was illiterate. Most of the women)84.0%(came from a family which had no savings or insufficient income. Most)85.8%(said that their current pregnancy was planned.

Table 2 Individual Characteristics of the Sample)n=374(

Characteristic	Number	Percentage
Age)years(		
15-24	231	61.7
25-34	133	35.5
>=35	10	2.6
)Mean = 23.7, SD = 4.3, Min = 17, Max = 40(		
Location of residence		
Inside the city	168	44.9
Outside the city	206	55.0
Religion		
Muslim	347	92.7
Hindu	27	7.2
Occupation		
Housewife	344	91.9
Businesswoman	3	0.8
Private sector employee	13	3.4
Government sector employee	8	2.1
Other	6	1.6
Education		
Illiterate	28	7.4
Literate	49	13.1
Primary	168	44.9
Secondary	63	16.8
College or higher	66	17.6
Income)household(		
No savings	234	62.5
Sufficient income	97	25.9
Insufficient income	43	11.5
Current pregnancy was planned		
Yes	321	85.8
No	53	14.1

PREDICTORS OF ANC UTILIZATION AMONG THE SAMPLE

Table 3 presents the results of the bivariate analysis. The significant predictors of adequate ANC utilization include family income, social media usage, and affordability of prescribed medicine/ultrasound.

Table 3 Predictors of Adequate ANC Utilization by Bivariate Model

Independent variables	Adequate utilization among pregnant women)April to May 2022(				
	No n)%(	Yes n)%(	COR	95% CI)Lower-Upper(	p-value
Age group)years(					
15-24	113)30.2(	118)31.6(	Reference		
25 or older	71)19.0(	72)19.3(	0.97	)0.64– 1.47(	0.890
Location of residence					
Inside the city	80)21.4(	88)23.5(	Reference		
Outside the city	104)27.8(	102)27.3(	0.89	)0.59-1.24(	0.581
Religion					
Muslim	169)45.2(	178)47.6(	Reference		
Hindu	15)4.0(	12)3.2(	0.76	)0.34 - 1.67(	0.494
Education					
No schooling	45)12.0(	32)8.6(	Reference		
Primary	80)21.4(	88)23.5(	1.54	)0.89-2.66(	0.117
Secondary	30)8.0(	33)8.8(	1.54	)0.79-3.02(	0.202
College or higher	29)7.8(	37)9.9(	1.79	)0.92-3.48(	0.085
Occupation					
Housewife	169)45.2(	175)46.8(	Reference		
Other than housewife	15)4.0(	15)4.0(	1.96	)0.45-2.03(	0.927
Income)household(					
No savings/insufficient income	151)40.4(	126)33.7(	Reference		
Sufficient income	33)8.8(	64)17.1(	2.32	)1.43 – 3.76(	0.001*
Current pregnancy was planned					
Yes	163)43.6(	158)42.2(	Reference		
No	21)5.6(	32)8.6(	1.57	)0.86 – 2.84(	0.134
Has autonomy in visiting an ANC facility					
No	39)0.4(	28)7.5(	Reference		
Yes	145)38.8(	162)43.3(	1.55	)0.91 – 2.60(	0.105
Uses social media					
No	123)32.9(	104)27.8(	Reference		
Yes	61)16.3(	86)23.0(	1.66	)1.09-2.53(	0.017*

Independent variables	Adequate utilization among pregnant women)April to May 2022(				
	No n)%(	Yes n)%(	COR	95% CI)Lower-Upper(	p-value
Husband accompanied to facility					
No	73)19.5(	78)20.9(	Reference		
Yes	111)29.7(	112)29.9(	0.94	)0.62-1.42(	0.786
Received folic acid supplement					
No	107)28.6(	92)24.6(	Reference		
Yes	77)20.6(	98)26.2(	1.48	)0.98 – 2.22(	0.060
Received tetanus vaccine					
No	71)19.0(	87)23.3(	Reference		
Yes	113)30.2(	103)27.5(	0.74	)0.49-1.12(	0.159
Can afford prescribed medicine					
No	114)30.5(	87)23.3(	Reference		
Yes	70)18.7(	103)27.5(	1.92	)1.27-2.91(	0.002*
Can afford prescribed ultrasound					
No	110)29.4(	87)23.3(	Reference		
Yes	74)19.8(	103)27.5(	1.76	)1.16-2.65(	0.007*
Wearing a sanitary mask					
Always – Almost always	78)20.9(	97)25.9(	Reference		
Sometimes - Never	106)28.3(	93)24.9(	0.70	)0.46-1.06(	0.094
Hand hygiene					
Almost always	28)7.5(	43)11.5(	Reference		
Sometimes - Never	156)41.7(	147)39.3(	0.61	)0.36-1.03(	0.069
Anxiety Level					
Minimum -> Mild anxiety	140)37.4(	144)38.5(	Reference		
Mild –> Severe anxiety	44)11.8(	46)12.3(	1.01	)0.63-1.63(	0.946
Difficulty in Daily life					
None –> Somewhat difficult	154)41.2(	145)38.8(	Reference		
Very -> Extremely difficult	30)8.0(	45)12.0(	1.59	)0.95-2.66(	0.076

Table 4 shows the results of the multivariate analysis. There was a significant association between family income and adequate ANC utilization. Women who come from a household with sufficient income were 2.1 times more likely to have received adequate ANC compared to their counterparts with no savings or insufficient family income: p-value = 0.020)AOR: 2.09; 95% CI: 1.12-3.90(. Among socio-cultural factors, the usage of the social media of the woman was statistically significant, with a p-value= 0.042 for adequate utilization of ANC. Women who had an account on any social media platform were 1.7 times more likely to have received adequate ANC than those with no social media account)AOR: 1.74; 95% CI: 1.02-2.98(. ANC-related components)e.g., receiving a folic acid supplement, tetanus toxoid

vaccination, and affordability of prescribed medicine/ ultrasound(were not significantly related with adequate utilization of ANC. Furthermore, Covid-19 preventive measures and Covid-related anxiety were not significantly associated with the adequate utilization of ANC in this sample of pregnant women. There was no statistical significance)p-value <0.05(found in logistic regression for hand hygiene, masking, and Covid-related anxiety level. That said, women who said they faced difficulty in their daily life, and having Covid-related anxiety were significantly related in the multiple regression model)AOR: 2.35; 95% CI: 1.13-4.90(.

Table 4 Predictors of Adequate ANC Utilization by Multivariate Model

Independent variables	**AOR**	**95% CI)Lower – Upper(**	**p-value**
Age group)years(			
15-24	Reference		
25 or above	1.02	)0.63-1.63(	0.930
Location			
Inside the city	Reference		
Outside the city	1.22	)0.76-1.96(	0.405
Religion			
Muslim	Reference		
Hindu	0.75	)0.30-1.87(	0.548
Education			
No schooling	Reference		
Primary	1.52	)0.82-2.81(	0.176
Secondary	0.96	)0.43-2.14(	0.960
College or higher	0.90	)0.38-2.15(	0.906
Occupation			
Housewife	Reference		
Other than housewife	0.93	)0.38-2.27(	0.876
Income)household(			
No savings/insufficient income	Reference		
Sufficient income	2.09	)1.12-3.90(	0.020*
Current pregnancy was planned			
Yes	Reference		
No	1.90	)0.98-3.68(	0.054
Has autonomy for visiting ANC facility			
No	Reference		
Yes	1.52	0.84-2.77	0.166
Uses social media			
No	Reference		
Yes	1.74	)1.02-2.98(	0.042*

Independent variables	AOR	95% CI (Lower – Upper)	p-value
Husband accompanied to ANC facility			
No	Reference		
Yes	0.85	)0.54-1.33(	0.485
Received folic acid supplement			
No	Reference		
Yes	1.49	)0.95-2.33(	0.081
Received tetanus vaccine			
No	Reference		
Yes	0.73	)0.46-1.15(	0.185
Affordability of medicine			
No	Reference		
Yes	1.86	)0.44-7.76(	0.390
Affordability of ultrasound			
No	Reference		
Yes	0.59	)0.14-2.47(	0.470
Wearing a sanitary mask			
Always-almost always	Reference		
Sometimes-never	0.90	)0.54-1.50(	0.704
Hand hygiene			
Almost always	Reference		
Sometimes-never	0.72	)0.38-1.35(	0.309
Anxiety level			
Minimum -> mild anxiety	Reference		
Mild -> severe anxiety	0.52	)0.26-1.04(	0.067
Difficulty in daily life			
None -> Somewhat difficult	Reference		
Very –> Extremely difficult	2.35	)1.13-4.90(	0.022*

Notes: AOR: Adjusted Odds Ratio; CI: Confidence Interval; * p-value <0.05

DISCUSSION

In this study, the rate of adequate utilization of ANC among currently-pregnant women was 50.8%, and that is higher than the national average in the 2017-18 BDHS. The reason might be that the national survey was conducted four years ago and, by this time, ANC utilization has increased; a trend that might be expected as the country develops. According to the BDHS, the proportion of women who reported having at least four ANC check-ups for the last complete pregnancy was 47%, and the Bangladesh government has set the target for 50% coverage of at least four ANC visits by the end of 2022 [5]. If this sample in Sylhet Division is representative, then the findings of this study suggest that the country could reach the 50% target. However, a nationally-representative survey would be needed to verify that achievement.

Nearly half of the pregnant women had not yet received four ANC check-ups, even though they should have according to their gestational age at the time of data collection. It is important for those women to make up for the shortage of ANC throughout the remainder of their pregnancy in order to protect against complications of pregnancy and delivery. In Bangladesh, maternal and neonatal mortality could be reduced without exorbitant cost by using more carefully-targeted intervention programs to attain at least four ANC visits for each pregnancy.

This study found that family income was a significant predictor of having adequate utilization of ANC among the sample of women in two cities of the Sylhet Division. Study results show that the families which had sufficient income were over twice as likely to have received adequate ANC than the women from families with no savings or insufficient income. This finding is consistent with other studies in Bangladesh and elsewhere, in that, pregnant women from wealthier families utilized more ANC services than their less-wealthy counterparts [14-17].

In most cases, there are costs associated with seeking ANC care, such as transportation and paying for prescribed medicines and ultrasound (which may not be considered elective expenses by the women). In this sample, nearly three-fourths of the women were from families with no savings or insufficient income. Accordingly, qualitative research would be useful to probe the financial barriers to ANC in greater depth.

Social media usage by the pregnant woman was another significant predictor of adequate ANC utilization. These women visit such social media sites as Facebook, WhatsApp, Messenger, Twitter, Youtube, and Imo. This finding is consistent with another study in Bangladesh which found that exposure to social media was an important determinant for receiving ANC check-ups [6, 16, 17]. Similarly, qualitative research would be helpful to identify what aspects of social media usage contribute to ANC utilization, or whether this variable is a proxy for some other determinant.

This study found that the pregnant woman's age, location of residence, and educational attainment were not significantly associated with ANC usage, and that finding contrasts with some previous studies in Bangladesh [5, 6, 14-17]. Moreover, the results found that one-fourth of the sample had mild-to-severe Covid-related anxiety, but that factor was not significantly associated with ANC utilization. Finally, this study found that about one in seven members of the sample said that the current pregnancy was not planned. This implies that there is still a significant level of unmet need for effective contraception in this area of Bangladesh.

LIMITATIONS

This was a cross-sectional study design and, thus, it was not possible to determine causality of the factors behind utilization of ANC in the study area. The sample size was rather small, and drawn from the population of three public hospitals/clinics from two districts, and did not cover hospitals or more diverse populations from the other two districts in the Sylhet Division. Hence, a larger sample size comprising all districts would provide more reliable data on predictors of ANC utilization. Ideally, a prospective study of a sample of women from the start of pregnancy to delivery would provide a more definitive picture of the determinants of ANC utilization.

CONCLUSIONS

This study found that nearly half of the sample of currently-pregnant women were not obtaining their scheduled ANC check-up according to their gestational age. This shortcoming should be addressed by policymakers and health programs. There should be campaigns through social media at the community level, as well as distribution of medicine and supplements in a sufficient quantity and an affordable manner.

RECOMMENDATION

A social motivational campaign should be implemented at the community level to promote timely ANC visits.

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DEVELOPMENT OF LIPIDOMIC LC-MS/MS METHOD FOR ABSOLUTE QUANTIFICATION OF TARGETED POLAR LIPIDS IN THE LIVER SAMPLE OF ZEBRAFISH MODELS

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ABSTRACT

The anatomical and genetic resemblance of zebrafish with mammals makes it an attractive model for studying a mammalian disease such as hepatic steatosis (HS). Although previous studies have demonstrated a high-fat-diet induced fatty liver in zebrafish, the alteration of polar lipids and their metabolic processes has not been fully explored. This is due to the lack of a reliable and sensitive method to quantify lipids from a small liver sample (~5 mg). This study aims to develop and validate the ultra-performance liquid chromatography-triple quadrupole mass spectrometry (UPLC-TQ/MS) method for quantifying polar lipids in zebrafish liver. The experimental design consists of the development of lipid extraction using methyl tert-butyl ether (MTBE), followed by liquid-liquid extraction (LLE) to separate polar and non-polar lipids. The mixture of 12-lipid standards and internal standard (IS) as 1,2-Dipalmitoyl-rac-glycero-3-phosphocholine was extracted using MTBE: MeOH (5:1 v/v), followed by the pre-separation of polar and neutral lipids by LLE, using 2 mL MeOH: NaCl (80:20, v/v) and 1 mL hexane: MeOH (98:2, v/v). Finally, the polar lipids from polar layers were quantified separately using UPLC-TQ/MS. For the quantification of targeted polar lipid, 5 mg of the lyophilized liver was subjected to the extraction, followed by the absolute quantification. The %Recovery of IS from the MTBE protocol was from 80–100% (%RSD = 7; N =10). Likewise, for the recovery of LLE-protocol for the lipid standards in the polar layer: PC (16:0/18:0), PG (16:0/18:1), PC (P-18:0/18:1), PS (18:0/18:2), SM (35:1), and PI (18:1/18:1) was from 80–98% (%RSD = 3–10; N = 4). Finally, the recovery of IS in the zebrafish-liver samples was 108% (%RSD = 2; N = 3). Based on the high %Recovery and RSD results in neat solution and liver matrix, we conclude that the protocol is effective for the separation and quantification of polar lipids in zebrafish liver.

Keywords: Hepatic steatosis, Lipidomics, Liquid chromatography, Mass spectrometry, Lipid extraction

INTRODUCTION

Hepatic steatosis (HS) is a clinical condition characterized by the accumulation of intrahepatic fat of at least 5% of the liver weight. It occurs in the absence of external factors such as hepatocellular injury caused by a virus, drugs, and alcohol intake. Likewise, HS is also synonymously called non-alcoholic fatty liver disease (NAFLD) [1]. NAFLD is the most common cause of chronic liver disease worldwide [2]. The current global prevalence of NAFLD is estimated at 24% globally, and 32% in Thailand [3]. Although NAFLD is considered a benign condition, it can progress into a severe form such as non-alcoholic steatohepatitis (NASH), which is characterized by steatosis together with the presence of ballooning of hepatocytes and inflammations. Ultimately, the NASH can progress into life-threatening conditions such as liver fibrosis and hepatocellular carcinoma (HCC) [2]. Currently, the diagnosis of NAFLD is performed using the gold standard histological staining of liver tissue, or non-invasive imaging approaches such as; ultrasonography, transient elastography, computed tomography (CT), and magnetic resonance [1].

Nevertheless, these tests have several drawbacks. For instance, the histological staining is susceptible to error caused by intra and inter-observer. Likewise, the CT scan has a low accuracy for detecting the mild forms of HS. Similarly, the sensitivity of the imaging ultrasonography, ultrasound, and magnetic resonance is significantly reduced when the steatosis is less than 30%, which shows the instability and incompetence for diagnosis of NAFLD and NASH [1]. Previous studies have suggested that the pathophysiological hallmark of HS is significantly related to altered lipid homeostasis [4, 5]. Numbers of lipidomics studies in humans have shown the alteration of various classes of phospholipids (polar lipids) such as; phosphatidylcholine (PC), phosphatidylethanolamine (PE), phosphatidylglycerol (PG), phosphatidylserine (PS), phosphatidylinositol (PI), phosphatidic acid (PA), sphingomyelin (SM), ceramide (Cer), plasmalogens PE (PEP), plasmalogen PC (PCP) and neutral lipids mainly, diacylglycerol (DAG) triacylglycerol (TAG), and cholesterol esters (CEs) in the human liver [5–8]. However, accurate lipid quantifications in a biological sample are very challenging because many lipid species are present at low concentrations in the biological sample, and are challenging to characterize in the presence of a matrix [9]. Biological samples, especially in a human or animal study, are often available in a limited quantity. Moreover, the structural complexity of polar phospholipids (polar head, length of acyl chains, and degree of unsaturation) makes their quantification more complex [10].

The study of lipidomics is often performed through analytical tools based on mass spectrometry such as liquid chromatography (LC), mass spectrometry (MS), MS-imaging technique, and nuclear magnetic resonance (NMR). The NMR does not require sample preparation and non-destructive technique but has low sensitivity and specificity, as compared with MS-based techniques [11]. On the other hand, chromatographic separation coupled with MS has good sensitivity and specificity for the detection of lipid species in biological samples [12]. To date, only a few studies have used high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS) for the detection of altered phospholipids [10] in a liver sample. In general, phospholipids consist of polyunsaturated fatty acids (PUFAs), monounsaturated fatty acids (MUFA) in the sn-2 position, and the saturated fatty acid chain in the sn-1 position. This structure gives the numerous isobaric and isomeric species of phospholipids which makes the quantification of phospholipids difficult. Thus, there is a dire need for an improved method for the identification and quantification of such low-abundance polar lipids with high accuracy, sensitivity, and specificity.

In addition to the development of analytical tools in lipid research, the use of the animal model has been gaining attention, particularly to understand the mechanism and progression of HS diseases [13]. The laboratory-induced HS model of animals is an effective tool for fully understanding the pathophysiology of HS, which is not possible in the human model [13]. Interestingly, due to genetic as well as physiological resemblance in developmental and metabolic processes in mammals, zebrafish have become a great model for studying HS [13, 14]. Although previous studies have demonstrated that overfeeding induced fatty liver in the zebrafish, there is a big gap of knowledge regarding the altered phospholipid metabolism that occurs in the HS model of zebrafish, which is vital to understanding the pathophysiology of HS [15].

Thus, in this study, we proposed a reliable sample preparation protocol and highly sensitive analytical method based on the ultra-performance liquid chromatography-triple quadrupole mass spectrometry (UPLC-TQ/MS) with multiple reaction monitoring (MRM) mode for the identification and quantification of the phospholipids (PC(16:0/18:0), PE(16:0/18:1), PE(P-18:0/18:1), PG(16:0/18:1), PC(P-18:0/18:1), PS(18:0/18:2), SM(d18:1/17:0), PI(18:1/18:1), Cer(d18:1/17:0), and non-polar lipids (TAG(18:1/18:1/18:1), DAG(18:0/18:0/0:0), and CE(18:2) from zebrafish livers. The methods include sample extraction using methyl tert-butyl ether (MTBE) and isolation based on liquid-liquid extraction (LLE) and

UPLC-TQ/MS for identification and quantification of those targeted lipids from the zebrafish livers. Finally, this study lays a foundation where future studies can apply the proposed method to understand the changes in phospholipids that occur in HS, facilitating the early diagnosis of HS.

MATERIALS AND METHODS

CHEMICALS AND REAGENTS

Ultra-pure water (H_2O) was obtained from the Milli-Q purification system (Millipore, Bedford, MA). Ammonium formate and formic acid were purchased from Fisher Scientific (Morris Plains, NJ, USA). HPLC-grade solvents, acetonitrile (ACN), methanol (MeOH), chloroform ($CHCl_3$), Hexane (Hex), and 2-propanol (IPA) were purchased from RCI Labscan (Bangkok, Thailand). A total of 12 lipid standards: PC(16:0/18:0), PE(16:0/18:1), PE(P-18:0/18:1), PG(16:0/18:1), PC(P-18:0/18:1), PS(18:0/18:2), SM(d18:1/17:0), PI(18:1/18:1), Cer(d18:1/17:0), TAG(18:1/18:1/18:1), DAG(18:0/18:0/0:0), and CE(18:2) were obtained from Avanti Polar lipids. The internal standard (IS) as 1,2-Dipalmitoyl-*rac*-glycero-3-phosphocholine (^{13}C-PC 16:0/16:0) was purchased from Cambridge Isotope Laboratories, Inc. (Massachusetts, USA). Finally, the working solutions of all lipid standards were prepared in 10 µM in MeOH/$CHCl_3$ (1:1 v/v) to increase the solubility.

ANIMAL HUSBANDRY AND SAMPLE COLLECTION

Wild-typed (WT) zebrafish were kept in standard laboratory conditions (temperature 28 ± 1°C; 14 hours light/10 hours dark cycle. The control group (normal feeding) was fed with 5 mg artemia per fish per day for 8 weeks. Before the liver collection, the zebrafish were subjected to fasting overnight (~ 12 hours). Consequently, the zebrafish were anesthetized and then sacrificed to collect the liver sample. Finally, the sample was stored at -80°C until lyophilization.

SAMPLE PREPARATION

Each liver sample was transferred into a tube, and the tubes were kept on dry ice. Next, the liver sample was subjected to lyophilization for 48 hours. Finally, samples were pooled to get a final weight (5 mg), and further ground in the tube using the plastic pestle for lipid extraction.

LIPID EXTRACTION USING MTBE-PROTOCOL

The method for lipid extraction of the liver samples was adopted from Matyash et al. [16] with slight modifications. In brief, approximately 5 mg of the liver sample (or lipid standards and IS at 10 µM concentration) was transferred into a 1.5 mL Eppendorf tube and mixed with 1 mL of MTBE/MeOH (5:1, v/v). The mixture was homogenized using a digital vortex at 2,000 rpm for 5 minutes. The tube was then vortexed for 10 minutes at room temperature (RT), then the Eppendorf was transferred into the ice bath, and the ice bath was further subjected to sonication for 15 minutes at 35°C. Finally, the tube was centrifuged at 13,000 *g* for 5 minutes (4°C). The upper-phase 900 µL of MTBE layer was collected into a new Eppendorf tube, and then the solvent was evaporated under vacuum using the MiVac evaporator to dryness. The extracted crude was reconstituted with MeOH/$CHCl_3$ (1:1, v/v) for calculating the percentage recovery, or further subjected to the liquid-liquid extraction (LLE) for separating polar and neutral lipids. The overview of the lipid extraction by the MTBE-protocol is summarized in Figure 1.

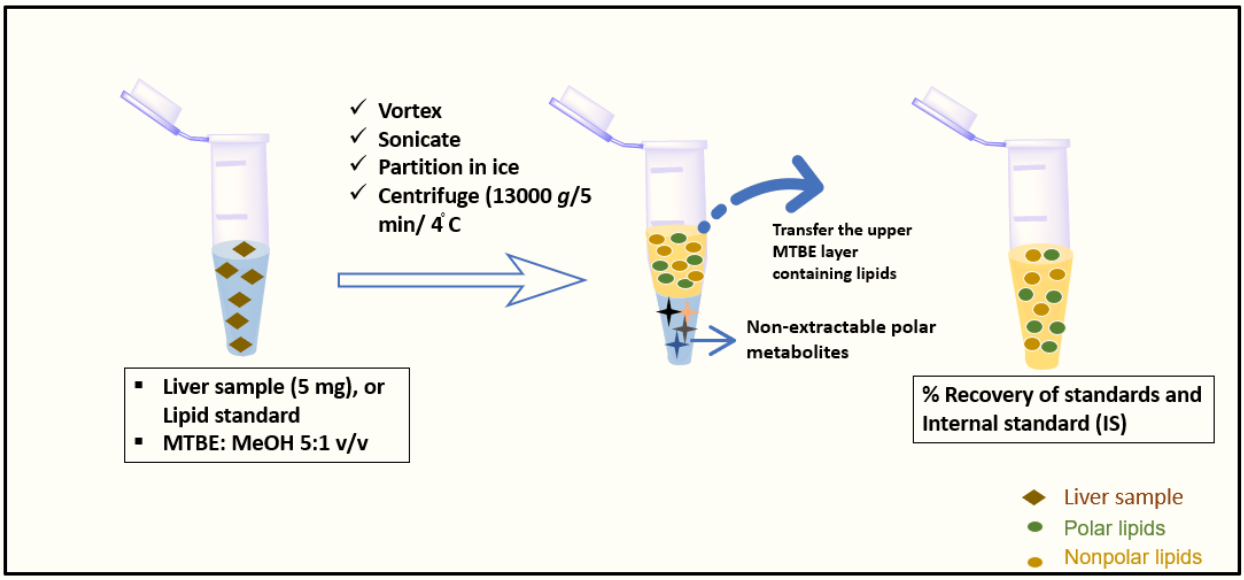

Figure 1: Lipid extraction using MTBE protocol.

SEPARATION OF THE POLAR AND NEUTRAL LIPIDS USING LIQUID-LIQUID EXTRACTION (LLE)

The LLE protocol was adapted and modified by Lofgren et al. (17) using 1 mL of Hex/MeOH (98:2, v/v) as a nonpolar system and 2 mL of MeOH/2.9% w/v NaCl (80:20 v/v) as a polar system. The total volume of extract solvent is 3 mL. The mixture of extracted lipid from the previous section and the solvent systems was transferred to the 10 mL-glass tube. The tube was vortexed for 10 minutes at room temperature, followed by centrifugation at 4,000 *g* for 15 minutes at 4°C. Then, each layer fraction was separated using micropipettes, and dried under vacuum using a MiVac evaporator separately. The dried lipid extract was reconstituted with 1 mL of MeOH/$CHCl_3$ (1:1, v/v) before injecting it into the UPLC-TQ-MS for analysis. The workflow of the LLE-protocol diagram is shown in Figure 2.

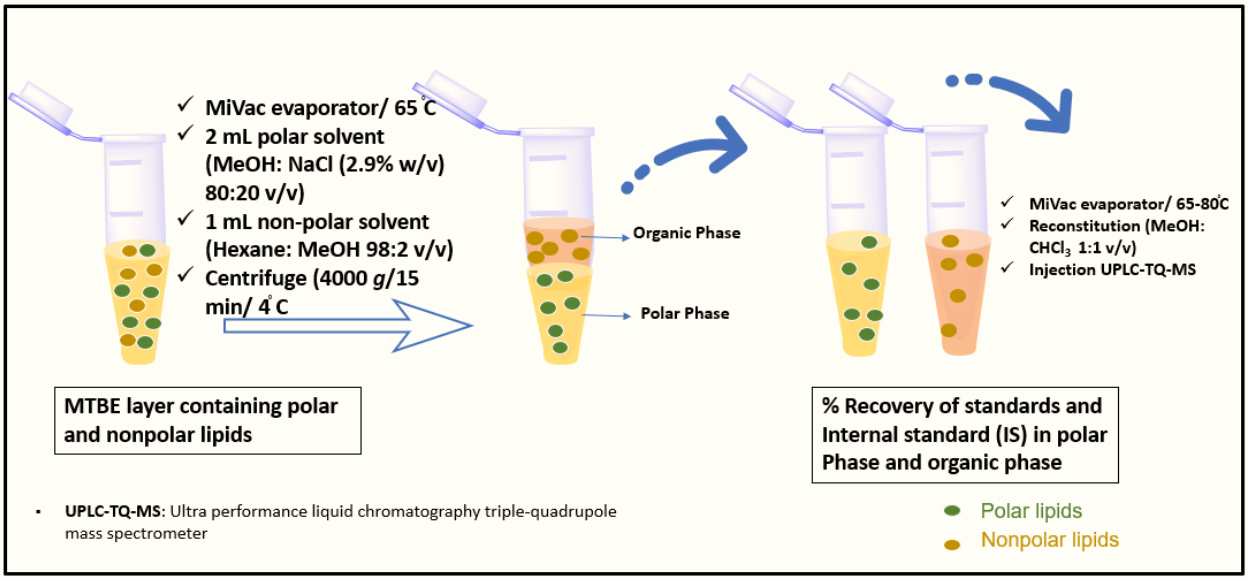

Figure 2: Liquid-liquid extraction for separation of polar and non-polar lipids.

SET-UP AND OPTIMIZATION OF UPLC-TQ-MS-MRM CONDITIONS FOR IDENTIFICATION AND QUANTIFICATION

The optimized chromatographic separation conditions include an ACQUITY UPLC Charged Surface Hybrid (CSH) C18 2.1 × 100 mm; 1.7 µm particle size column (Waters, USA) with 5 µL injection and column temperature of 55 °C. The mobile phase A consist of ACN/H_2O (60:40 v/v) with 10 mM ammonium formate and 0.1% formic acid. Mobile phase B consists of IPA/ACN (90:10 v/v) with 10 mM ammonium formate and 0.1% formic acid. The solvent gradients were programmed as follows: min 0.0–2.0 from 40% B to 43% B, min 2.0–2.1 to 50% B, min 2.1–12.0 to 54% B, min 12.0–12.1 to 70% B, min 12.1–18.0 at constant 99% B, and min 18.0–18.1 at continuous 40% B. Then the system was optimized to re-equilibrium to initial condition for 2 minutes before the next injection. The total run time was 20 minutes.

The set-up of multiple reaction monitoring (MRM) aims to improve the speed and efficiency of lipidomic analysis. In general, MRM scans for functional group specific precursor ion (Prec), and neutral loss (NL)[18]. We employed one IS and 12-targeted lipid standard for the optimization of MRM-condition (transition of precursor ions to daughter ions). The identification of targeted lipid using MRM mode was performed using a precursor ion, and its transition to specific product ions or neutral losses as a daughter ion (Table 1). All the standards were analyzed in the positive mode (ESI^+). In the ESI^+, most of the targeted lipids were in analyzed in the protonated molecule $[M+H]^+$: (PE(16:0/18:1), PE(P-18:0/18:1), PC(16:0/18:1), PC(P-18:0/18:1), PS(18:0/18:2), TAG(18:1/18:1/18:1), SM(d18:1/17:0), and a sodium adduct $[M + Na]^+$: CE(18:2), PG(16:0/18:1), Cer(d18:1/17:0), PI(18:1/18:1), and DAG(18:0/18:0/0:0), formed the $[M+H–H_2O]^+$ adduct. For the identification of each precursor ion, we used at least two daughter ions observed from the reference standard to identify the targeted lipids from the zebrafish liver sample. The product ion with the highest intensity was taken as a quantifier daughter ion, while the daughter ion with the second highest intensity was used as a qualifier ion.

Table 1 Optimized UPLC-TQ-MS MRM condition of targeted lipids.

Compounds	**Formula**	**Adduct**	**RT**	**Parent mass *(m/z)***	**Daughter mass (quantifier) *(m/z)***	**Cone voltage**	**CID**
DAG(18:0/18:0/0:0)	$C_{39}H_{76}O_5$	$[M+H-H_2O]^+$	14.08	607.57	341.32	20	35
CE(18:2)	$C_{45}H_{76}O_2$	$[M+Na]^+$	15.85	671.6	303.23	20	30
PE(16:0/18:1)	$C_{39}H_{76}NO_8P$	$[M+H]^+$	8.96	718.54	577.52	20	10
PE(P-18:0/18:1)	$C_{41}H_{80}NO_7P$	$[M+H]^+$	12.91	730.58	339.31	20	10
PC(16:0/18:0)	$C_{42}H_{84}NO_8P$	$[M+H]^+$	10.61	762.6	184.07	20	10
PG(16:0/18:1)	$C_{40}H_{77}O_{10}P$	$[M+Na]^+$	6.69	771.51	194.99	20	25
PC(P-18:0/18:1)	$C_{44}H_{86}NO_7P$	$[M+H]^+$	12.29	772.62	184.07	20	10
^{13}C-PC 16:0/16:0*	$C_{40}H_{80}NO_8P$	$[M+H]^+$	8.08	774.7	189.11	20	10
PS(18:0/18:2)	$C_{42}H_{78}NO_{10}P$	$[M+H]^+$	7.08	788.54	603.56	20	10
TAG(18:1/18:1/18:1)	$C_{57}H_{104}O_6$	$[M+H]^+$	15.96	885.79	603.5	20	25
Cer(d18:1/17:0)	$C_{35}H_{69}O_3$	$[M+Na]^+$	9.06	574.51	534.52	20	5
SM(d18:1/17:0)	$C_{40}H_{81}N_2O_6P$	$[M+H]^+$	6.13	717.59	184.07	20	5
PI(18:1/18:1)	$C_{45}H_{86}NO_{13}P$	$[M+Na]^+$	6.5	885.54	603.53	20	10

Notes: Abbreviations: *Internal standard; retention time (RT); collision-induced dissociation (CID); DAG: diacylglycerol; CE: cholesterol ester; TAG: triacylglycerol PC: phosphatidylcholine; PE: phosphatidylethanolamine; PA: phosphatidic acids; PG: phosphatidylglycerol; PS :phosphatidylserine; PE(P): alkenyl phosphatidylethanolamine; PC(O): alkyl phosphatidylglycerol; SM: sphingomyelin; PI: phosphatidylinositol; PE: phosphatidylethanolamine; Cer: Ceramide.

ANALYSIS OF POLAR LIPID QUANTIFICATION USING UPLC-TQ-MRM

The quantification of polar lipids from the liver sample was performed using the UPLC-TQ-MS instrument. The chromatographic separation was performed using a C18 2.1 × 100 mm; 1.7 µm particle size. Then, the analyte samples were acquired in positive ESI mode followed by TQ mass analyzer. The multiple reaction monitoring (MRM) mode was applied for the analysis and quantification of intact polar lipids. The total run time was 20 minutes. The data obtained from UPLC-TQ-MRM, including retention time (RT), the mass of precursor, and fragmented ions, was used for the identification and quantification of each targeted polar lipid.

DATA PROCESSING AND ANALYSIS

The MRM and MS/MS spectral were processed manually using the vendor-provided software TargetLynx (Waters, USA). The %Recovery of targeted lipids was calculated based on the peak area of targeted lipids in spiked solution and peak area of targeted lipids in solution subjected to extraction

(%Recovery = peak area of extracted solution/peak area of spiked solution times 100). Likewise, percent residual standard deviation (%RSD) was calculated based on the average %Recovery of targeted lipids (%RSD = standard deviation/ average %Recovery of targeted lipids times 100). Finally, the concentration of the targeted phospholipids was calculated from their relative abundance in response to internal standards using the standard additions method. The Bar-chart was obtained by transferring the data into Microsoft Excel.

RESULTS

EXTRACTION EFFICIENCY OF MTBE-PROTOCOL

We used 12 lipid standards containing both polar and neutral lipids and one internal standard (IS) to develop and validate the protocol. The performance of the lipid extraction method was evaluated through %Recovery of the mixture lipid standards. Overall, the results show a good %Recovery (> 80%, *n* = 3) for all the lipid standards as well as IS (Figure 3). However, the %Recovery of non-polar lipids, CE, is relatively low compared to other lipid species, at 60%. It is possibly because of the use of MTBE as a solvent system for the extraction of lipid. MTBE is comparatively more polar than other extraction solvent such as chloroform. Thus, the extraction efficiency is higher for polar lipids and lower for non-polar lipids, such as CE (18:2) [19].

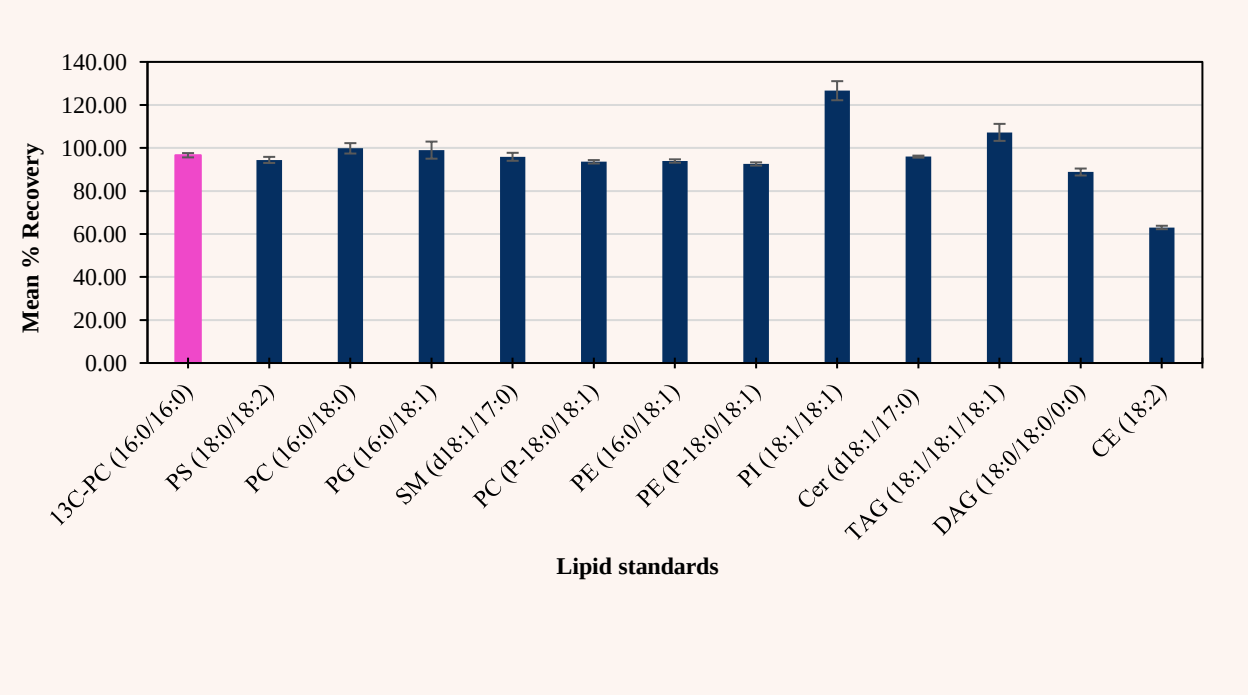

Figure 3: Percentage recovery of mixed lipid standards using MTBE-protocol.

EXTRACTION EFFICIENCY OF THE LLE PROTOCOL

For validating the LLE protocol, the %Recovery of representative 12 lipid standard was calculated on each polar and non-polar fraction (Figure 4). From the preliminary results, we noticed a significant decrease in the overall %Recovery of IS (68%; *n* = 3) and other targeted lipids (52–79%; *n* = 3) by using a low amount of extraction solvent system (total volume of 1.5 mL). Hence, the method was further improved by increasing the total volume of extraction solvent to 3 mL (2 mL of polar solvent and 1 mL of non-polar solvent). The results show an improvement in the overall %Recovery of IS up to 93% (*n* = 3) as well as other targeted lipids 68–101% (*n* = 3). Likewise, the polar lipids, PC(16:0/18:0), PG(16:0/18:1), PC(P-18:0/18:1), PS(18:0/18:2), SM(d18:1/17:0), and PI(18:1/18:1) shows the overall %Recovery of (80–98%, n = *4*). Similarly, the non-polar lipid, TAG (18:1/18:1/18:1), DAG (18:0/18:0/0:0), and CE (18:2) shows the overall %Recovery of (67–87%, *n* = 3). Likewise, the recovery of IS in the presence of matrix (5 mg liver sample) was found to be 108% (%RSD=1, N = 3).

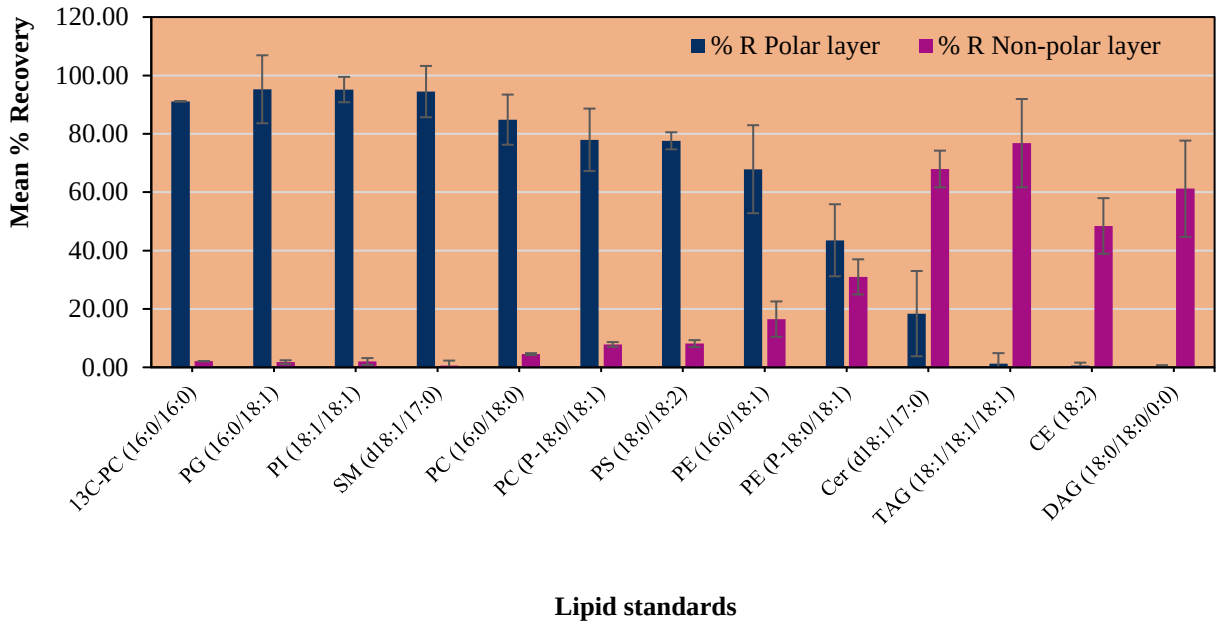

Figure 4: Percentage recovery of mixed lipid standards in the polar and non-polar layer

ABSOLUTE QUANTIFICATION OF POLAR LIPIDS IN ZEBRAFISH LIVER

In the absolute quantification experiment, we found that the concentration of polar lipids ranges from (2.5–309.6 nmol/mg of liver sample, $n = 2$). Among the our targeted lipids, PC(16:0/18:0) was the most abundant phospholipid found in the zebrafish liver (309.6 nmol/mg) followed by PG(16:0/18:1), SM(d18:1/17:0), PI(18:1/18:1), PE(16:0/18:1), PS(18:0/18:2), and PE(P-18:0/18:1) (Figure 5).

However, a polar lipid PC(P-18:0/18:1) and cer(d18:1/17:1) were excluded from the absolute quantification. The concentration of PC(P-18:0/18:1) was below the level of detection. Similarly, Cer(d18:1/17:1) was largely recovered (~68 %, $n = 3$) in the non-polar phase compared to the polar phase (~18 %, $n = 3$).

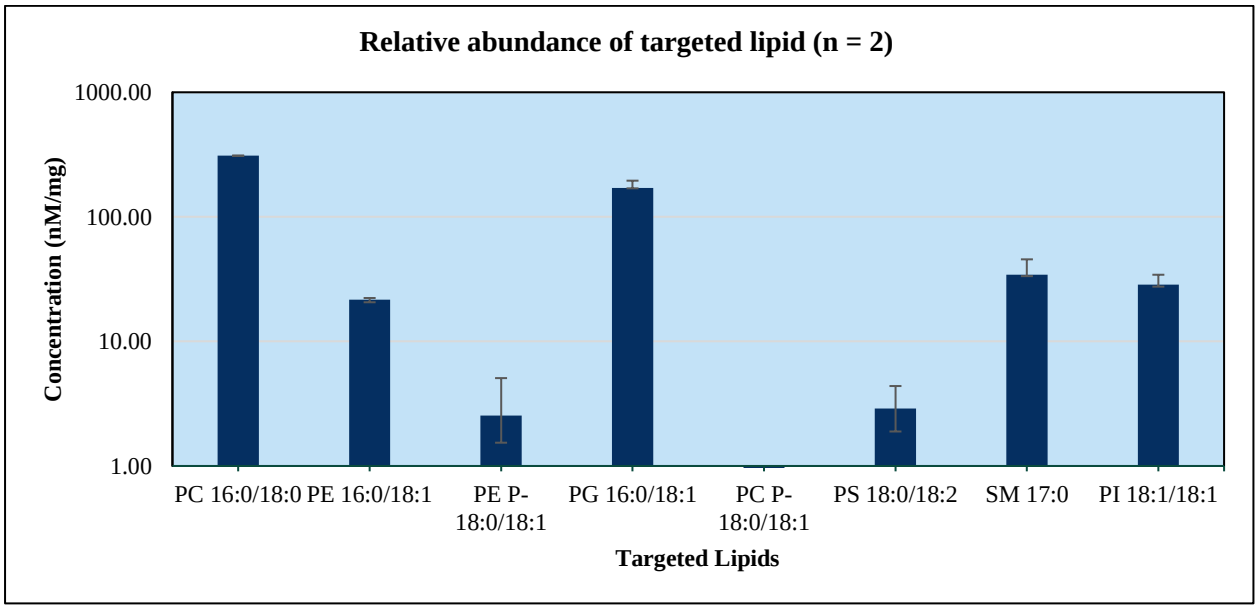

Figure 5: Relative abundance of targeted polar lipids in the zebrafish liver

DISCUSSION

Recent studies have highlighted the involvement of low-abundance polar lipids, mainly the glycerophospholipids and the sphingolipids, in the pathophysiology of HS [6, 20]. However, the previous study has suggested that currently available protocols and methods are incapable of extracting and quantifying the lipids with higher coverage. Thus, there is an utmost need for a sensitive and reliable method for the absolute quantification of those lipids with potential toxicity in HS. Here in this study, we proposed the sample preparation method based on the UPLC-TQ-MS for the absolute quantification of targeted polar lipids. Our results show a high recovery of IS and standards of targeted polar lipids after subjecting to the proposed MTBE and LLE extractions. The absolute quantification of targeted low-abundance targeted lipids in control zebrafish (normal feeding) was between (1.83–310 nmol/ mg liver sample) (Figure 5).

Previously, Huang et al. proposed the method for phospholipids analysis using UPLC-TQ-MS. Phospholipid species such as PC, PE, and SM were analyzed using positive ion mode, and phospholipid species (PA, PG, PI, and PS) were analyzed using negative ion mode (10). On the contrary, we were able to optimize all the targeted phospholipids (PC, PE, PG, PS, PI, SM, PCP, PEP) in positive mode, making the method less complicated and the results more comparable to each other. Likewise, the efficiency of the MTBE protocol was tested by observing the %Recovery of the targeted lipids. All the targeted lipids, including IS, show a recovery greater than 80% except for the sterol lipid CE (18:2). This is mainly because of the high hydrophobicity index of sterol lipid; thus, a comparatively non-polar solvent such as (cyclohexane or toluene) is suitable for extraction compared to a moderately polar solvent such as MTBE [21]. Furthermore, the extraction efficiency of the proposed MTBE protocol for IS was compared with the conventional gold standard Bligh and Dyer method that uses the chloroform as the main solvent system [16]. The result shows that %Recovery of IS using CHCL3/MeOH 2:1 v/v in matrix (2 mg) was 96% (%RSD = 5, n = 3). Interestingly, the recovery of IS using MTBE/methanol, 5:1, v/v in matrix (2mg liver sample) was slightly higher as 99% (%RSD = 4, n = 3). Moreover, the use of the proposed MTBE protocol also prevents exposure to carcinogenic chemicals such as Chloroform which is the main constituent of Bligh and Dyer's method of lipid extraction [16]. After the MTBE extraction, we performed the LLE to enrich the targeted polar lipids separately in the polar layer. Although we observed the high recovery of all the lipid standards after the MTBE extraction, we subjected the crude extracts to LLE in order to minimize the matrix effects caused by the abundant untargeted non-polar lipids that can potentially cause ion suppression of our low abundance targeted polar lipids.

Similarly, the efficiency of the LLE protocol was tested by observing the %Recovery of all the targeted lipids in the respective polar phase and non-polar phase. As expected, a significant amount of the polar lipids was mostly detected in the polar phase, and a negligible amount of the polar lipids was detected in the non-polar phase. Interestingly, PE(16:0/18:1) shows the recovery of approximately 71% in the polar layer. On the other hand, PG(16:0/18:1) has the same acyl chain length as PE(16:0/18:1) and shows a recovery of approximately 94%. It is possibly because of the difference in polar head group PG and PE, where PG is more polar than PE. Likewise, PE(P-18:0/18:1) and Cre(d18:1/17:0) were primarily found in both layers (~44% and ~18% recovery in the polar layer and ~31% and ~68% in the non-polar layer, respectively). In this scenario, the absolute quantification of these lipids should be performed in both polar and non-polar layers. In this current study, we had only the polar IS; thus, we quantified the lipid only in polar layer. However, future research can include the non-polar IS in the experiment and quantify these lipids in both layers to get an insight into the total concentration of these lipids in the zebrafish liver.

Lastly, we applied the proposed method to the normal feeding zebrafish liver (5 mg) and were able to see a peak of all our targeted lipids with high intensity. In keeping with the previous reports in rat liver samples (10, 22), the PC with saturated acyl chain, i.e., PC(16:0/18:0), was the most abundant polar lipid detected in our normally fed zebrafish liver. The MUFA-PE, i.e., PE(16:0/18:1) and PE(P 18:0/18:1), were detectable in our zebrafish liver, while this class is barely detectable in rat liver sample [22]. This discrepancy may possibly be caused by different sample preparation or superior sensitivity of our UPLC-TQ-MS with MRM mode to the normal-phase HPLC-MS used in the previous study [22]. However, it can also be caused by the natural variability of lipidome between the different species. For instance, Huang et al. observed the distinct classes of phospholipids between the rat serum and human serum samples. Similarly, Lange et al. observed the variation in lipidome between the different species (human versus Caenorhabditis versus drosophila) as well as different tissue (human plasma versus human skin) [10, 23]. Thus, to identify the actual cause, in the future study, the methods can be applied to a rat liver and zebrafish liver simultaneously.

This study supports the notion that a reliable sample preparation protocol together with sensitive UPLC-TQ-MS and optimized MRM conditions can be successfully employed to achieve the absolute

quantification of the low-abundance polar lipids. We observed a high %Recovery of IS and targeted phospholipids in the polar layer after subjecting to MTBE and LLE extraction. Moreover, we were able to quantify the low abundance of polar phospholipids with MUFA in zebrafish liver that was previously considered unquantifiable in rat liver. In the further study, we aim to apply the proposed method in two experimental groups, normal feeding zebrafish (control) and overfeeding zebrafish (case), to identify and perform the absolute quantification of the differentiating polar lipids between two groups.

CONCLUSION

In this study, we proposed a reliable lipid extraction protocol and the separation protocol that can extract the lipids and further allows the separation of polar and non-polar lipids from the zebrafish liver with high efficiency and sensitivity. The UPLC-TQ-MS method we developed has been validated via lipid quantifications of seven classes of glycerophospholipids, two classes of sphingolipids, two classes of glycerolipids, and one class of sterol lipid standards using the specific MRM mode. With our optimized MRM conditions (precursor ion, qualifier, and quantifier daughter ion), we can accurately identify and quantify the targeted lipids in the zebrafish sample. In the further study, we will quantify the targeted lipid from the liver sample (control and HS model zebrafish), and statistical analysis will be conducted to identify the differentiating targeted lipid between the case and control.

RECOMMENDATIONS

The quantification of a phospholipid in a biological sample is challenging not only because of the structural complexity of polar lipids but also due to the presence of numerous isobaric and isomeric species of the phospholipid present in samples. To establish a biomarker for HS, profiling individual species of phospholipids is essential. Thus, in the future study, a researcher can apply the proposed method and perform the profiling of hundreds of lipids (isomers and isobars) with possible toxicity in the NAFLD model to establish the biomarkers for the HS.

ETHICAL DECLARATION

This research was conducted at Siriraj Metabolomics and Phenomics Center (SiMPC) and the Zebrafish Laboratory, Department of Biochemistry, Faculty of Medicine, Siriraj Hospital, Mahidol University. The protocols followed for experiments were approved by the Institutional Review Board (IRB) of Siriraj Hospital, Mahidol University.

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DEMOGRAPHIC CHANGE IN THE WORKING-AGE POPULATION AND ECONOMIC GROWTH IN MACAU: EVIDENCE FROM FEMALE LABOR FORCE PARTICIPATION: 1982-2019

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ABSTRACT

In the past four decades, Macau has witnessed vigorous economic growth and massive demographic change. Apart from the shifting population size and age structure, the sex ratio (males divided by females) has declined substantially. The falling sex ratio has coincided with the burgeoning service sector, which highly depends on the labor force, especially female workers. In this study, we focused on Macau from 1982 to 2019 to investigate the impact of demographic change on Macau's GDP growth. We set a five-year time lag for the dependent variable, GDP. The time-series data adopted in this article were collected from the Yearbook of Statistics, World Bank Open Data, and *Boletim Oficial de Macau*. Due to the data limitations, we constructed two regression models covering the period from 1982 to 2019, and 1992 to 2019. The data of the two models are from the same datasets. The first model includes sex ratio in the total population, life expectancy, total fertility rate (TFR), government expenditure on education, dependency ratio, sex ratio in the working-age population, and male and female working-age populations, as independent variables. The second model replaced the working-age population with the labor force participation rate and replaced the sex ratio in the working-age population with the sex ratio in the labor force. We found that demographic change substantially contributed to Macau's economic growth between 1982 and 2019. The first regression model suggests that a lower sex ratio in the working-age population positively affected the GDP (β= -9.9; p = 0.006, CI=[-16.8, -3.1]). However, there was no strong evidence to prove that the increasing female working-age population contributed to GDP growth (β= -5.4; p = 0.120; CI=[-12.2, 1.5]). The results of the second model indicate that a higher female labor force participation rate had a positive impact on GDP (β= 6.3; p = 0.010; CI=[1.8, 10.9]), while the male labor force participation rate had the opposite effect (β= -8.0; p = 0.003, CI=[-12.7, -3.2]). The difference in the results of the two models implies that women are playing increasingly important role in Macau's economic activity. The authors recommend that the government carry out gender budgeting to increase female labor participation and expend more on education.

Keywords: *Macau, demographic change, economy, population, labor force participation*

INTRODUCTION

Demographic change describes the dynamic in a population's composition which has substantial economic implications. Although there is a deep tradition of studying demographic change as part of economics, *demographic economics* is a new subject derived from interdisciplinary research on economy and demography. For decades, academic interest in this field of study has focused on the impact of demographic change on economic growth. The earliest studies primarily focused on the effect of population growth. Based on theoretical studies conducted in varied locations, demographic economists have debated how population growth has affected economic growth [1-3]. Since the late 1990s, studies on the population age structure have become popular. More scholars started to explore how change in the population age structure impacted economic growth [4, 5].

Finally, demographic economists highlighted the increase in the working-age population and labor force participation as an impetus for economic growth. In recent decades, the substantial increase in female labor force participation has significantly boosted total labor force participation. Sinha claimed that the nexus between economic growth and female labor participation represented a U-shape model, i.e., female labor participation falls when society transitions from an agrarian to an industrial economy, but increases in the late stages of the industrial economy [6]. In some regions, the falling sex ratio can also be a potential factor contributing to increased labor force participation [7]. Nevertheless, very few studies focus on the impact of the changing sex ratio and female labor force participation on economic growth.

In the past four decades, Macau has witnessed vigorous economic growth and massive demographic change. Apart from shifts in population size and age structure, the sex ratio (males divided by females) has declined substantially. The falling sex ratio has coincided with the burgeoning service sector, which highly depends on the labor force, especially female workers. Therefore, this study uses Macau as the study area, and focusing on the time period between 1982 and 2019 to investigate the impact of demographic change on economic growth. We define the demographic change in Macau as change in population size and structure, sex ratio, and labor force participation. Instead of the total population size, we focus on the working-age population, because the latter substantially impacts the economy. In the last four decades, Macau has witnessed vigorous economic growth as well as massive demographic change. Apart from the population size and change in age structure, the sex ratio has declined substantially. Therefore, a study on the relationship between demographics and the economy can help us better understand how Macau's demographic change, especially the changes in sex ratio, have affected its economic growth.

DEMOGRAPHIC TRENDS AND ECONOMIC GROWTH IN MACAU

Despite the increasing population due to migration, Macau has not experienced a dramatic demographic transition over the last four decades. As shown in Figure 1, the crude death rate (CDR) of Macau remained below 5 ‰ from 1982 to 2019. By contrast, the crude birth rate (CBD) has fluctuated widely from year to year. The Macau CBR peaked at 22.9% in 1986 but dropped to 7.67% in 2005. While the CBR resumed its ascent in the rest of the period, it has never returned to its peak level. Despite the overall downtrend in fertility and the low CDR, the total population of Macau increased from approximately 260,000 in 1982 to around 680,000 in 2019. Migration has played a significant role in that increase.

The booming economy of Macau in the late 1970s created a great demand for labor. Meanwhile, the opening-up policy in Mainland China resulted in a large migration of working-age mainland Chinese to Macau [8]. According to the 1991 population census estimation, around 70,000 migrants from mainland China settled in Macau during the 1980s, most of whom were illegal [9]. After Macau reverted to Chinese control in 1999, another 90,000 migrants (most of whom were born in mainland China), moved to Macau. Over the four decades, massive immigration has dramatically changed the demographic profile of Macau.

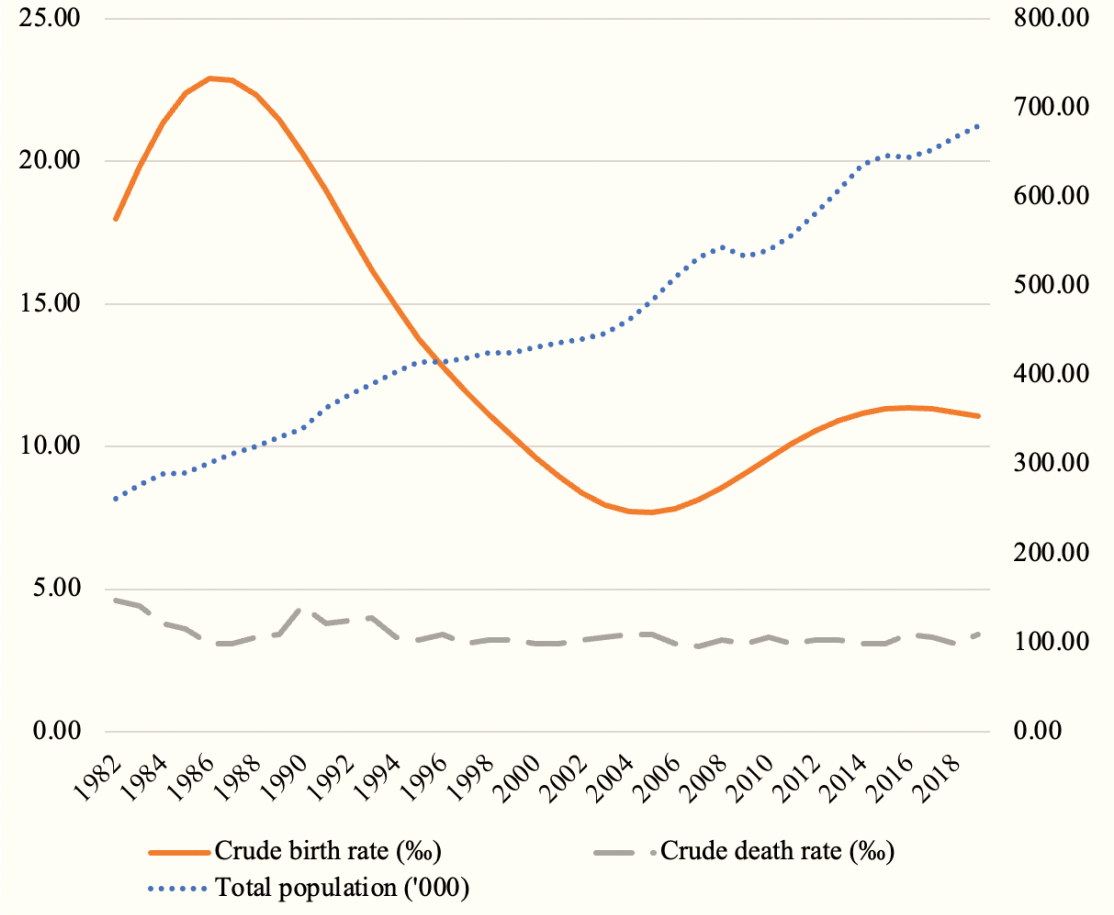

Figure 1: Demographic Transition of Macau: 1982 – 2019
Sources: (1) CBR and CDR are from the World Bank; (2) Data on total population are from Yearbook of Statistics (1982 – 2019) by the Statistics and Census Service of Macao SAR [14-15].

The age pyramids of the population demonstrate the changes in Macau's population structure. The age pyramid in 1980 is an expanding pyramid with wide bars at the younger ages and very narrow bars at older ages, which indicates a fast-growing population (Figure 2.1). In 1980, although the sex ratios for the population group under age 15 and over 65 years remained skewed, the sex ratio in the working-age population increased from 94.5 to 105.5. Macau's population age structure had rapidly evolved from an expansive pyramid to a quasi-stationary pyramid in 2000, which can be described as an oblong shape. In Figure 2.2, the proportion of the working-age population became predominant while the proportion of people under age 15 shrank considerably. At the same time, the sex ratio in the population under age 15 was 107.8, similar to the previous level. However, with more female workers, the sex ratio in the working-age population declined to 87.4 in 2000. Surprisingly, Macau's population structure had changed to a constrictive pyramid by 2020, and the population appears to be very narrow at the bottom (Figure 2.3). Although the proportion of the working population was still predominant, the proportion of the population age over 65 years also grew considerably. The sex ratio in the population under age 15 and in the working ages were 109.9 and 84.1, respectively, which did not dramatically differ from the sex ratios in 2000.

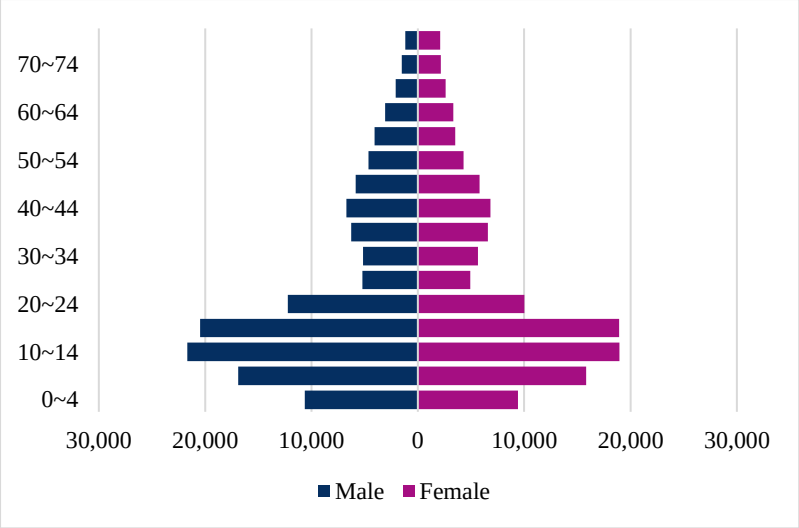

Figure 2.1: Population pyramid – Macau (1980)
Source: Yearbook of Statistics 1980 by Repartição dos Serviços de Estatística.

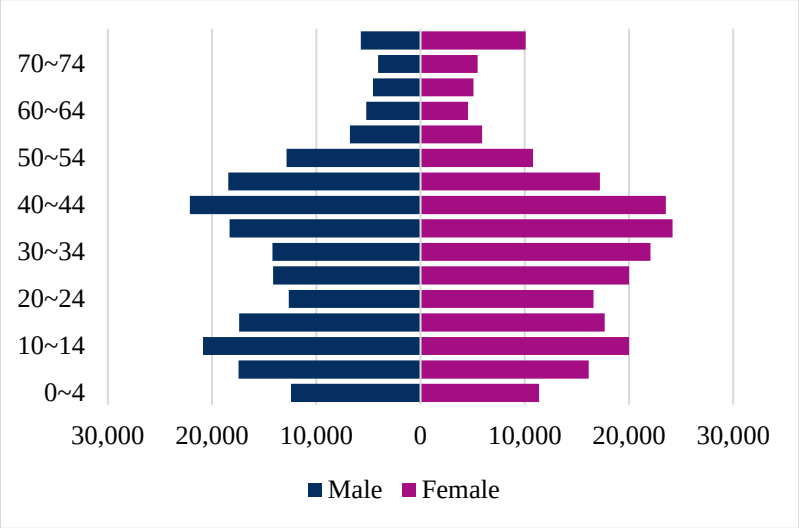

Figure 2.2: Population pyramid – Macau (2000)
Source: Yearbook of Statistics 2000 by the Statistics and Census Service of Macao SAR.

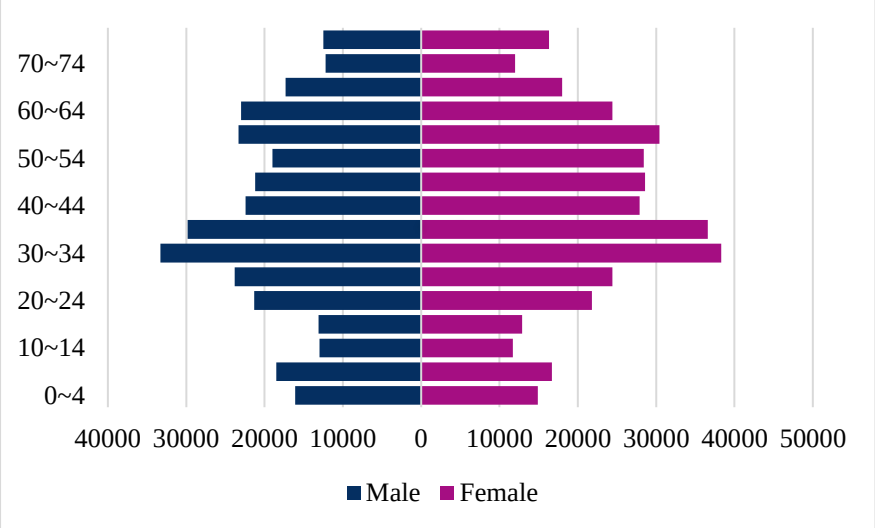

Figure 2.3: Population pyramid – Macau (2020)
Source: Yearbook of Statistics 2020 by the Statistics and Census Service of Macao SAR.

The changes in the age structure are reflected in the dependency ratio. As shown in Figure 3, the total dependency ratio reflects a declining trend, which reached the lowest point in 2011 at 24.6% before slightly increasing. By contrast, the GDP of Macau increased over the same time period. The declining total dependency ratio is largely attributable to changes in the youth dependency ratio. Meanwhile, the elderly dependency ratio remained relatively stable at around 10%. The increasing proportion of the working-age population provides a demographic dividend for Macau's economic growth.

The other remarkable change in the population structure is the change in the sex ratio. Figure 4 illustrates the sex ratios in the working-age population, labor force, and total population between 1992 and 2019. Despite the stable sex ratios in the total population and working-age population (fluctuating by around 0.9 percentage points), the sex ratio in the labor force experienced a tremendous decline: From 1.52 in 1992 to 0.96 in 2019. The declining sex ratio in the working-age group indicates the changes in the labor force participation rate. As shown in Figure 5, Macau's labor force participation rate appeared to have two ladders. During 1992 – 2001, the rate was approximately 65%; after a dip between 2001 and 2003, it jumped to a higher level of 73%. That abrupt jump can be attributed to the increasing female labor force participation. The concurrent increase in the female labor force participation rate and GDP suggests a causative correlation between the two variables. Therefore, in this paper, we speculate that the declining dependency and sex ratios in the labor force positively affected Macau's economic growth.

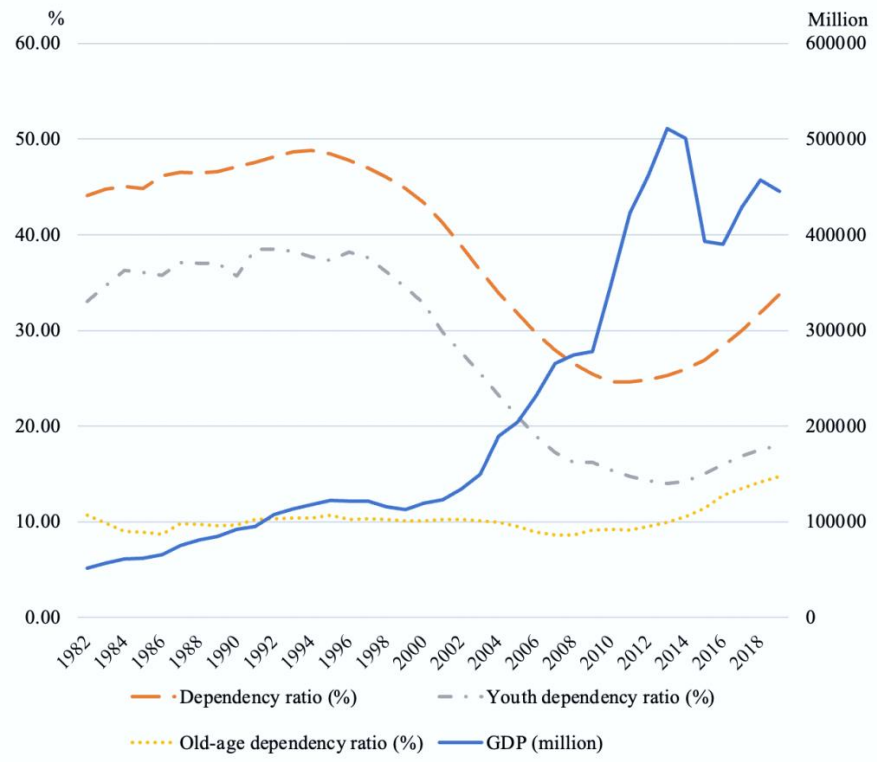

Figure 3: Dependency ratios and GDP of Macau: 1982 – 2019.
Source: Yearbook of Statistics (1982 – 2019) by the Statistics and Census Service of Macao SAR

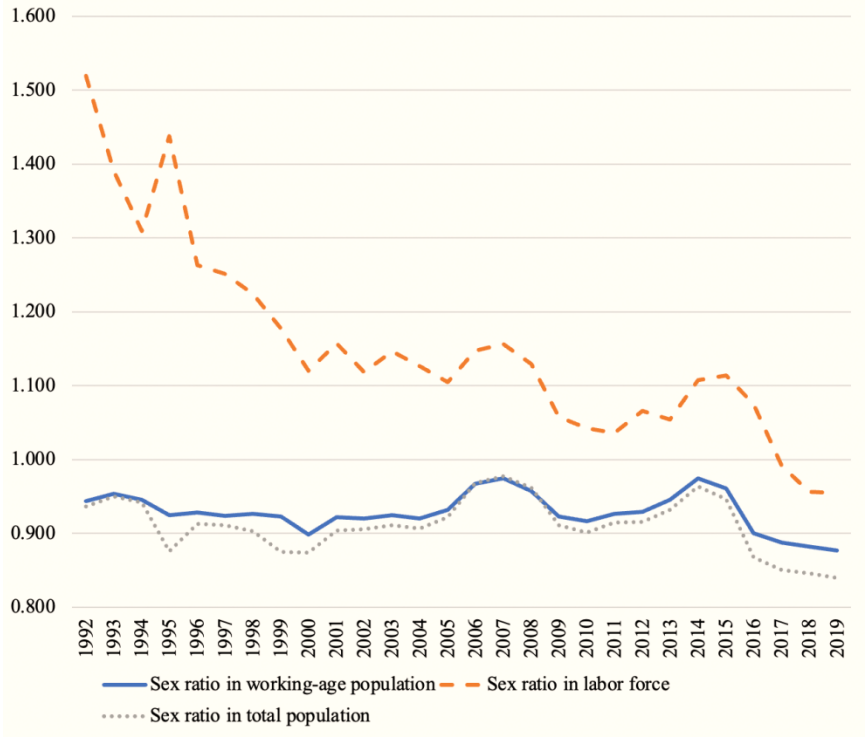

Figure 4: Sex ratio in Macau: 1992 – 2019
Source: Yearbook of Statistics (1992 – 2019) by the Statistics and Census Service of Macao SAR

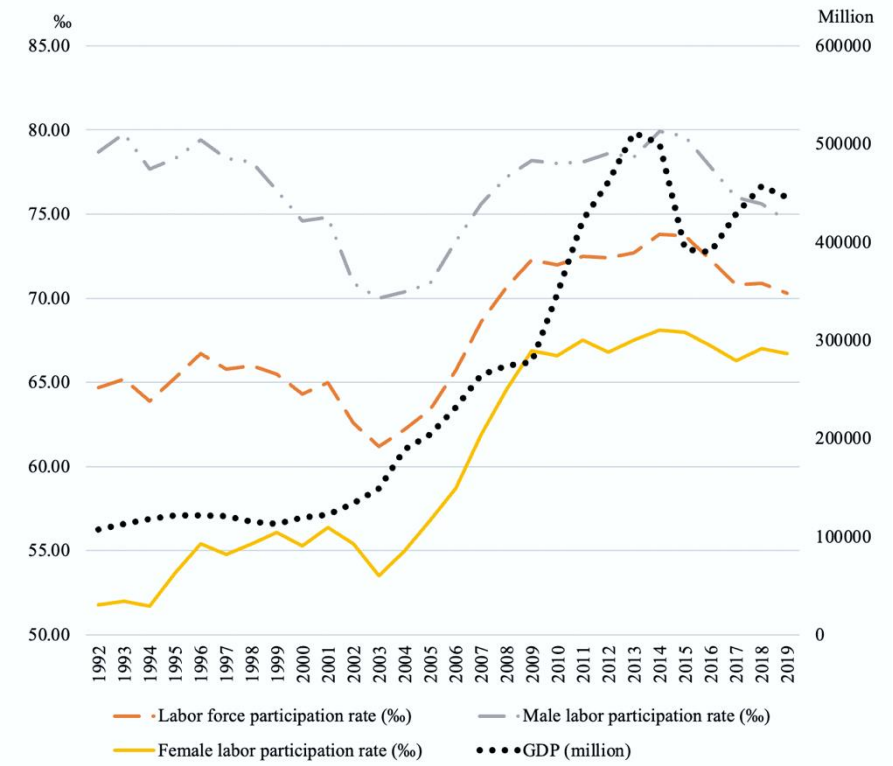

Figure 5: Labor Force Participation Rates of Macau: 1992 – 2019
Source: Yearbook of Statistics (1992 – 2019) by the Statistics and Census Service of Macao SAR

METHODS

DATA

This study investigates the impact of demographic change on Macau's GDP growth from 1982 to 2019. The exclusion of data in 2020 is to avoid the interference of the Covid-19 pandemic on the data linearity. Macau's GDP in 2020 was severely stunted by Covid. The primary data source are the Yearbooks of Statistics compiled by the Government of Macao Special Administrative Region Statistics and Census Service (DSEC). Other data are from the World Bank Database and *Boletim Oficial de Macau*. All the variables used in this paper are illustrated in Table 1. Among them, the dependent variable (GDP) is measured by the purchasing power of 2019, and denominated in Macanese Pataca (MOP). "*Chained dollars*" is a measure of adjusting the actual GDP amount for inflation over time, which allows the comparison of GDP in different years. Concerning the independent variables, according to the definition given by the OECD data, the working-age population is people age 15 to 64 years [10]. In addition, DSEC has defined the labor force as people age 16 or older who are available to participate in work [11]. As shown in Table 1, we transformed the data of some variables into logarithms to normalize the originally-skewed data, and improve linearity between independent and dependent variables.

Table 1: Descriptive Statistics of Variables and Data Sources

Variable	Source	Mean	Standard deviation	Minimum	Maximum
1982-2019					
Demographic factors					
Log Dependency ratio	Yearbook of Statistics	3.61	0.26	3.2	3.89
Log End-year population	Yearbook of Statistics	6.15	0.21	5.77	6.52
Sex ratio in the total population	Yearbook of Statistics	0.95	0.05	0.88	1.07
Sex ratio in the working-age population	Yearbook of Statistics	0.94	0.07	0.84	1.12
TFR	World Bank data	1.32	0.41	0.86	2.12
Log male working-age population	Yearbook of Statistics	5.12	0.25	4.7	5.52
Log female working-age population	Yearbook of Statistics	5.18	0.28	4.7	5.62
Log Life expectancy	World Bank	4.38	0.04	4.31	4.43
Economic factors					
Log GDP	Yearbook of Statistics	12.00	0.72	10.84	13.14
Government expenditure on education	*Boletim Oficial de Macau* and Yearbook of Statistics	6.63	1.08	4.13	7.96
1992-2019					
Demographic factors					
Male labor force participation rate	Yearbook of Statistics	0.76	0.03	0.7	0.799
Female labor force participation rate	Yearbook of Statistics	0.60	0.06	0.517	0.681
Sex ratio in the labor force	Yearbook of Statistics	1.15	0.14	0.95	1.52

Note: Datasets are cleared for public use, and are available online.

EMPIRICAL MODEL

This study adopts the linear regression method and employs the empirical model developed by Bloom and Williamson (12) to examine the relationship between demographic change and economic growth in Macau. We establish two regression models due to the data limitation of labor force participation (Table 1). By comparing the two models, we can examine the impact of population structure change and the impact of the labor force participation rate on economic growth.

The Solow-Swan model is a long-run economic growth model which attempts to construct population growth, capital accumulation, and productivity and technology as exogenous factors to explain long-run economic growth. The Cobb-Douglas production function can also express this neoclassical growth model as follows:

$$Y = AL^{1-\alpha}K^{\beta}\mu$$

In this formula, Y = GDP; A = constant term; L = labor input for a worked year; K=human capital input; μ =

random error; and α and β are the elasticity of labor and capital.

We transformed the equation into a logarithm to improve linearity:

$$lnY = A + \alpha lnL + \beta lnK + \mu$$

Based on this equation, we extend it by including more endogenous variables. In the first model (covering 1982 – 2019), we replaced labor input (L) with male and female working-age population, dependency ratio, and life expectancy to more precisely test for the effect of demographic change. Human capital input (K) is replaced by government expenditure on education. In addition, the sex ratio in the total population, sex ratio in the working-age population, and TFR are included to examine the effect of the changing sex ratios, and reduce the constant term.

$$\begin{aligned}\ln GDP = A_0 &+ \alpha \ln M_{15-64} + \gamma \ln F_{15-64} + \beta \ln K \\ &+ \theta \ln GDR + \varepsilon \ln Elife + \epsilon TFR \\ &+ \rho SR_{15-64} + \vartheta SR + \mu\end{aligned} \quad (1)$$

In the second model (covering 1992 – 2019), we replaced the working-age population with the labor force participation rate, and replaced the sex ratio in the working-age population with the sex ratio in the labor force.

$$\begin{aligned}\ln GDP = A &+ \alpha \ln M_{lfpr} + \gamma \ln F_{lfpr} + \beta \ln K \\ &+ \theta \ln GDR + \varepsilon \ln Elife + \epsilon TFR \\ &+ \rho SR_{labor\ force} + \vartheta SR + \mu\end{aligned} \quad (2)$$

Symbols of the Model
Life expectancy = Elife
Government expenditure in education (Human capital) = K
Sex ratio in total population = SR
Dependency ratio = GDR
Sex ratio in the working-age population = $SR_{labor\ force}$
Male labor force participation rate = M_{lfpr}
Female labor force participation rate = F_{lfpr}
Sex ratio in the labor force = $SR_{labor\ force}$
Male working-age population = M_{15-64}
Female working-age population = F_{15-64}

RESULTS

Since some variables of this study are log-transformed, parameter estimation involves more calculations than simply deriving the coefficients. As shown in Table 2, the result of the regression Model 1 indicates that neither changes in dependency ratio nor sex ratio in the working-age population significantly impacted GDP. This result was unexpected and contrary to the study hypothesis. By contrast, life expectancy and TFR had a strong positive correlation with GDP. According to the regression result, if there is a 1% increase in life expectancy, Macau's GDP will be expected to have approximately 20% increase (β= 18.3; p = 0.003; CI=[6.9, 29.7]). Regarding fertility, an increase of one unit in the TFR is associated with a 49.3% increase in the GDP (β= 0.4; p = 0.005; CI=[0.1, 0.7]).

Regression Model 2 replaced the variables of the working-age population with the labor force (Table 2). The results show that the changes in the dependency and sex ratio in the labor force have strong negative correlations with the GDP between 1992 and 2019. For every 1% increase in the dependency ratio, the GDP decreased by about 0.6% (β= -0.6; p = 0.045; CI=[-1.2, 0]). Further, an increase of one unit in the sex ratio in the labor force is associated with a 61.2% decrease in GDP (β= -1.0; p = 0.055; CI=[-1.2, 0]). These results are consistent with the trends and our hypothesis (Figures 3 and 4). Concerning other demographic variables, life expectancy and TFR also correlate with GDP. With a 1% increase in life expectancy, Macau's GDP is expected to have a 12.5% increase (β= 11.9; p = 0.005; CI=[4.0, 19.8]). Further, if there is a one unit increase in the TFR, the GDP will have a surprisingly 265.1% increase (β= 1.3; p = 0.000; CI=[0.8, 1.8]).

Although the two models are established on the same function and draw on the same dataset, they focus on different time series and variables. Compared with Model 1, Model 2 covers a shorter and later time period, and focuses on the labor force rather than the working-age population. The shorter and later time period gives a more convincing result for the impact of the dependency ratio. That said, the results of the two models reveal the strong impact of TFR and life expectancy on the GDP. The magnitude of life expectancy in Model 1 is larger than in Model 2. That finding can be attributed to the quasi-logarithmic growth of life expectancy. However, the regression results of TFR appear to be suspicious, and contrasts with the trends (Figures 1 and 3). Moreover, the results barely provide any evidence for our hypothesis about labor force participation and the working-age population. One possible explanation for this contradiction can be the delay between a change in the demographic variable and a consequence known as a "time lag." With a time lag, it is difficult to quantify the impact of demographic change, insofar as that change takes time to influence the economy.

To reduce the time-lag effect, we included one to five years of lag in the GDP to compare with the baseline model. As shown in Appendices 1 and 2, as the duration of the lag period increases, the impact of expenditure on education and other demographic variables becomes more significant, suggesting that the 5-year

lag is robust to the dependent variable. As illustrated in Table 2, both Models 1 and 2, with 5-year lags, suggest that demographic change substantially contributed to Macau's economic growth from 1982-2019 and 1992-2019, respectively.

With a 5-year lag, Model 1 implies a positive correlation between the dependency ratio and GDP, suggesting that there is a negative relationship between working-age population and economic growth. This result could be attributed to the lag periods in the dependent variable in ways which might not apply to the dependency ratio. Concerning the sex ratio, a lower sex ratio in the working-age population had a positive effect on the GDP (β= -9.9; p = 0.006, CI=[-16.8, -3.1]). However, although there is a positive correlation between an increasing male working-age population and the GDP, there is no strong evidence to prove that an increasing female working-age population contributes to GDP growth (β= -5.4; p = 0.120; CI=[-12.2, 1.5]).

Given the similar findings with its counterpart, Model 2 (with a 5-year lag) suggests that a higher female labor force participation rate had a positive impact on GDP (β= 6.3; p = 0.010; CI=[1.8, 10.9]), while the male labor force participation rate had the opposite effect (β= -8.0; p = 0.003, CI=[-12.7, -3.2]). The difference in the results of the two models implies that women play an increasingly important role in Macau's macro-economic activity. Therefore, the change in the labor force sex ratio **(i.e.**, the rise in the number of female workers relative to male workers**)** is positively correlated with GDP**.**

Comparing Models 1 and 2 with time lags, we found that the magnitude of expenditure on education has been augmented in recent years. An increase of one unit in expenditure on education is associated with a 17.8% increase in GDP during 1982-2019, but a 31.5% increase in GDP during 1992-2019. Nevertheless, compared with Model 2, Model 2 with time lag seems not to fit well to quantify the impact of changes in the dependency ratio.

Table 2: Model 1: Impact of demographic change and expenditure on economic growth (GDP), 1982-2019

Independent variables	Log GDP				Log GDP (Model with 5-year lags)			
	Coefficient	Std. Error	*P*-value	Conf. Interval	Coefficient	Std. Error	*P*-value	Conf. Interval
Sex ratio in the total population	0.116	(2.15)	0.957	[-4.29, 4.52]	0.175	(1.70)	0.919	[-3.33, 3.68]
Log Life expectancy	18.284***	(5.59)	0.003	[6.86, 29.71]	8.634**	(3.53)	0.022	[1.34, 15.93]
TFR	0.401***	(0.13)	0.005	[0.13, 0.67]	0.698***	(0.08)	0.000	[0.54, 0.86]
Government expenditure on education (human capital)								
	-0.160	(0.11)	0.169	[-0.39, 0.07]	0.164**	(0.07)	0.031	[0.02, 0.31]
Log Dependency ratio	-0.685	(0.25)	0.012	[-1.21, -0.17]	0.555***	(0.15)	0.001	[0.24, 0.87]
Sex ratio in the working-age population	1.663	(1.82)	0.368	[-2.06, 5.38]	-9.911***	(3.32)	0.006	[-16.76, -3.01]
Log male working-age population	-3.117	(2.79)	0.274	[-8.83, 2.60]	7.029**	(3.41)	0.050	[-0.01, 14.07]
Log female working-age population	3.357	(2.86)	0.250	[-2.50, 9.21]	5.360	(3.32)	0.012	[-12.22, 1.50]
Constant	-68.231***	(23.66)	0.007	[-116.62, -19.84]	-29.18**	(17.76)	0.077	[-61.80, 3.44]
Observations	38				33			
R^2	0.9726				0.9867			

Note. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table 3: Model 2: Impact of demographic change and expenditure on economic growth (GDP), 1992-2019

Independent variables	Log GDP				Log GDP (Model with 5 year lags)			
	Coefficient	Std. Error	P-value	Conf. Interval	Coefficient	Std. Error	P-value	Conf. Interval
Sex ratio in the total population	1.979*	(1.07)	0.079	[-0.26, 4.21]	-0.846	(1.01)	0.416	[-3.01, 1.32]
Log Life expectancy	11.867***	(3.77)	0.005	[3.98, 19.75]	9.363**	(3.73)	0.025	[1.37, 17.36]
TFR	1.295***	(0.23)	0.000	[0.82, 1.77]	2.046***	(0.40)	0.000	[1.18, 2.91]
Government expenditure on education (human capital)	-0.133	(0.10)	0.213	[-0.35, 0.08]	0.274***	(0.08)	0.004	[0.10, 0.45]
Log Dependency ratio	-0.595***	(0.28)	0.045	[-1.17, -0.02]	0.703***	(0.24)	0.010	[0.19, 1.21]
Male labor force participation rate	-2.421	(1.68)	0.165	[-5.93, 1.09]	-7.970***	(2.21)	0.003	[-12.72, -3.22]
Female labor force participation rate	1.940	(2.15)	0.379	[-2.56, 6.44]	6.334***	(2.14)	0.010	[1.75, 10.9]
Sex ratio in the labor force	-0.946**	(0.46)	0.055	[-1.91, 0.02]	0.902	(0.82)	0.292	[-0.86, 2.67]
Constant	-38.352***	(16.21)	0.029	[-72.28, -4.42]	-33.803*	(16.57)	0.061	[-69.34, 1.73]
Observations	28				23			
	0.9837				0.9920			

Note. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

CONCLUSIONS

In the past four decades, Macau has witnessed massive demographic change in terms of population size, sex ratio, and age structure. By establishing two regression models, this study verified the contention that demographic change substantially contributed to Macau's economic growth from 1982 to 2019. The findings suggest that female labor force participation has had a significant positive impact on Macau's economic growth, especially in recent years. In addition, this study also found that the impact of government expenditure on education has also become more significant in recent years.

Macau is an economy that is highly dependent on the service sector. In the last decade, the proportion of the service sector in the gross domestic product (GDP) has been around 90% [(11)]. The proportion of female workers, undoubtedly, is high in this sector [(13)]. Therefore, with the gradual increase in female labor force participation over the years, the Macau government may carry out gender budgeting, increasing women's participation, and boosting economic growth. Moreover, as the findings found a positive impact of expenditure on education on economic growth, the government should expend more on education to cultivate high-quality talent, and encourage more females to attain higher education.

Given the length and data linearity limitations, the data and discussion during the pandemic are not included in this analysis. This study only included certain variables in the realms of demography, human capital input, and economics, but did not consider qualitative variables such as Macau's political and economic system. Additionally, a disadvantage of using secondary data is that it may not contain specific information that the researchers require. The end-year population was adopted to maintain consistency due to the absence of accurate census data for each year. There was no empirical data on capital input, and data on education expenditure was used to estimate the capital inputs. The application of alternative data might lead to inaccurate results. Still, this study provides a model and a direction for future studies. The model established in this study could be reused and extended to other regions to compare with Macau. Moreover, future studies should be conducted to investigate the impact of the Covid-19 pandemic on Macau's population.

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APPENDIX 1

Table 1: Model 1: Impact of demographic change and expenditure on economic growth, 1982-2019, with zero to five-year time lags

Independent variables	Log GDP	Log GDP (with 1-year lags)	Log GDP (with 2-year lags)	Log GDP (with 3-year lags)	Log GDP (with 4-year lags)	Log GDP (with 5-year lags)
Sex Ratio in the total population	-0.116	2.675	3.984	3.265	1.434	0.175
	(2.15)	(2.51)	(2.46)	(2.15)	(1.66)	(1.70)
Log Life expectancy	18.284***	21.047***	21.419***	23.768***	13.526***	8.634**
	(5.59)	(6.35)	(6.23)	(5.47)	(4.51)	(3.53)
TFR	0.401***	0.549***	0.645***	0.733***	0.743***	0.698***
	(0.13)	(0.15)	(0.15)	(0.13)	(0.10)	(0.08)
Government expenditure in education (human capital)	-0.160	0.004	0.071	0.095	0.113	0.164**
	(0.11)	(0.13)	(0.13)	(0.12)	(0.09)	(0.07)
Log Dependency ratio	-0.685	-0.250	-0.017	0.323	0.443**	0.555***
	(0.25)	(0.30)	(0.29)	(0.26)	(0.20)	(0.15)
Sex ratio in the working-age population	1.663	1.162	1.505	1.583	-11.316	-9.911***
	(1.82)	(2.16)	(2.12)	(2.11)	(4.28)	(3.32)
Log male working-age population	-3.117	-3.000	-4.105	-3.842	8.460*	7.029**
	(2.79)	(3.26)	(3.20)	(2.94)	(4.21)	(3.41)
Log female working-age population	3.357	3.123	4.265	4.028	-7.174*	5.360
	(2.86)	(3.33)	(3.27)	(2.97)	(4.05)	(3.32)
Constant	-38.775**	-84.609***	-89.541***	-100.924***	-47.683**	-40.85**
	(16.48)	(27.07)	(26.56)	(23.48)	(20.68)	(17.76)
Observations	38	37	36	35	34	33
R^2	0.9878	0.9641	0.9644	0.9724	0.9832	0.9900

Note. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

APPENDIX 2

Table 2: Model 2: Impact of demographic change and expenditure on economic growth, 1992-2019, with zero to five-year time lags

Independent variables	Log GDP	Log GDP (with 1-year lags)	Log GDP (with 2-year lags)	Log GDP (with 3-year lags)	Log GDP (with 4-year lags)	Log GDP (with 5-year lags)
Sex Ratio in the total population	1.979*	4.099***	2.938	0.757	-1.086	-0.846
	(1.07)	(0.94)	(1.10)	(1.32)	(1.58)	(1.01)
Log Life expectancy	11.867***	9.483***	12.801***	21.411***	16.124***	9.363**
	(3.77)	(3.72)	(4.34)	(5.08)	(5.39)	(3.73)
TFR	1.295***	1.381***	1.469***	1.009*	1.422**	2.046***
	(0.23)	(0.22)	(0.31)	(0.51)	(0.56)	(0.40)
Government expenditure in education (human capital)	-0.133	0.034	0.132	0.069	0.193	0.274***
	(0.10)	(0.09)	(0.11)	(0.12)	(0.12)	(0.08)
Log Dependency ratio	-0.595***	0.013	0.044	0.399	0.602	0.703***
	(0.28)	(0.25)	(0.30)	(0.37)	(0.37)	(0.24)
Male labor force participation rate	-2.421	-4.342**	-2.667	0.369	-4.268	-7.970***
	(1.68)	(1.77)	(2.06)	(2.25)	(3.26)	(2.21)
Female labor force participation rate	1.940	5.297	3.643	2.147	5.350	6.334***
	(2.15)	(1.99)	(2.38)	(2.75)	(3.26)	(2.14)

Independent variables	Log GDP	Log GDP (with 1-year lags)	Log GDP (with 2-year lags)	Log GDP (with 3-year lags)	Log GDP (with 4-year lags)	Log GDP (with 5-year lags)
Sex ratio in labor force	-0.946**	-0.255	0.212	0.245	1.432	0.902
	(0.46)	(0.47)	(0.54)	(0.68)	(1.26)	(0.82)
Constant	-38.352***	-34.664**	-49.968	-87.650***	-64.513	-33.803*
	(16.21)	(16.08)	(18.86)	(22.43)	(23.86)	(16.57)
Observations	28	27	26	25	24	23
R^2	0.9837	0.9874	0.9828	0.9800	0.9803	0.9920

Note. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

HEALTH IMPACT ASSESSMENT OF SHORT-TERM EXPOSURE TO PARTICULATE MATTER (PM2.5) ON HOSPITAL ADMISSIONS FOR RESPIRATORY DISEASES IN THAILAND

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ABSTRACT

Fine particulate matter with a diameter ≤ 2.5 microns or micrometers (PM2.5) is highlighted as a harmful pollutant worldwide. Several previous epidemiological studies investigated the dangerous effects of PM2.5 on human health due to various diseases, particularly respiratory problems. This study aims to assess the impact of PM2.5 exposure and provide the estimation of attributed cases of hospital admissions for respiratory diseases, which could be avoided where "cut-off values" are respected due to short-term PM2.5 exposures among the Thai population. This study analyzed PM2.5 concentration and health data in 2019. The total population and area size for the specific province was collected. This study collected data related total number of hospital admission for respiratory diseases in all provinces from the Ministry of Public Health, Thailand. The daily average of PM2.5 concentrations was calculated from all air stations in 77 provinces within Thailand. The Air Q+ Software developed by World Health Organization was used to elaborate on the changes and health impact of air pollution PM2.5 in the population. This study applied six options of daily PM2.5 average as "cut-offs" or counterfactual factors following Air Quality Guideline (AQG) standards. The total number of hospital admissions for respiratory diseases **(**ICD-10-CM codes J00–J99) in 2019 was 3,180.35 incidences per 100,000 at-risk population (adults ages ≥ 30 years old). The number of at-risk population for all provinces was 40,572,731 or 60,957.6 per 100,000 people. The highest number of province-specific incidences was in Nakhon Ratchasima at 77,876.76 cases per 100,000 at-risk population. The benefit of reduction of PM2.5 on hospital admissions for respiratory diseases is related to 0.61% for cut-off equal to 15μg/m^3 and 0.07% for cut-off equal to 50μg/m^3. This study adjusted the daily average of PM2.5 at 15μg/m^3 as the lowest cut-off value. The results described the estimated case numbers as 159,902 respiratory admissions to the hospital or 349 attributed cases per 100,000 people. The result demonstrated the significant impact of short-term exposure to PM2.5 on hospital admissions by estimating attributed proportion and cases. The estimation indicates the roadmap for policymakers and stakeholders to improve air pollution risk and management actions.

Keywords: *Air pollution, PM2.5, AirQ+ tool, Short-term Impacts, Respiratory diseases.*

INTRODUCTION

Air pollution has been a highlighted environmental health issue over the past years, especially exposure to particulate matter (PM) size ≤ 2.5 microns or micrometers. This pollutant can easily penetrate the deepest part of the human lungs, potentially causing many respiratory problems. Air pollution causes hundreds of millions of people to lose years of healthy life and over 4 million deaths yearly [(1)]**.** In 2019, ambient PM2.5 exposure was listed as the Top 3 leading risk factors for global attributable disability-adjusted life years (DALYs) and years of life lost (YLLs) (Global Burden, 2019). While the increased number of respiratory incidences has become a significant global disease burden, many scientific studies exhibited substantial impacts of short-term exposure to PM2.5 on human health. Studies in European countries reported the substantial effects of short-term PM2.5 exposure and the inclining of the daily number of hospital admission for respiratory diseases (ICD-10-CM codes J00–J99). Another time series study in Shanghai demonstrated the association between PM2.5 and the attributed burden of hospitality respiratory diseases. Additionally, several studies investigated that increasing 10μg/m^3 PM2.5 in a short duration of exposure was associated with an incline in the risk of respiratory diseases [(2-4)]**.** The negative impact on respiratory hospitality due to PM2.5 exposure also affects the length of hospital stay and economic burden [(5)].

Located in Southeast Asia, Thailand also faces problem-related burdens from the effects of PM2.5 exposure. In 2019, Thailand recorded just over 24μg/m^3 and ranked the 28th most polluted country globally. In Thailand, the estimated death-related PM2.5 exposure was 32,200 deaths in 2019 (Health Effect Institute, 2020). In 2021, a study in Thailand published a Health Impact Assessment (HIA) concerning PM2.5 exposure, which reported around 50,000 annual deaths among people aged ≥ 25. The number of mortality incidences was estimated according to the effect of PM2.5 exposure over a long period [(6)]. Then another study among Thai children found that daily exposure to elevated PM2.5 can encourage asthma exacerbation within three days. In contrast, children with indications of asthma are sensitive to exposure to daily concentrations of PM2.5 exceeding 12μg/m^3 [(7)].

Identifying the impacts of short-term PM2.5 exposure is needed to analyze the trend and create program monitoring as control actions. The health impact assessment clarifies the estimation attributed health burden of air pollution exposure at local, country, regional and international levels. The result of the HIA also could be a roadmap for policymakers to create regulations and strategic planning to face the air pollution problem. To support the impact assessment program, many software programs have been developed to calculate the estimated burden of ambient PM2.5 exposure to human health, environment, and economic sectors. For instance, Air Q+ is software provided by the World Health Organization (WHO) European regional office in 2016. The software estimated the disease burden number and impact on the targeted population. Using Air Q+ can help users analyze the health impact of various pollutants and estimate outdoor and household air pollution effects in communities.

No previous studies in Thailand have estimated the health impact of short-term PM2.5 exposure on hospital numbers of respiratory diseases. This study aims to assess the effects of PM2.5 exposure and provide the estimation attributed cases of hospital admissions for respiratory infections due to short-term PM2.5 exposures in the Thai population, which could be avoided where "cut-off values" are respected.

METHODS

DESIGN AND AREA OF STUDY

The study was an analytic cross-sectional study. The assessment was conducted in all the provinces of Thailand. Thailand has 77 provinces with a total area of 510,890 km^2. This study analyzed the health impact due to short-term PM2.5 exposure during 2019.

MEASUREMENT TOOL AND DATA COLLECTION METHOD

We used Air Q+ software to assess the estimation health impact of the changes in short-term particulate matter (PM2.5) concentrations in the population. This software was developed by the World Health Organization as a Health Impact Assessment Tool. Air Q+ needs pre-load data to calculate the estimation attributed cases. We collected all data, including daily PM2.5 concentration, the number of hospital admissions for all respiratory incidences, area sizes, and the populace. The data on PM2.5 concentration was acquired from the Pollution Department Control (PCD) of Thailand. In 2019, all data on PM2.5 concentrations for all provinces were recorded from the ordinary Kriging Technique, which

constructed the interpolation of PM2.5 levels based on each district. This study also input health data from all hospitals in Thailand that were recorded with the Ministry of Public Health Thailand. This study calculated hospital admission numbers for all respiratory incidences according to the ICD-10-CM codes for Diseases of the Respiratory System (J00–J99). For health endpoint analysis, a baseline incidence (BI) was described as the rate of all respiratory disease admission numbers in hospitals for specific provinces per 100,000 at-risk population. In 2019 the incidence rate for hospital admission numbers due to respiratory disease cases were 3,180.35 incidences per 100,000 at-risk population.

POPULATION

This study calculated all populations in Thailand based on province-specific data from the Statistical Bureau of Thailand. The total number of people in Thailand of all ages was collected. People of different ages have health risks of PM2.5 in short-term exposure; however, this study just assessed the health impact among the at-risk population of Thai people aged equal to or over 30 years old. In this targeted group, the numbers of hospital admissions due to respiratory incidences were higher than in the young group. Moreover, Air Q+ software also provides calculation parameters based on epidemiological studies in the past that place people ages ≥ 30 years old as the targeted group. At the time of data collection, the total Thai population of all ages was 66,558,935 within the 77 provinces of Thailand. Nearly 61% of the total population, or 40,572,731 people (60,957.6 per 100,000 people), were considered an at-risk population according to the Air Q+ software calculation. This study just included people with permanent resident status for analysis. People who lived in Thailand without permanent residential status were excluded.

CALCULATION PARAMETERS

The relative risk (RRs) for this study was 1.0056 [1.0023;1.0070] per 10μg/m^3 with a 95% confidence interval. This study applied six options of cut-off values referring to the daily PM2.5 standard, followed according to the literature (Table 1).

Table 1: Counterfactual Values for Short-term PM2.5 Exposure to Hospital Admission of Respiratory diseases Analysis

Cut-Off for Short-Term Analysis	
Option 1: 37.5μg/m^3	Interim target 24-hour mean standard from the WHO Air Pollution Guidelines in 2022
Option 2: 15μg/m^3	Gold Standard AQG daily level from the WHO Air Pollution Guidelines in 2021
Option 3: 35μg/m^3	United States PM2.5 daily standard from the US EPA 2016
Option 4: 50μg/m^3	Current Thailand PM2.5 daily NAAQS
Option 5: 25μg/m^3	Interim target daily mean standard from the WHO Air Pollution Guidelines in 2021
Option 6: 37μg/m^3	Purposed daily standard from the Thai NAAQS PM2.5 revision project

RESULTS

The annual average of PM2.5 exposure in 2019 for all provinces in Thailand was 24.149μg/m^3. The range for daily average exposure in each province was 1.28 to 229.52μg/m^3, with the highest daily average reported by Chiang Mai province. Phra Nakhon Si Ayutthaya ranked the top polluted province with an annual average of 32.8μg/m^3. Most provinces in the Bangkok Metropolitan, North, and Central regions reported exceeding the national average PM2.5 concentration in 2019. In contrast, provinces in the South region reported lower daily and annual average PM2.5 exposure.

Total population at risk or adults ≥ 30 years old was 40,572,731 or 60,957.6 per 100,000 populace. Concerning the baseline health endpoint data, the total initial hospital admissions for respiratory incidence rate was 3,180.35 per 100,000 at-risk population for 77 provinces in Thailand. Nakhon Ratchasima faced the highest number of hospitalized respiratory disease cases at 77876.76 per 100,000 at-risk population, while Ranong showed the complete opposite.

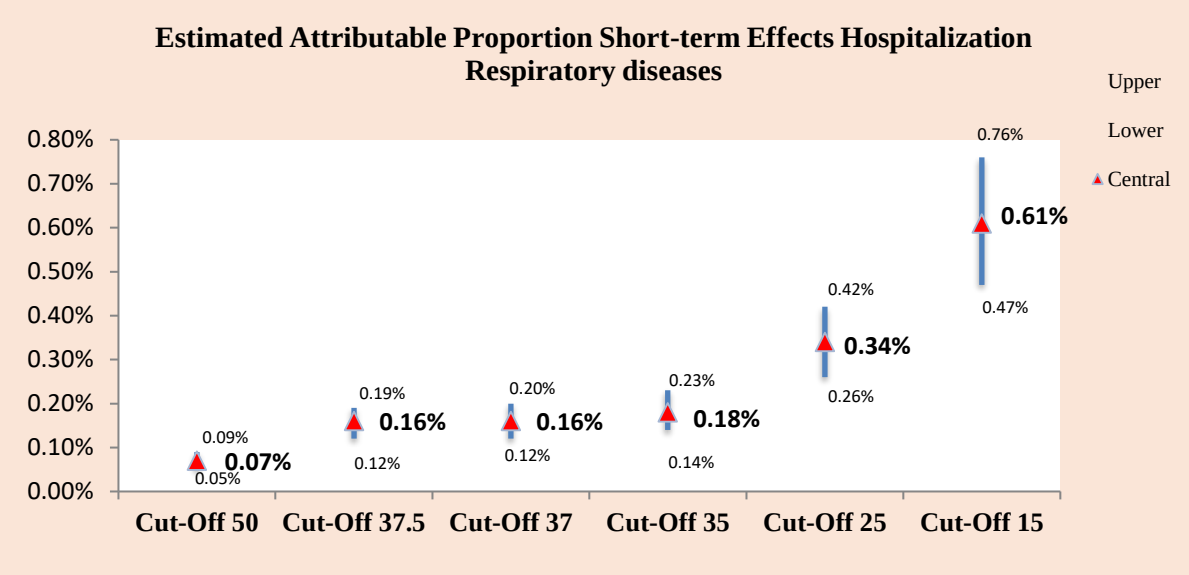

Figure 1: Estimation of Attributable Proportion of PM2.5 Short-term Exposures to Hospital Admission of Respiratory Diseases Incidences (95% CI) at the at-risk population (ages ≥ 30 years old) for All Provinces in 2019

Table 2 and Figure 1 show the result of this study at the country level. The application of various daily options from the standard PM2.5 short-term exposures illustrated different health impacts. The smaller standard daily concentration described the higher attributed incidence. It indicated that a smaller daily average used as a cut-off provides the effect of the probability number of disease burden can still be calculated if the daily average of that area does not exceed the counterfactual value. The estimation attributed incidence proportion in all provinces, with the cut-off on 50μg/m^3, was just at 0.07% [0.05%;0.09%] with a 95% confidence level. In contrast, 0.61% attributed proportion was counted if the daily standard at 15μg/m^3. On the other hand, by meeting the gold standard by WHO in Air Quality Guideline (AQG) 2021 for short-term exposure at 15μg/m^3, the estimated number of attributable cases was 159,902 (122,764;199,910) or 394 per 100,000 at-risk population. It illustrated the great magnitude if the calculation was compared with the cut-off value at 50μg/m^3, where it was estimated to be around 18,511 (14,187;23,185) or 46 per 100,000 at-risk population. Moreover, the lowest PM2.5 concentration defined a significant increase attributable to case hospital admission numbers for respiratory diseases.

Table 2: Estimation of Health Impact of PM2.5 Short-term Exposures to Hospital Admission for Respiratory Diseases Incidences (95% CI) at the at-risk population (ages ≥ 30 years old) for All Provinces in 2019

Cut-Off Value	Estimated number of Attributable Cases	Estimated number of Attributable Cases per 100 000 Population at Risk
Cut-Off 50μg/m^3	18,511 (14,187;23,185)	46 (35;57)
Cut-Off 37.5μg/m^3	40,910 (31,371;51,211)	101 (77;126)
Cut-Off 37μg/m^3	42,245 (32,396;52,882)	104 (80;130)
Cut-Off 35μg/m^3	47,940 (36,766;60,005)	118 (91;148)
Cut-Off 25μg/m^3	88,797 (68,130;111,090)	219 (168;274)
Cut-Off 15μg/m^3	159,902 (122,764;199,910)	394 (303;493)

DISCUSSION

This study was the first health impact assessment using Air Q+ software analysis. This study observed the data set from 77 provinces in Thailand, and the result shows that the average daily PM2.5 was associated with the increasing risk of hospital admissions for respiratory disease in the targeted population. The analysis of negative effects on the respiratory system due to PM2.5 short-term exposure was supported by many epidemiological studies. For instance, in Taiyuan, every 10μg/m^3 increase of the daily PM2.5 average is associated with a 0.53% increase in the admission numbers of hospitalized cases with respiratory disease [(3)]. A study in European countries also showed a substantial effect of a 10μg/m^3 increase in the PM2.5

daily average. Each 10µg/m^3 increase was correlated with a 1.90% increase in hospitals admission numbers with respiratory disease [8].

The studies that used the Air Q+ health impact assessment tool in Ardanil showed around 1.97% attributed proportion for hospital admission numbers due to respiratory diseases when the daily average was above 5µg/m^3 (9). This similar study estimated the total number of attributable cases and the number of attributable cases per 100,000 population (with a 95% confidence level) for hospital admissions with respiratory diseases at 68 persons and 19.42 persons, respectively. A study in 708 cities in the United States showed an increase of 2.57% in hospital admission due to respiratory diseases associated with an inclining 10µg/m^3 PM2.5. Each 10µg/m3 PM2.5 increase also showed a significant correlation with an average of 38% hospital admissions in the 20 million population of Beijing [10].

Looking at the province-specific results, using different cut-offs provides variances in estimating attributed cases and proportions. This study compared the standard of the 2019 daily average PM2.5 in Thailand and the target-related new version of the Air Quality Guidelines. Mae Hong Son reported the highest attributed rate for daily cut-off value at 37.5µg/m^3 of around 731 cases per 100,000 at-risk population or ages ≥ 30 years old. Mae Hong Son was followed by Chiang Rai and Chiang Mai at 460 persons and 462 persons per 100,000 at-risk population, respectively. Meanwhile, the recent Thailand National standard daily average PM2.5 is 50µg/m^3, and the estimated attributed cases rate would be lower with a cut-off of 37.5µg/m^3. To conclude, an illustration of the daily average met with the cut-off value at 37.5µg/m^3. The achievement could show a 0.16% decrease in total death cases attributed or 101 cases per 100,000 at-risk population to short-term PM2.5 exposure. The number of exposures is compared to Thailand in 2019 with a short-term PM2.5 exposure of 24.149µg/m^3.

CONCLUSION

The higher number estimation of the impact of burden due to particulate matter (PM2.5) and hospital admission numbers for respiratory diseases correlate with the number of PM2.5 concentrations, the at-risk population, and incidence rates for each province. Although some cities have low concentration levels, it could be because the area has a possible significant association with the attributed incidence of respiratory hospital admission numbers because of the daily average and health baseline. The various cut-off values represent the daily average that can be used for referencing as estimation attributed proportion and the burden of hospital admission cases for respiratory diseases that can be avoided regarding the health baseline and daily average in provinces specific or country general.

RECOMMENDATION

The PM2.5 short-term exposure measurement could be taken regularly to present the health impact of PM2.5 short-term exposure on the number of hospital admissions for respiratory diseases. Hence, the effect of the burden of disease can be avoided in the Thai population

ETHICAL DECLARATION

Ethics approval for this study was received from Chulalongkorn University Research Ethics Review Committee for Research Involving Human Research Participants Group I (COA: 093/65).

ACKNOWLEDGEMENT

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GEOGRAPHICAL DISTRIBUTION IMPROVEMENT OF PHYSICIANS IN THAILAND AND JAPAN: A COMPARATIVE LONGITUDINAL SECONDARY DATA ANALYSIS

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ABSTRACT

Equitable healthcare workforce distribution to all citizens is necessary to achieve health for all, and has been discussed and addressed in all countries, including Thailand and Japan. This study aimed to longitudinally examine the change in the geographical distribution of physicians between 2008 and 2018 through a comparison between Thailand and Japan via open secondary data available on government websites. The number of physicians, the physician-population ratio, the Gini coefficient, and Spearman's correlation coefficient between population density and physician-population ratio in 2008 and 2018 were calculated and compared between Thailand and Japan. As a subgroup analysis, all 76 provinces in Thailand and 335 secondary medical areas in Japan were divided into four groups according to urban-rural and higher-lower initial physician supply classification. During the decade in question, the Gini coefficient improved from 0.372 to 0.319 in Thailand and from 0.217 to 0.211 in Japan. The correlation coefficient in Thailand was 0.168 and 0.181 in 2008 and 2018, respectively, with no statistical significance. In Japan, the correlation coefficient was 0.368 and 0.405 in 2008 and 2018, respectively, with statistical significance. As for the subgroup analyses, the number of physicians in Thailand increased from 1.97 to 1.99 and 1.55 to 1.74 times for the groups with higher and lower initial physician supply, respectively. In comparison, Japan rose from 1.10 to 1.17 and 0.99 to 1.00 times for the urban and rural groups, respectively. With an increase in the number of physicians in both countries, this comparative study revealed that physicians do not diffuse to unserved areas in Japan, while Thailand relatively successfully allocated physicians to physician shortage areas. In order to produce rural physicians, it is necessary to determine how many physicians in which areas and fields are in short supply and which countermeasures have been effective in each country. It is then necessary to implement policies in a way that is suitable for each country's context and existing systems.

Keywords: *Gini coefficient, Health workforce, Health policy, Physician supply and distribution, Rural health services*

INTRODUCTION

Geographical maldistribution of healthcare resources has been a topic of great interest and debate in various countries [1]. The geographical maldistribution of healthcare workers, especially physicians, within and between countries is a long-standing and critical worldwide problem. In many countries, the number of physicians per capita is on the rise, whether rich or poor. Still, the distribution of physicians is concentrated in urban centers and wealthy areas [2].

The maldistribution of physicians has a variety of effects. For example, a maldistribution of the healthcare workforce can lead to significant disparities in health status between rural and urban populations. In Mexico, the average life expectancy of people in rural areas is 55 years, compared to 71 years in urban areas. The infant mortality rate is 20/1,000 in the wealthier northern regions, compared to 50/1,000 in the poorer southern regions [3]. Geographical maldistribution of physicians also causes inequities in access. It has been reported that some citizens have limited access to healthcare due to a lack of resources. For instance, people living in areas with few physicians may travel farther to see a physician or face long waiting times [4]. In Ghana, access to healthcare is poor in some rural areas, and about 30% of the population is forced to travel long distances to receive secondary or higher levels of healthcare [5].

Geographical maldistribution of physicians has also been pointed out in Japan. Notably, despite the increase in the number of physicians in Japan, the trickle-down effect, as pointed out by Newhouse, has not been observed [6, 7]. It has been noted that the geographical maldistribution of physicians in Japan has mainly remained unchanged or even worsened [8-11]. Japan is attempting to confront this problem by developing a maldistribution index, in addition to the regional quota of medical schools, the establishment of Jichi Medical University, and the ceiling number of medical specialties that have been set up in the past [12]. Physician distribution is expected to be influenced by a country's healthcare and physician education systems. Comparing physician distribution among countries with different healthcare systems makes it possible to consider what kind of system is desirable for the equitable distribution of physicians.

In Thailand, it is shown that physicians are unevenly distributed in different regions [13], but at the same time, the distribution of physicians is fair [14]. In Thailand, Collaborative Project to Increase Production of Rural Doctors (CPIRD) and One-Doctor-One-District (ODOD) programs have been implemented, and specific results have been reported [15, 16]. Thailand appears to have developed an effective policy to eliminate the geographical maldistribution of physicians, and the comparison may provide valuable suggestions for Japan. A comparison between Japan and Thailand would be beneficial for Japan and also for Thailand.

Japan has the most aged population in the world. It has been pointed out that Thailand will experience rapid aging. It would be beneficial for Thailand to learn what problems Japan has faced and how it has solved them. However, few studies have shown differences between Thailand and Japan in physician distribution and the related systems and policies. Therefore, this study compares the geographical distribution of physicians over ten years using data from Thailand and Japan. Based on these results, we discuss what aspects of the Thai and Japanese healthcare systems influence the geographical distribution of physicians and which policy interventions can improve physician distribution.

METHODS

DATA SOURCES

Data, including population, area, and the number of physicians, was compiled for all provinces in Thailand and all municipalities in Japan for the years 2008 and 2018.

All Thai data was downloaded from the Thai National Statistical Office (NSO) website. Originally, population and area data were arranged by the Bureau of Registration Administration, Ministry of Interior. Data on the number of physicians were arranged by the Office of the Permanent Secretary for Public Health, MoPH. Both data are disclosed annually, and province-by-province data is available.

As for Japanese data, the Japanese number of physicians was cited in "Statistics of Physicians, Dentists, and Pharmacists." The census was conducted by the Ministry of Health, Labour and Welfare biannually, and the data included the workplace of each physician. Population data was cited from "Counts of population, vital events and households derived from Basic Resident Registration," published annually by the Ministry of Internal Affairs and Communications. Since the Basic Resident Registration Act was amended (effective July 9, 2012) to include foreign nationals, only the Japanese population was used in this study to enable comparisons between years. Area data

was collected from "Municipalities Area Statistics of Japan," which the Ministry of Land, Infrastructure, Transport, and Tourism. Municipality-by-municipality data was available for all data.

STUDY AREA SETTING

The setting of this study was nationwide, which included all the provinces of Thailand and all the Secondary Medical Areas (SMAs) derived from the 47 prefectures of Japan. The SMAs were used as the geographic unit of analysis and are responsible for most of the hospitalization, surgery, emergency, and outpatient care between primary and tertiary medical areas. Each prefecture is divided into 5 to 10 secondary medical areas, and each is composed of several municipalities. Health policies and related plans are made based on SMAs, the most critical units in Japan. Since the region had been restructured from 2008 to 2018, the number and boundaries of provinces and SMAs with the larger number of provinces and SMAs between 2008 and 2018 were modified based on the year with the smaller number of provinces/SMAs. Variables were calculated after the modification.

Specifically, Bung Kan province was carved out from Nong Khai province as the 77th province in Thailand in 2011. This increased the number of provinces from 76 in 2008 to 77 in 2018. In this study, each variable was calculated based on the lesser number, 76 provinces in 2008. This assumes that Bung Kan province and Nong Khai province, as of 2018, were combined and considered the same area as Nong Khai province in 2008. Thus, it was assumed that Thailand had 76 Province in 2008 and 2018. Similarly, in Japan, there were 348 SMAs in 2008, but since then, many municipalities have been merged, and the number of SMAs has been reorganized to 335 as of 2018. Since the year with the smaller number was used as the base year, each variable was calculated based on 335 SMAs in Japan. All analyses were based on 76 provinces in Thailand and 335 SMAs in Japan.

ANALYSIS

Univariate analysis was conducted to obtain descriptive statistics, including median and interquartile range (IQR) of population, area, population density, the number of physicians, and physician-population ratio. A comparison of each variable between 2008 and 2018 was performed with non-parametric tests (Wilcoxon signed-rank test).

The Gini coefficient, which has been most commonly used to measure inequality, was calculated to assess the equity of the geographical distribution of physicians. It is derived from the Lorenz curve that plots the provinces or SMAs in decreasing order of physician-population ratio [7]. The Gini coefficient ranges between 0 (perfectly equal) and 1 (perfectly unequal). A correlation between population density and the physician-population ratio was calculated to examine the degree of concentration of physicians in urban areas. Since the distributions of both population density and physician-population ratio among provinces and SMAs were skewed, the correlation coefficient was calculated as Spearman's correlation coefficient for both 2008 and 2018 for Thailand and Japan.

As for the subgroup analyses, all 76 provinces or 335 SMAs were divided into four groups according to two criteria: urban or rural, and whether they had a higher or lower initial physician supply in 2008. This approach was based on previous studies [17, 18]. Using the median population density as a reference, provinces or SMAs with higher and lower than the median value were designated urban and rural, respectively. Similarly, provinces or SMAs were assigned higher and lower initial physician supply than the median physician-population ratio. As such, all provinces and SMAs were divided based on the two criteria into four groups, as shown in Figure 1. Descriptive statistics and the Wilcoxon signed-rank test of each group variable were performed.

Figure 1. Dividing provinces and SMAs into four groups
Note: High and low indicate higher or lower than the median value

All collected data were entered, cleaned, and totaled according to the area setting mentioned in the previous section. Statistical analyses were performed using Python 3.7.11. The level of statistical significance was set at $\alpha = 5\%$.

ETHICAL CONSIDERATION

This study was reviewed and approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University (approval number: COA No. 112/65). This study is exempted from ethics review in compliance with the Office for Human Research Protections (OHRP Exempt Categories) 45 CFR part 46.101(b). All data in this study was open access secondary data without any individual data, and downloaded from the National Statistical Offices of Thailand and Japan.

RESULTS

Tables 1 and 2 show the trends in each variable of the two countries. The population increased in Thailand while it decreased in Japan. The number of physicians increased in both countries. While the increased ratio of physicians in Thailand exceeded that in Japan, the increase in the number of physicians in Japan exceeded that in Thailand. The resulting physician-population ratio improved 1.65-fold in Thailand, while the improvement ratio in Japan was 1.16-fold. While the number of physicians in Thailand increased significantly, the physician-population ratio in 2018 was still about one-fifth that of Japan.

Table 1 Descriptive Statistics of Thailand and Japan

	Thailand			Japan		
	2008	2018	Ratio	2008	2018	Ratio
Number of population	63,389,730	66,413,979	1.05	127,076,183	124,776,364	0.98
Area (sq.km.)	513,119.54	513,139.54	1.00	372,077.02	372,953.07	1.00
Population density (/sq.km)	123.54	129.43	1.05	341.53	334.56	0.98
Number of physicians	21,354	36,938	1.73	286,699	327,210	1.14
Physician population ratio	0.34	0.56	1.65	2.26	2.62	1.16

Note: Ratio is calculated by dividing the value in 2018 by the value in 2008

Table 2 Descriptive statistics of the Thailand provinces and Japan SMAs

		Thailand				Japan			
		2008	2018	Ratio	p-value [a]	2008	2018	Ratio	p-value [a]
Number of population	Median	631,905	716,543	1.13	< .001*	235,406	218,094	0.93	< .001*
	Q1	464,023	478,046	1.03		112,132	101,762	0.91	
	Q3	1,010,321	1,082,667	1.07		480,542	465,834	0.97	
Area (sq.km.)	Median	5,760.84	5,760.84	1.00	.317	855.27	855.67	1.00	.010*
	Q1	3,520.12	3,520.12	1.00		434.03	434.46	1.00	
	Q3	9,599.70	9,599.70	1.00		1,402.09	1,405.51	1.00	
Population density (/sq.km.)	Median	121.94	125.80	1.03	< .001*	258.65	243.56	0.94	< .001*
	Q1	78.68	84.04	1.07		99.78	91.31	0.92	
	Q3	161.75	169.09	1.05		675.60	676.70	1.00	
Number of physicians	Median	140	273	1.95	< .001*	407	435	1.07	< .001*
	Q1	95	179	1.87		186	188	1.01	
	Q3	252	449	1.78		1,054	1,239	1.18	
Physician population ratio	Median	0.23	0.39	1.71	< .001*	1.75	1.98	1.13	< .001*
	Q1	0.16	0.30	1.81		1.46	1.70	1.16	
	Q3	0.31	0.48	1.57		2.16	2.46	1.14	

Notes: Ratio is calculated by dividing the value in 2018 by the value in 2008; a: Wilcoxon signed rank test. Comparison between 2008 and 2018; *Statistically significant at p-value < .05.

Figure 2 illustrates the changes in the Lorenz curve and the Gini coefficient for the physician-population ratio at the provincial and SMA level. Thailand relatively improved its physician distribution over Japan during the decade, but the Gini coefficient in Thailand was still higher than in Japan.

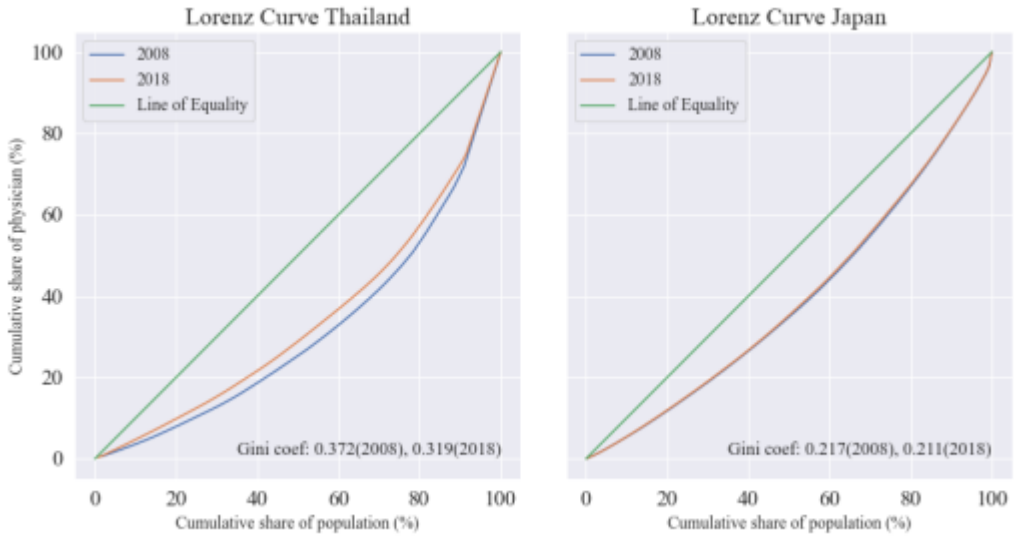

Figure 2. Changes in the Gini coefficient of the physician-population ratio in provinces (Thailand) and SMAs (Japan) with the Lorenz curve

The correlation between physician-population ratios and the population density of the provinces and SMAs in each country is shown in Figure 3. The correlation with statistical significance was found in Japan, while there were no correlation and statistical significance in Thailand. In addition, as a decade trend, the correlation in Japan had become increasingly.

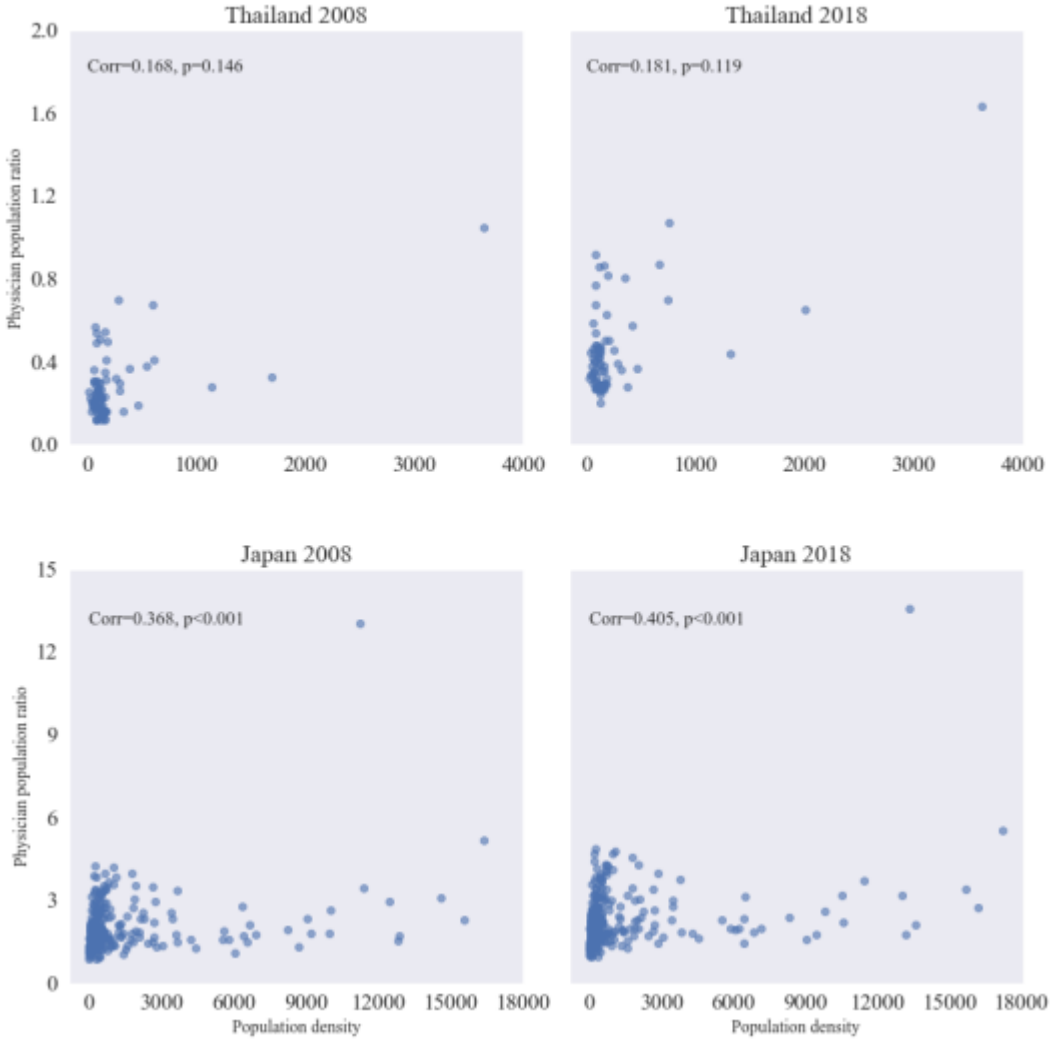

Figure 3. Correlation between population density and physician-population ratio
Note: Correlation is presented as Spearman's rho coefficient.

Changes in variables in each group between 2008 and 2018 are shown in Tables 3 and 4. In Thailand, all groups had 19 provinces. As for Japan, there were 101 SMAs in Group 1, 66 SMAs in Groups 2 and 3, and 102 SMAs in Group 4.

Table 3. Changes in variables for the four groups of Thailand

	Group	2008		2018		p-value [a]
Number of population	1	835,861	(606,767 – 1,099,908)	848,720	(644,070 – 1,286,452)	< .001 *
	2	906,877	(546,698 – 1,408,486)	946,043	(539,052 – 1,435,434)	< .001 *
	3	484,722	(432,252 – 805,805)	532,326	(425,523 – 812,812)	.005 *
	4	538,330	(394,091 – 783,559)	564,092	(426,180 – 810,479)	< .001 *
Area (sq.km.)	1	2,556.64	(986.23 – 5,056.99)	2,556.64	(986.23 – 5,056.99)	1 *
	2	5,512.67	(4,010.38 – 8,569.71)	5,512.67	(4,010.38 – 8,569.71)	1 *
	3	6,367.62	(4,641.72 – 11,247.11)	6,367.62	(4,641.72 – 11,247.11)	1 *
	4	7,195.14	(5,466.83 – 12,070.24)	7,195.14	(5,466.83 – 12,070.24)	.317 *
Population density (/sq.km.)	1	289.87	(164.93 – 575.15)	290.01	(174.22 – 706.83)	.001 *
	2	147.51	(129.51 – 161.96)	153.32	(131.55 – 169.35)	.001 *
	3	80.15	(73.59 – 100.78)	85.03	(74.11 – 106.94)	.001 *
	4	77.77	(54.77 – 90.23)	78.51	(57.22 – 95.58)	< .001 *
Number of physicians	1	255	(185 – 362)	443	(331 – 809)	< .001 *
	2	134	(95 – 198)	264	(159 – 406)	< .001 *
	3	144	(114 – 282)	223	(192 – 469)	< .001 *
	4	99	(67 – 119)	197	(130 – 244)	< .001 *
Physician population ratio	1	0.35	(0.29 – 0.45)	0.57	(0.46 – 0.81)	< .001 *
	2	0.16	(0.14 – 0.18)	0.29	(0.27 – 0.36)	< .001 *
	3	0.30	(0.26 – 0.34)	0.47	(0.41 – 0.57)	< .001 *
	4	0.18	(0.16 – 0.21)	0.31	(0.28 – 0.35)	< .001 *

Notes: Values are presented as median (IQR); Group 1: Provinces and SMAs with higher population density and higher initial physician supply; Group 2: Provinces and SMAs with higher population density and lower initial physician supply; Group 3: Provinces and SMAs with lower population density and higher initial physician supply; Group 4: Provinces and SMAs with lower population density and lower initial physician supply; a: Wilcoxon signed rank test. Comparison between 2008 and 2018; *Statistically significant at p value < .05.

Table 4. Changes in variables for the four groups of Japan

	Group	2008		2018		p-value [a]
Number of population	1	543,379	(306,371 – 813,566)	517,062	(306,245 – 824,962)	.066 *
	2	391,870	(249,206 – 668,884)	381,742	(233,341 – 677,183)	.273 *
	3	142,225	(97,415 – 212,101)	129,351	(85,998 – 202,279)	< .001 *
	4	92,103	(64,144 – 186,681)	80,553	(55,473 – 166,199)	< .001 *
Area (sq.km.)	1	557.23	(276.84 – 929.13)	559.15	(276.94 – 929.95)	.002 *
	2	432.64	(254.79 – 671.73)	432.68	(254.75 – 686.51)	.050 *
	3	1,101.99	(767.64 – 1,569.21)	1,102.05	(767.64 – 1,568.78)	.972 *
	4	1,259.31	(943.44 – 2,157.19)	1,293.90	(946.04 – 2,157.65)	.783 *
Population density (/sq.km.)	1	656.62	(424.33 – 2,101.74)	667.06	(414.25 – 2,011.61)	.114 *
	2	749.72	(404.73 – 2,028.89)	705.04	(377.13 – 2,001.43)	.589 *
	3	148.53	(99.04 – 194.54)	132.65	(89.01 – 178.34)	< .001 *
	4	82.36	(55.69 – 125.59)	70.36	(48.02 – 112.78)	< .001 *
Number of physicians	1	1,362	(760 – 2,030)	1,589	(834 – 2,311)	< .001 *
	2	578	(320 – 928)	633	(360 – 1,120)	< .001 *
	3	283	(189 – 449)	284	(188 – 505)	.001 *
	4	137	(87 – 245)	136	(84 – 265)	.320 *
Physician population ratio	1	2.46	(1.98 – 3.09)	2.82	(2.31 – 3.44)	< .001 *
	2	1.49	(1.33 – 1.6)	1.77	(1.55 – 1.88)	< .001 *
	3	1.99	(1.88 – 2.18)	2.26	(2.07 – 2.52)	< .001 *
	4	1.45	(1.27 – 1.59)	1.65	(1.4 – 1.79)	< .001 *

Notes: Values are presented as median (IQR); Group 1: Provinces and SMAs with higher population density and higher initial physician supply; Group 2: Provinces and SMAs with higher population density and lower initial physician supply; Group 3: Provinces and SMAs with lower population density and higher initial physician supply; Group 4: Provinces and SMAs with lower population density and lower initial physician supply;
a: Wilcoxon signed rank test. Comparison between 2008 and 2018;
*Statistically significant at p value < .05.

DISCUSSION

This study compared the trend of physician distribution between Thailand and Japan from 2008 to 2018. First, from 2008 to 2018, the number of physicians and the physician-population ratio in Thailand increased more than in Japan. Although the improvement in Thailand was more significant than in Japan, the physician-population ratio in Thailand had not yet reached the WHO-recommended 1 in 1,000 standard [19]. In addition, it was still about one-fifth of Japan's physician-population ratio. Even though the number of physicians in Japan was higher than in Thailand, the number of physicians in Japan was not enough. Among 38 OECD countries, Japan's physician-population ratio is in eleventh place, counting from the last as of 2019 [20].

This comparative study describes that the distribution of physicians in Japan is significantly more equitable than in Thailand, both in 2008 and 2018. Moreover, the trend shows that the Gini coefficient has improved considerably in Thailand, while there has been a slight improvement in Japan. The result that the Gini coefficient in Thailand remains high is consistent with previous studies [13]. Similarly, this minor improvement over the years in Japan is consistent with other studies [7-11, 17]. One previous research showed that the distribution of physicians in Thailand, excluding physicians who work in Bangkok and the private sector, was generally equitable [14]. Physicians are

presumed to be concentrated primarily in Bangkok and the private sector.

The correlation analyses revealed that Thai physicians were not concentrated in populated urban areas. In contrast, Japanese physicians tended to prefer urban areas, and this trend in Japan became stronger during the decade. The subgroup analyses also explain the tendency of physician concentration in urban areas in Japan. Thailand has successfully allocated physicians not to urban areas but lower initial physician areas. However, subgroup analyses imply that Japanese policy has not worked well in distributing physicians to lower physician supply areas. The Gini coefficient improved in Japan despite the greater allocation of physicians to central city areas, a seeming contradiction. This contradiction may be interpreted as an improvement in the Gini coefficient, perhaps because the decline in the rural population was more significant. As such, the number of physicians per population in the rural areas appeared to improve. Suppose it is true that physicians who have worked in urban areas are not likely to migrate to rural areas, as Inoue pointed out [10]. In that case, it can be guessed that the geographical maldistribution of physicians in Japan is not expected to extinguish unless effective countermeasures are put in place because there are a lot of physicians in urban areas.

These differences in the trend of physician distribution are attributable to policies that each country has implemented. One of the most significant differences in their policies is mandatory rural service for all physicians. All physicians in Thailand are required to work in rural areas for three years after graduation, and failure to do so means the payment of a fine. On the other hand, Japanese medical school graduates, in general, can freely choose their workplace. The particular tracks in Thailand, CPIRD and ODOD, and Japan's regional quota are similar systems that impose mandatory rural services for their graduates in return for the accessibility of medical school and scholarships.

In addition, the financial incentives for working in physician shortage areas in Thailand and Japan are very different. The variety and number of incentives in Thailand are more than those in Japan. The incentives may motivate physicians to work in rural areas in Thailand.

Health systems are thought to influence the geographical maldistribution of physicians. For example, it is known that the more people with private and extended coverage insurance, the higher the density of physicians is likely to be [21]. In addition, the capitation payment system has the potential to address equity issues in the distribution of healthcare workforces by providing incentives for health facility managers to maintain optimal staffing levels to reduce costs and thereby redistribute "excess" personnel to underserved areas [22]. Moreover, if physicians can choose where to practice without regulation and most healthcare providers are privately owned, the concentration gap between surplus and shortage areas decreases as the physician-population ratio increases [6, 8].

There are mainly four limitations to this study. The first limitation is data. A registry data of physicians was used in this study. There may be several physicians who did not participate in the census, and this may cause sampling bias. Furthermore, the data do not distinguish between clinical and non-clinical physicians. This may overestimate the number of physicians in both countries. In particular, because of the high ratio of non-clinicians in Thailand [23], the number of physicians or physician-population ratio may be assessed as relatively low. Since identifying the number of clinicians in Thailand is difficult, in contrast to Japan, one possible way to conduct an analysis targeting only clinicians in Thailand would be to assume the number of clinicians by multiplying a certain percentage by the total number of physicians, based on previous studies [23].

The second limitation of this study is that physicians' specialties were not considered. Since each specialty has its distribution pattern, the ideal distribution should be evaluated within each specialty. Research on specific medical departments is needed. Population adjustment is the third limitation. Despite people needing more medical care as they age [17, 24], this study assumed that all ages needed medical care equally. This may underestimate the demand for medical care, especially in Japan, where the population is older. To calculate each variable based on the adjusted population using age- and gender-specific medical care utilization rates are possible options [17]. The fourth limitation is that differences in geographic units between the two countries may complicate the interpretation of the results of this study. Provinces and SMAs were the base of the analyses in Thailand and Japan, respectively. Thai and Japanese median land area was 5,760.84 (IQR: 3,520.12–9,599.70) and 855.67 (IQR: 434.46–1,405.51) square kilometers, respectively. The smaller the area, the easier the residents can cross the border to access physicians in other areas. Access to healthcare for the Japanese is underestimated.

CONCLUSION

This comparative study revealed that physicians did not diffuse to unserved areas in Japan while Thailand relatively successfully allocated them to physician shortage areas with an increase in the number of physicians in both countries. Rather, Japanese physicians seemed to diffuse according to the distribution of people. In addition, several similarities and differences among educational and health policies were identified. To the best of the author's knowledge, this is the first study comparing the geographical maldistribution of physicians between Thailand and Japan. This study will provide helpful information for Japan, where the geographical maldistribution of physicians has not yet been resolved, and for Thailand, which, although improving the geographical distribution of physicians during the decade, still has a large maldistribution and will rapidly face an aging population in the future.

RECOMMENDATIONS

Maldistribution of physicians has been one of the most serious political concerns in Thailand and Japan, and producing rural physicians is also required for both countries. In order to do so, first, it is necessary to determine how many physicians in which areas and fields are in short supply. Developing the maldistribution index like that is just beginning to be applied in Japan would be helpful to establish the concrete shortage and goal. At the same time, it is required to identify which countermeasures have been effective in each country. It is then necessary to implement policies in a way that is suitable for each country's context and existing systems.

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SEROPREVALENCE OF DENGUE, ZIKA, AND CHIKUNGUNYA VIRUSES AMONG HUMAN AND NON-HUMAN PRIMATES LIVING IN PROXIMAL AREAS IN LAEM CHABANG, CHONBURI, THAILAND

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ABSTRACT

With the dissemination of mosquito vectors *Aedes aegypti* and *A. albopictus*, mosquito-borne viruses such as dengue (DENV), zika (ZIKV), and chikungunya viruses (CHIKV) were commonly reported in Thailand. However, these infected cases may be underreported or misdiagnosed due to the asymptomatic and self-limiting clinical signs, and the infected individual may not attend the hospital for recording. Hence, this study investigated the seroprevalence of DENV serotype 1-4, ZIKV, and CHIKV in the local communities of Laem Chabang, Chon Buri, Thailand. Considering non-human primates (NHPs) are an important reservoir for maintaining arboviruses in nature, serosurvey on NHPs living nearby were also conducted for comparison. In this study, 105 blood samples from monkeys and 115 blood samples from humans in proximity to monkey habitats in Laem Chabang district, Chonburi province, were collected. Seroprevalence of DENV1-4, ZIKV, and CHIKV was investigated by plaque reduction neutralization (PRNT) assay. Pre-existing antibodies against DENV1-4 and CHIKV were found in human blood samples, with DENV-2 (86.1%) being the dominant strain of circulation. Followed by DENV-3 (68.7%), DENV-1 (65.2%), CHIKV (38.3%), DENV-4 (23.5%). None of the humans sampled were found to exhibit ZIKV infection. In contrast, only a total of 7 out of 105 NHP samples (6.7%) displayed seropositivity against arbovirus infection, one against DENV-1 (1.0%) and another six against ZIKV (5.7%). Significant associations of age and seropositivity were also found in DENV-1, DENV-2, and CHIKV infection in the sampled human population. Overall, our findings suggested the possible urban cycle transmission of mosquito-borne viruses in the human communities in Laem Chabang, Chon Buri province of Thailand.

Keywords: DENV, ZIKV, CHIKV, Seroprevalence, Serosurvey, Non-human primates, Human

INTRODUCTION

Arbovirus such as dengue (DENV), Zika (ZIKV), and chikungunya (CHIKV) are known to be endemic in Thailand due to the widespread *Aedes* vector mosquito in the country [(1)]. Though the symptoms are usually mild and self-limiting, ZIKV is associated with Guillain-Barré syndrome (GBS) and congenital disorders during the outbreak in Brazil [(2)]. Whereas chronic CHIKV disease exhibits persistent arthralgia months after infection [(3)], secondary DENV infection is hypothesized to enhance severe dengue via antibody-dependent enhancement [(4)].

Antibody-dependent enhancement (ADE) is a phenomenon when the pre-existing antibody from primary infection binds to the virus from secondary infection but fails to neutralize them, causing a boost in viral loads in the body [(5)]. As such, ZIKV, belonging to the same *Flaviviridae* family as DENV, may also cross-react with the pre-existing antibody from DENV and drives the ADE process [(4)]. Especially in mosquito-borne virus endemic areas like Thailand, individuals with multiple arbovirus infections are commonly seen.

Many arboviruses, including DENV, ZIKV, and CHIKV, have originally circulated in a sylvatic cycle between wild animals or non-human primates (NHPs) until they accidentally spillover and become a human infection. The adaptation of *Aedes aegypti* and *A. albopictus* mosquito vectors feeding preference on humans [(6)] has encouraged this transmission cycle to move solely from sylvatic towards the urban cycle, where the virus transmits between humans species and eventually no longer requires an NHP reservoir. Unlike a human infection, an NHP does not display any symptoms when infected, which makes the transmission status in nature challenging to access. Communities close to the natural environment with these NHPs are likely to be exposed to the virus regularly, and then the virus spreads throughout the neighborhoods. Besides, some NHPs may act as an amplification host that aids in viral replication at a higher concentration before transmitting to another host or reservoir [(7)]. Therefore, identifying these hosts and reservoirs may be crucial in viral spread prediction and prevention in the future. To determine the presence of the arboviruses and their association between the two communities, the seroprevalence of DENV1-4, ZIKV, and CHIKV in humans and NHP living in proximity in Laem Chabang, Chon Buri province of Thailand was conducted for a preliminary detection.

METHODS

SAMPLE SIZE CALCULATION

The sample size was calculated according to the percentage of immunoreactivity against ZIKV envelope protein in Thai patients with undifferentiated fever (76%) [(8)]. Open Epi Version 3 was applied for the sample size estimation, and roughly 300 samples were enrolled in the overall study (Table 1). Nevertheless, this report focused on only one study site, of which approximately 100 samples were appointed for collection.

SPECIMEN COLLECTION

Ethical statements were submitted and approved by Ethical Committee (EC), Animal Care and Use Committee (IACUC), and Faculty's Institutional Biosafety Committee (FTM-IBC) before specimen collection.

Since the NHP serum samples from wild long-tailed macaques (*Macaca fascicularis*) in Laem Chabang, Si Racha district, were readily accessed via the collaboration with the Department of National Park, Wildlife and Plant Conservation (DNP) and Kasetsart University, this location was selected as a target site for the research.

After ground trapped, monkeys were injected with Zoletil® (Tileamine and Zolazepam, 2–10 mg/kg) and Xylazine HCl (0.5–2 mg/kg) intramuscularly for sedation. Blood samples were drained from an inguinal vein, and the serum was isolated and stored at -80°C. Basic information such as gender, weight, body length, arm, leg, tail length, and dental casts was recorded.

Human samples were collected from volunteers living around the trapping area. General knowledge and research objectives were provided to the volunteers when screening at the Public Health Center. Only unpregnant healthy volunteers aged 18–55, who lived or worked within approximately 10 km of the monkey habitat for a minimum of 5 years, and did not participate in other clinical trials involving vaccinations or drug investigations 6 months prior to the enrollment were allowed to take part. The volunteers were requested to sign an informed consent before entering the project. Qualified volunteers were assigned for physical examination, and 10 ml of blood were drawn from each participant. Upon completion,

all documents, including the sheet of participation, consent form, and compensation, were given to the participants.

SEROPREVALENCE ANALYSIS

A plaque reduction neutralization test (PRNT) was performed to investigate the prior exposure to DENV serotypes 1-4, ZIKV, and CHIKV infection in NHP and human serum samples.

Vero cell (p.140–150), approved by World Health Organization (WHO), was used in this research. The cell was maintained in T225 flasks with minimum essential media (MEM) supplemented with 10% fetal bovine serum (FBS), L-glutamine, and antibiotic-antimycotic before seeding onto 24-well plates. Serum samples were heat inactivated at 56°C for 30 minutes and diluted at a 4-fold dilution, starting at a ratio of 1:5 with reduced serum media. The DENV-1 (WP), DENV-2 (NGC), DENV-3 (7164), DENV-4 (7-4A-1A2), ZIKV (Paraiba 2015) strain, and CHIKV (TM-0091A2/ 2019) isolate were diluted to 70 plaques/ 120 µl; equal volume of sera and virus were added and incubated at 37°C for 30 minutes. The serum-virus mixture was transferred onto culture media removed 24-well plates with 90–100% Vero cell confluency for DENV and CHIKV, and 80% for ZIKV infection. Plates were incubated for an hour with a rock plate at 20-minute intervals. Overlay media was added to coat the plate for three and a half-, four-, and five-day incubation period for ZIKV, CHIKV, and DENV, respectively.

Followed by immunostaining, the technique was operated to visualize the plaque for ZIKV and DENV. Overlay media was removed, and the plates were rinsed with 1X phosphate buffered saline (PBS) twice. The cell was fixed with 80% methanol for 10 minutes, and 5% skim milk in PBS for additional 10 minutes to block the plate. Primary antibody 4G2, mouse anti-flavivirus envelop protein antibody, and 2H2, mouse anti-DENV 1-4 prM protein 10, were diluted in 5% skim milk at 1:200 and added to the plate for 2 hours incubation. Plates were washed with 5% skim milk twice, and the secondary antibody, peroxidase-labeled goat anti-mouse IgG diluted in 5% skim milk at 1:2000, were added for another 2 hours incubation. Finally, plates were rinsed with 1X PBS twice, and TrueBlue peroxidase substrate was added to observe the plaque. The CHIKV plates were stained and visualized with 0.2% crystal violet in 80% methanol after overlay media was rinsed off. Plates were washed with tap water after 15 minutes of incubation with 0.2% crystal violet.

DATA ANALYSIS

Laboratory data from PRNT was recorded and inputted into an Excel-based PRNT calculator established from the algorithm and statistic assumption of the LID statistical Web Tool (https://bioinformatics.niaid.nih.gov/plaquereduction/) . $PRNT_{50} \geq 20$ was used as a cutoff for CHIKV positivity since it does not cross-react with both DENV and ZIKV infections. Then $PRNT_{90} \geq 20$ was applied for DENV and ZIKV seropositivity determination due to the high endemicity of disease in Thailand. To differentiate ZIKV from DENV, WHO criteria of $PRNT_{90} \geq 20$ with a four-fold difference in ZIKV and DENV $PRNT_{90}$ titer [9] was utilized to minimize the cross-reaction. PRNT results from NHP were all evaluated with $PRNT_{50} \geq 20$; considering its low anti-DENV antibody titer, it is not likely to cross-react.

IBM Statistical Package for the Social Sciences (SPSS) version 23 was used for statistical analysis and data interpretation. Binary logistic regression was selected to determine the association between each variable using the crude odds ratio (COR) and *p*-value significance. Prism Software (PRISM) Version 9.1.2 was used to generate graphics for antibody titers against each virus with mean and standard error mean (SEM).

QGIS version 3.14.15-Pi was performed to create geographical heat maps for seroprevalence and antibody titer distribution at the study site. The location of the human samples was plotted by the coordination of each participant's residential area.

RESULTS

Of the 115 human participants, the majority were female (69.6%), aged between 46–55 (39.1%). Presented in Table 1, of all human samples, 75 (65.2%) had previously been infected with DENV-1, 99 (86.1%) with DENV-2, and 79 (68.7%) with DENV-3, 27 (23.5%) with DENV-4, and 44 (38.3%) with CHIKV. None of the human samples were infected with ZIKV. Except the low seropositivity in DENV-4, high seropositivity against DENV-1, 2, and 3 in human subjects were similarly observed in both male (74.3%,

85.7%, 62.9%) and female (61.3%, 86.3%, 71.3%), and the age group of 18–25 (75.0%, 68.8%, 62.5%), 26-35 (69.7%, 81.8%, 63.6%), and 46-55 (71.1%, 91.9%, 75.6%), respectively. While DENV-2 has the highest seropositivity in the age group of 36-45 (95.2%). In contrast, the percent of seropositivity in CHIKV infection exhibit differently by gender. Females (42.5%) showed a higher seropositive in CHIKV infection compared to males (28.6%).

Table 1 Human arbovirus seropositivity demonstrate in socio-demographic data

Characteristic	Total N (%)	DENV1	DENV2	DENV3	DENV4	ZIKV	CHIKV
Gender							
Male	35 (30.4)	26 (74.3)	30 (85.7)	22 (62.9)	11 (31.4)	0 (0.0)	10 (28.6)
Female	80 (69.6)	49 (61.3)	69 (86.3)	57 (71.3)	16 (20.0)	0 (0.0)	34 (42.5)
Age group (year)							
18-25	16 (13.9)	12 (75.0)	11 (68.8)	10 (62.5)	2 (12.5)	0 (0.0)	0 (0.0)
26-35	33 (28.7)	23 (69.7)	27 (81.8)	21 (63.6)	7 (21.2)	0 (0.0)	2 (6.1)
36-45	21 (18.3)	8 (38.1)	20 (95.2)	14 (66.7)	8 (38.1)	0 (0.0)	11 (52.4)
46-55	45 (39.1)	32 (71.1)	41 (91.9)	34 (75.6)	10 (22.2)	0 (0.0)	31 (68.9)
Occupation							
Unemployed	16 (13.9)	13 (81.3)	13 (81.3)	12 (75.0)	3 (18.8)	0 (0.0)	8 (50.0)
Street vendor	23 (20.0)	14 (60.9)	20 (87.0)	19 (82.6)	9 (39.1)	0 (0.0)	4 (17.4)
Office worker	25 (21.7)	16 (64.0)	23 (92.0)	20 (80.0)	10 (40.0)	0 (0.0)	11 (44.0)
Freelance	42 (36.5)	28 (66.7)	38 (90.5)	24 (57.1)	5 (11.9)	0 (0.0)	18 (42.9)
Others	9 (7.8)	4 (44.4)	5 (55.6)	4 (44.4)	0 (0.0)	0 (0.0)	3 (33.3)
Length of residency (year)							
1-10	19 (16.5)	13 (68.4)	17 (89.5)	14 (73.7)	3 (15.8)	0 (0.0)	3 (15.8)
11-20	13 (11.3)	9 (69.2)	10 (76.9)	10 (76.9)	2 (15.4)	0 (0.0)	3 (23.1)
>20	83 (72.2)	53 (63.9)	72 (86.7)	55 (66.3)	22 (26.5)	0 (0.0)	38 (45.8)
Total	115	75 (65.2)	99 (86.1)	79 (68.7)	27 (23.5)	0 (0.0)	44 (38.3)

Table 2 Binary logistic regression analysis for the association between socio-demographic characteristics

Variables	DENV-1			DENV-2			DENV-3			DENV-4			CHIKV		
	COR	95% CI	*p*-value	COR	95% CI	*p*-value	COR	95% CI	*p*-value	COR	95% CI	*p*-value	COR	95% CI	*p*-value
Gender															
Male	1			1			1			1			1		
Female	0.55	0.23, 1.32	0.180	1.05	0.33, 3.27	0.939	1.22	0.52, 2.84	0.649	0.84	0.33, 2.11	0.708	1.75	0.74, 4.14	0.199
Age group (year)															
18 -25	1			1			1			1			0.00	0.00	0.998
26-35	0.77	0.20, 2.97	0.700	2.05	0.52, 8.12	0.309	1.05	0.31, 3.61	0.938	1.89	0.34, 10.32	0.465	0.03	0.01, 0.15	0.000*
36-45	0.21	0.05, 0.86	0.030*	9.09	0.94, 87.96	0.057	1.2	0.31, 4.67	0.793	4.31	0.77, 24.14	0.097	0.55	0.19, 1.58	0.268
46-55	0.82	0.22, 3.02	0.766	4.66	1.07, 20.34	0.041*	1.86	0.55, 6.28	0.321	2.00	0.39, 10.31	0.407	1		
Occupation															
Unemployed	5.42	0.90, 33.36	0.069	-	-	-	3.75	0.66, 21.25	0.135	1			1		
Street vendor	1.94	0.41, 9.24	0.403	-	-	-	4.50	0.87, 23.35	0.073	2.79	0.62, 12.60	0.183	0.21	0.05, 0.90	0.035*
Office worker	2.22	0.47, 10.45	0.312	-	-	-	6.56	1.21, 35.73	0.030*	2.04	0.45, 9.24	0.355	0.79	0.22, 2.77	0.707
Freelance	2.50	0.58, 10.80	0.220	-	-	-	1.67	0.39, 7.10	0.490	0.87	0.19, 3.86	0.851	0.68	0.21, 2.16	0.514
Others	1			-	-	-	1			0.00	0.00	0.999	0.5	0.09, 2.73	0.423
Length of stay (year)															
1-10	1			1			1			1			1		
11-20	1.96	0.32, 12.12	0.961	0.39	0.06, 2.76	0.347	1.19	0.23, 6.17	0.835	0.97	0.14, 6.80	0.975	1.60	0.27, 9.53	0.606
>20	1.76	0.55, 5.68	0.707	0.77	0.16, 3.80	0.748	0.70	0.23, 2.15	0.534	1.92	0.51, 7.24	0.334	4.29	1.16, 15.85	0.029*

Table 2 displays the predicted variables associated with the seropositivity of DENV and CHIKV infection. According to the WHO criteria, ZIKV was not included in this analysis since none of the human subjects were detected for a prior ZIKV exposure. The age group presented has a significant association with DENV-1, DENV-2, and CHIKV seropositivity. Humans 26–35 were more likely to have previous exposure to CHIKV infections (*p* value = .000), 36–45 years old to DENV-1 (*p* value = .030), and 46–55 years to DENV-2 infection (*p* value = .041). Prior DENV-3 and CHIKV infection showed a significant relationship with participants working as businesspeople (*p* value = .030) and employed under the private or governmental sector (*p* value = .035), respectively. Moreover, staying in the community for over 20 years was significantly related to previous CHIKV exposure (*p* value = .029). However, occupation and DENV-2 infection did not show any association; hence, the data cannot be computed with binary logistic regression.

Among the 105 NHPs collected, only one captured adult male NHP (1%) appeared to have DENV-1 antibody titer, 6 NHP (5.7%) with anti-ZIKV antibody, and none were detected for CHIKV (Table 3).

Table 3 Seropositivity of DENV 1-4, ZIKV, and CHIKV in NHP

Characteristic	Total N (%)	DENV1	DENV2	DENV3	DENV4	ZIKV	CHIKV
Gender							
Male	63 (60.0)	1 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)	3 (4.8)	0 (0.0)
Female	42 (40.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (7.1)	0 (0.0)
Age group							
Juvenile	54 (51.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.7)	0 (0.0)
Adult	51 (48.6)	1(2.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (7.8)	0 (0.0)
Total	105	1(1.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (5.7)	0 (0.0)

Figure 1 summarizes the PRNT antibody titer against each tested arbovirus with mean and standard error mean (SEM) labeled. Among all viruses, the participants from Laem Chabang had the highest level of antibody titer against DENV-2 on average (Figure 1A), with DENV-1 and DENV-3 being the second and third, respectively. Only a few NHPs displayed $PRNT_{50}$ titer for DENV-1 and ZIKV (Figure 1B). Figure 1C illustrates the $PRNT_{50}$ antibody titer in human and NHP samples. Compared to human samples, NHPs showed a lower antibody titer against CHIKV in Laem Chabang.

The geographical distribution of human samples with antibody titer against the arboviruses is shown individually in the heat map below (Figure 2). The antibody titer was presented by the intensity of the color. The darker the red, the higher the antibody titer. As shown below, Figure 2B has the widest cluster and darkest color of samples previously exposed to DENV-2 infection. Whereas DENV 1, 3, 4, and CHIKV (Figures 2A, 2C, 2D & 2F), the distribution of exposed cases was more spread out. Especially CHIKV (Figure 2F), the points were spread with higher antibody intensity in contrast to DENV serotypes 1, 3, and 4. Although none of the human samples was found to have antibodies against ZIKV according to WHO criteria, the ZIKV antibody titer displayed on the heat map (Figure 2E) could be a cross-reaction from DENV exposure.

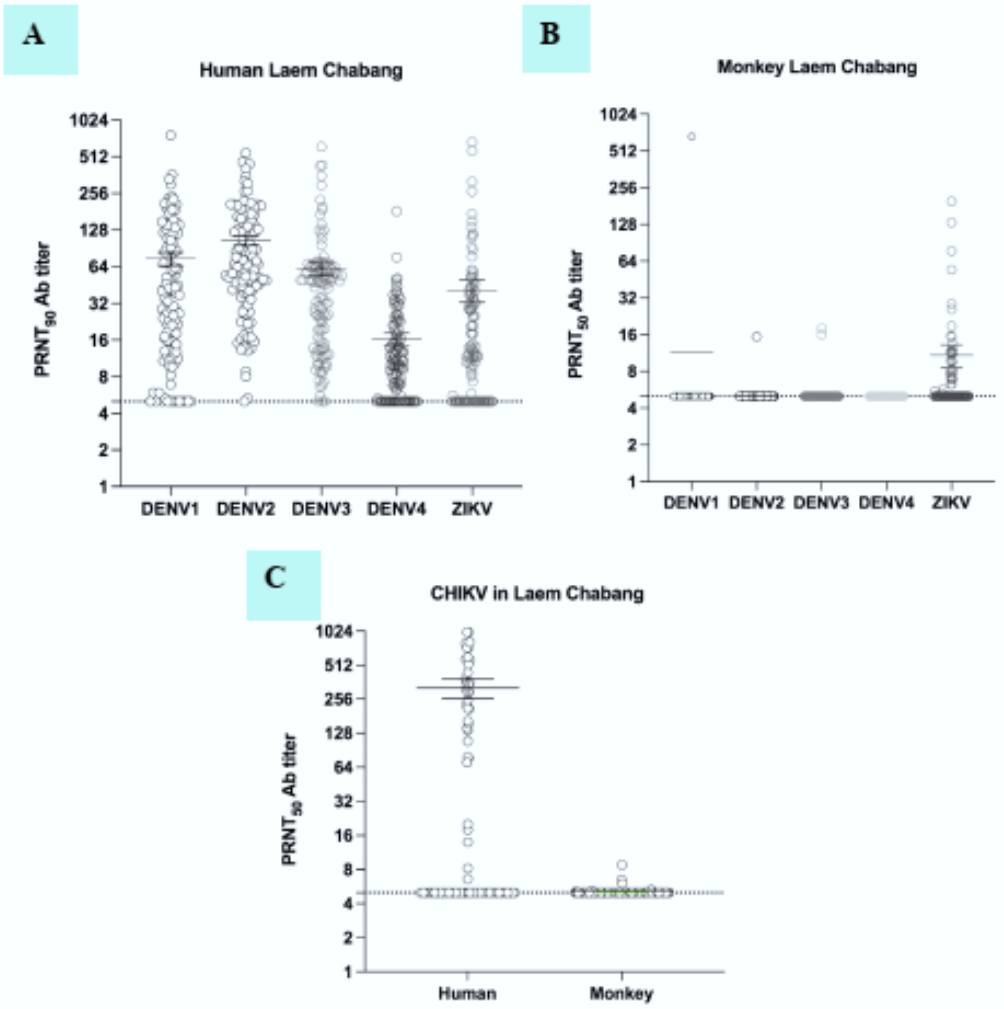

Figure 1 PRNT titer against DENV 1-4, ZIKV, and CHIKV. (A) Distribution of $PRNT_{90}$ antibody titer against DENV serotype 1-4 and ZIKV in human samples (B) $PRNT_{50}$ antibody titer against DENV serotype 1-4 and ZIKV in non-human primates (C) CHIKV $PRNT_{50}$ antibody titer in human and non-human primate samples

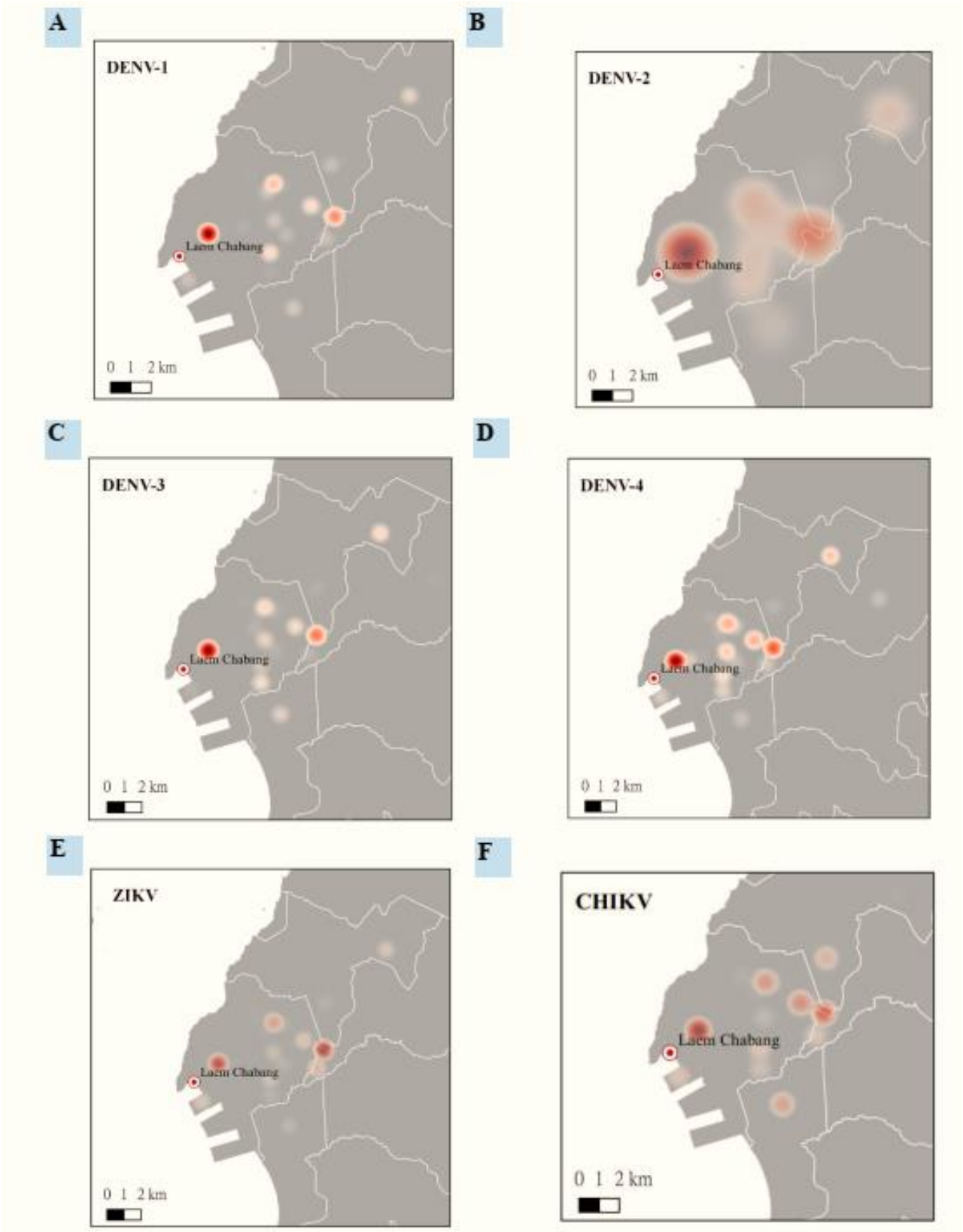

Figure 2 Heat map of human seroprevalence against each arbovirus infection. (A) DENV-1 $PRNT_{90}$ (B) DENV-2 $PRNT_{90}$ (C) DENV-3 $PRNT_{90}$ (D) DENV-4 $PRNT_{90}$ (E) ZIKV $PRNT_{90}$ (F) CHIKV $PRNT_{50}$

DISCUSSION

This study examined the seroprevalence of humans and NHPs living in proximity in Laem Chabang, Chon Buri province, in 2019. According to the laboratory outcome, the human population was more prone to arbovirus infections than NHPs in Laem Chabang. Unlike the past NHP arbovirus serosurvey conducted between October 2018 to January 2019 in three national parks in Thailand: Khao Yai, Kaeng Krachan, and Mu Ko Ranong National Parks [10]. The assessment suggested that there is a presence of DENV (51.5%) and possible ZIKV infection (18%) circulating among wild monkeys in Kaeng Krachan National Park [10]. In contrast, most NHPs in this study in Laem Chabang did not have neutralizing antibodies against these viruses. Only the human communities living nearby exhibited antibody titer and most displayed exposure to at least one of the arbovirus infections. Interestingly, the human and NHP positive samples from both study sites, Kaeng Krachan National Park and Laem Chabang, have a high antibody titer against DENV-1 and DENV-2 [10] which corresponds to the hospital patient surveillance done between May and October 2016 in Chumporn, Songkhla, and Pattani provinces of Southern Thailand [1]. However, DENV-2 appears to be the predominant DENV strain circulating in Thailand [1] and Southeast Asia [11].

In addition, the older age group was statistically significant to DENV infection in our study and a dengue incidence spatial analysis from data recorded in Khon Kaen province of northeastern Thailand [12]. The older age group demonstrates a greater risk of infection with DENV [12].

Antibody against CHIKV infection was also found in the sampled participants from Laem Chabang, emphasizing that there could be co-infection or circulation of the virus in the area. Prior ZIKV infection, on the contrary, was not found in any human samples. Although neutralizing antibody was detected in the serum samples, the titer does not pass the WHO criteria for ZIKV identification. The neutralizing antibody against ZIKV likely resulted from a cross-reaction or cross-immunity from previous DENV exposures.

Besides the seroprevalence investigation, the NHP species captured for examination may be another concern. Since NHPs are asymptomatic of mosquito-borne infections, the reservoir and amplification hosts are yet to be discovered. ZIKV serosurvey among 234 wild long-tailed macaques (*Macaca fascicularis*) in Peninsular, Malaysia has provided an insight into the NHP reservoir [13]. The low ZIKV seroprevalence in long-tailed macaques (1.3%) has implied this monkey species may not be a reservoir for the ZIKV virus in Malaysia [13]. The investigation of Khao Yai, Kaeng Krachan, and Mu Ko Ranong National Parks in Thailand also encourages this assumption [10]. Twenty-five northern pig-tailed macaques (*Macaca leonine*), 33 stump-tailed macaques (*Macaca arctoides*), and four long-tailed macaques were trapped in Khao Yai, Kaeng Krachan, and Mu Ko Ranong National Parks accordingly [10]. The study found no evidence of ZIKV neutralizing antibody titer in northern pig-tailed macaques and long-tailed macaques [10]. Likewise, this study captured 105 long-tailed macaques for arbovirus seroprevalence assessment. Only 6 NHPs (5.7%) has neutralized antibody against ZIKV. However, the stump-tailed macaques in Kaeng Krachan National Park present to have anti-ZIKV (18%) and anti-DENV (51.5%) neutralizing antibodies [10], and the 38 northern pig-tailed macaques from the northern provinces of Thailand, Chiang Mai, Chiang Rai, and Mae Hong Son, were detected for anti-DENV (23.7%), CHIKV (10.5%), and Japanese encephalitis (JEV) antibody (13.2%) [14]. As a result, the NHP species investigation may be another factor influencing the data result. More research must be done to support the hypothesis.

CONCLUSION

To conclude, this study examined the seroprevalence of DENV-1 (65.2%), DENV-2 (86.1%), DENV-3 (68.7%), and DENV-4 (23.5), ZIKV, and CHIKV (38.3%) in human living at Laem Chabang, Chon Buri province in 2019. While NHPs only showed 1% seropositivity against DENV-1 and 5.7% against ZIKV infection, the arbovirus transmission appeared to lean towards the urban cycle in the Laem Chabang area. Among all the human samples screened, DENV-2 presented the highest seropositivity compared to other arboviruses, which complies with the hypothesis of DENV-2 being the predominant strain in Thailand and Southeast Asia.

LIMITATIONS AND RECOMMENDATION

Although this study has provided an overview of the current arbovirus infections and circulation in humans and NHPs living proximal in Laem Chabang, the data is still insufficient to represent the overall situation in

Thailand due to the low sample size tested in one study site and the extensive female samples in the human participants. Cross-reaction between flaviviruses, DENV, and ZIKV, is another issue in determining the prior ZIKV infection. Even though the gold standard $PRNT_{90}$ and WHO criteria were performed and applied, the method was not specific enough to differentiate ZIKV from DENV infection. Therefore, further investigation with larger sample size and study areas that cover the geographical region of Thailand is required.

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SOCIODEMOGRAPHIC CORRELATES OF COMING OUT AMONG SEXUAL IDENTITY MINORITIES IN THE UNITED STATES

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ABSTRACT

Previous research has shown that disclosing sexual identities in unsupportive environments has resulted in rejection, discrimination, or violence, leading to poorer physical and mental health outcomes and a greater risk of suicidal ideation. However, coming out as a sexual minority when done in a supportive environment can be associated with improved well-being and health outcomes. Little evidence is known about what sociodemographic factors may influence who comes out and who is outed and their correlations. This research aims to assess sociodemographic and individual factors potentially associated with coming out as Lesbian, Gay, Bisexual, Queer, and other sexual identities (LGBQ+) to friends and family and being outed as LGBQ+ to family members before being ready or without consent. This research utilized the Generations Study, a nationally representative population-based survey collected between 2016–2017 across three generations of LGBQ+ persons in the United States. This research analyzed a sample of 1,416 sexual minority adults and calculated the odds ratio of coming out and being outed utilizing multivariate logistic regression. Three models were deployed for the outcome variables of interest (1) coming out to a friend, (2) coming out to a family member as LGBQ+, and (3) being outed as LGBQ+ to a family member before telling them. We analyzed coming out against independent variables: cohort (age group), gender, sexual orientation, race, nativity, education, economic status, experiencing conversion therapy, and Adverse Childhood Experiences (ACE). We found evidence of multiple factors that increase or decrease the odds of coming out and being outed as a sexual minority. Within the models deployed, statistically significant results for individual categories emerged within the variables for cohort (age), gender, sexual orientation, education, ACE, and those who experienced conversion therapy. Some of the most striking results included those who experienced conversion therapy had 3.61 times ($p < .001$) the odds of being outed as LGBQ+ to their family compared to those who did not. Lesbian and gay persons had 4.96 ($p < .001$) times the odds of coming out to their family and 3.84 ($p < .001$) times the odds of being outed to family compared with other sexual identities. This research will help policymakers and practitioners who work directly with and determine legislation on where to focus support to help reduce health disparities for LGBQ+. The study also provides quantitative evidence of the dangers that outed LGBQ+ persons before they are ready that can be used to advocate against anti-gay laws in many states across the United States.

***Keywords**: Gender and Sexuality, LGBQ+, Demography, Sexual and Gender Minorities*

INTRODUCTION

'Coming out' is a journey of self-discovery related to disclosing one's sexual orientation and identity to others, including family, friends, colleagues, acquaintances, and/or strangers. In a world where heteronormativity is everywhere, and most people assume that everyone is heterosexual unless told otherwise, the coming out process is something that one may need to do many times throughout their life. The process of coming out for the first time is one of the most critical, stressful, and life-changing experiences for Lesbian, Gay, Bisexual, Queer, and other sexual minority (LGBQ+) individuals [1, 2]. Depending on the environment and an individual's readiness, the coming out process may include negative and positive or aspects of both to the individual over the short and long term. Evidence has shown that the coming out process may result in traumatic life events such as rejection and discrimination due to sexual minority status and stigma [3]. This can affect the health and well-being of LGBQ+ persons throughout their life. Besides rejection and discrimination, some negative aspects after coming out or being outed that LGBQ+ people face include negative mental health outcomes, including suicide ideation [4], and for persons in a relationship, the threat of being outed may be used as a tactic for intimate partner violence [5].

Aside from the negative aspects of coming out, an increasing number of studies have also found that the coming out process may result in positive outcomes at the individual, community, and societal levels. Previous studies had found that when LGBQ+ persons chose to come out, they may experience better mental health afterward [6, 7] thanks to acceptance from friends, and family and reduced anxiety about keeping a secret so integral to one's identity and life. Additional studies have also noted greater cognitive flexibility and creativity [8, 9] and higher satisfaction at work and in relationships when the coming out process is done in supportive environments [4, 10]. The supportive environment is an essential factor in enabling these positive aspects of coming out. With more significant numbers of persons coming out as LGBQ+, we may see more acceptance and an increase in supportive environments. This has led to greater social acceptance of LGBQ+ persons and increased legal protection nationally and in a number of the US states to fully enhance the participation of sexual minorities in society [11].

While research on LGBQ+ constitutes a primary global source of discoveries and knowledge, there has been a relatively small number of quantitative studies in the United States or globally that have explored sociodemographic factors related to coming out as LGBQ+ [12], and most of these previous studies were conducted in specific local contexts such as New York City [13, 14]. Moreover, thus far, no quantitative studies have examined the event of being outed as LGBQ+ to their family accidentally or without consent. This study attempts to fill this gap by using the nationally representative survey in the United States to examine the sociodemographic correlates of three specific coming-out milestones. Moreover, the study investigates if, and to what extent, the adverse experiences during childhood significantly impact the coming out milestones. Also, the study aims to identify groups of LGBQ+ who are at higher risk of unwanted or involuntary disclosure to family.

Due to variations in acronyms used to represent sexual orientations and sexual minorities, it is essential to note that the current study uses LGBQ+ as the study's sample did not include transgender persons. In other studies that include transgender persons or intersex persons, the acronym LGBTIQ+ is typically used.

DATA AND METHODS

DATA

This study relies on data from the Generations study, the first nationally representative population-based survey for sexual identity minorities in the United States. The study was specifically designed to examine health and well-being across three generations of sexual minorities in the United States and explored identity, stress, health outcomes, and health care and services utilization among lesbian, gay, bisexual, and other sexual minority individuals [15].

The study's target population included self-identified lesbian, gay, bisexual, queer, or same-gender loving persons (who did not identify as transgender) who resided in the United States. Eligibility criteria for participation in the survey comprised of age (i.e., 18–25 years, 34–41 years, or 52–59 years), race (i.e., Black, Latino, or White), and education level (i.e., having completed at least 6th-grade education). Due to issues with sample size and recruitment, Native Indian/American and Asian participants were not eligible as their inclusion would possibly be insufficient to be representative of the entire United

States. Recruitment for participants took place between March 2016 to March 2017, with an additional enhancement oversample of mostly Black and Latino LGBQ+ individuals taking place between April 2017 to April 2018. This resulted in the total sample size of wave 1 to complete the survey at 1,518 individuals, including 1,331 from the original sample and 187 from the enhancement sample.

The study's sample was restricted to LGBQ+ individuals who provided valid information on all variables of interest. As such, 102 participants (7% of the total original example) were excluded from the analysis due to missing information on sexual minority identity, nativity, income, and timing of coming out. Analysis of missing data was conducted in R, in which the patterns of missing values were examined to determine the best method to handle the missing data. Given the random nature of the missing data pattern and its small percentage, the listwise deletion was adopted in which all observations with missing information were removed. The final analytic sample for this study included 1,416 LGBQ+ individuals.

VARIABLE MEASUREMENT

Outcome Variables

Our outcome variables of interest comprise three sexual identity milestones: (1) disclosure to at least one straight friend, (2) disclosure to at least one family member, and (3) outed to at least one family member before disclosure.

Disclosure to at least one straight friend was derived from a question asking respondents at what age they first told a straight friend about their sexual identity status. The reported age (recorded in years) was coded into a dichotomous variable where 1 indicates the respondent had come out to at least one straight friend and 0 represents that it did not occur.

Disclosure to at least one family member was derived from asking respondents at what age they first told a family member about their sexual identity status. The reported age (recorded in years) was coded into a dichotomous variable where 1 indicates the respondent had come out to at least one straight friend and represents that it did not occur.

Outed to at least one family member before disclosure was derived from a question asking respondents at what age it was clear that someone in their family had found out they were LGBQ+ before the person could tell their family member about their sexual identity status. The reported age (recorded in years) was coded into a dichotomous variable where 1 indicates the respondent had come out to at least one straight friend and 0 represents that it did not occur.

SOCIODEMOGRAPHIC COVARIATES

The literature largely determined the selection of covariates and their potential association with reaching the sexual identity milestones of interest. These covariates included variables at the individual level and family level. Individual level indicators include cohort (younger, middle, and older), gender (men, women, and non-binary), sexual identity (gay/lesbian, bisexual, and other sexual identities), race (white, a person of color), education (high school and below, above high school), nativity (U.S. born, no), economic status (low, lower-middle, middle, high) and participation in conversion therapy (yes, no). "Conversion therapy," also known as "Sexual Orientation Change Efforts (SOCE)," refers to a practice that is considered to be against medically agreed upon ethics and standards where a person (usually a health provider or spiritual leader) tries to change the sexual identity of a person who is not heterosexual. The practice is considered to be a form of psychological torment and abuse. At the family level, the Adverse Childhood Experiences (ACE) were assessed through the information on household mental health issues, emotional abuse, sexual abuse, parental intimate partner violence, and substance abuse within the household and measured as a count variable reported as ACE scale. The scale was constructed based on the guidance from the Center for Disease Control's (CDC) ACE study by the Generations Study team, where 11 questions were asked related to the eight key areas and given a score of 1 if the experience occurred before age 18 [16]. Indicator codes included COHORT, gender, lesbian_gay, bisexual, white, GEDUC2 (education), US_born (nativity), W1POVERTYCAT (economic status), W1COVERSION (conversion therapy) [17].

ANALYSIS

The study employed both descriptive and inferential statistics. Firstly, descriptive statistics (e.g., median, Interquartile range (IQR), and frequency are used to illustrate and examine the sample distribution according to demographics, socioeconomic status, individual experiences, and the ACE scale. Significant differences between outcome variables and independent covariates were tested using chi-squared. Bivariate analysis is provided for each covariate to analyze the unadjusted odds ratio (OR) in relation to the coming-out milestones. For multivariate analysis, adjusted odds ratios (AOR) are presented, holding other covariates constant. Logistic regression was the most appropriate method given the binary nature of whether the event occurred, along with our research question of how specific socio-economic or demographic factors may impact the likelihood of the event occurring. Tests for multi-collinearity were conducted to ensure assumptions for logistic regression were met, including correlation matrix and variance inflation factors (VIFs). Statistical significance levels are reported at 5%, 1%, and greater than 1%. Survey weights provided with the dataset [15] were utilized in the analyses to obtain the nationally representative estimates. All data cleaning and statistical analyses were performed using R programming language via RStudio and their relevant packages [18, 19].

RESULTS

SAMPLE CHARACTERISTICS

The key demographic and socioeconomic characteristics of the study sample are presented in Table 1. The younger cohort was made up of the most significant proportion of the sample (44.4%), followed by the older cohort (31.2%), and the middle cohort (24.4%). Women constituted approximately half of the sample (49.9%), with the smallest percentage (6.5%) reporting themselves as non-binary. Slightly more than half of the sample identified themselves as gays or lesbians (54.8%), and around two-thirds reported their race as White (65.5%). The vast majority of the sample was born in the United States, with only 6% born outside the country. Moreover, 7.3% of participants reported having been enrolled in a sexual orientation change efforts (SOCE) program, also known as conversion therapy, at some point in their lifetime. In relation to ACE scores, the participants experienced, on average, three adverse events before age 18. Only a small proportion of the sample reported never experiencing any negative events during childhood (9.9%).

Table 1 escription of sample characteristics (N = 1,416)

Characteristics	Sample size (n)	Percent
Cohort		
Younger (18–25 years)	629	44.4
Middle (34–41 years)	345	24.4
Older (52–59 years)	442	31.2
Gender		
Woman	707	49.9
Man	617	43.6
Non-binary	92	6.5
Sexual Minority		
Lesbian/Gay	774	54.7
Bisexual	474	33.5
Other	168	11.9
Race		
White	929	65..6
Black	274	15.0
Latino	213	19.4
Education level		
High school or lower	283	20
Beyond high school	1133	80
Economic Status		
Low (< poverty level (PL))	193	13.6
Lower-middle (100–199% PL)	268	18.9
Middle (200–299% PL)	182	12.9

Characteristics	Sample size (n)	Percent
High (300% + PL)	773	54.6
United States nativity		
Yes	1331	94.0
No	85	6.0
Conversion therapy		
Yes	103	7.3
No	1313	92.7
Adverse Childhood Experience (ACE) score		
0	140	9.9
1	245	17.3
2	221	15.6
3	219	15.5
4	183	12.9
5	180	12.7
6	114	8.1
7	77	5.4
8	37	2.6

COMING OUT MILESTONES

Most of the sample, as shown in Table 2, reported coming out to a straight friend)96%(, a family member)85%(, or both a friend and family)84%(. Only a small proportion)2.9%(reported that disclosure to either friends or family has never occurred. Around 60% of the sample indicated that they had ever experienced an involuntary outing to a family.

A closer examination of the coming out pattern by cohorts revealed that overall, the younger generation is more likely to come out to a straight friend but less likely to come out to a family as compared to the two older generations. The proportion of the younger cohort is twice as likely as the two older cohorts to disclose themselves to straight friends only. The observation is reverse for the disclosure to family only, where the older generation is three times higher to come out to a family only. This pattern is more pronounced when both friends and family are jointly considered. The result further showed that involuntary disclosure to a family is highest among the older cohort and lowest among the youngest cohort.

Table 2 Selected measures of coming out milestones by cohort

Percentage came out to	Total	Cohort		
		Younger	Middle	Older
A straight friend	96%	96%	98%	95%
A family				
By their own will	85%	79%	91%	90%
Outed without consent	58%	48%	61%	70%
Both came out and outed	55%	44%	60%	66%
A straight friend only	12%	17%	8.1%	6.8%
A family only	1.1%	0.5%	1.4%	1.6%
Both friends and family	84%	78%	90%	89%
Neither friend nor family	2.9%	4.0%	0.9%	2.9%
Unweighted observations	1,416	629	345	442

Under this study, we carried out a binary logistic regression and present both unadjusted and adjusted odds ratios to explore differences when holding other factors constant compared to the simpler bivariate analysis. Within the models deployed, statistically significant results emerged for at least one individual category within all covariates in at least one of the three models. Table 3 provides an overview of the unadjusted odds ratio (OR) reported as a gross effect and the AOR reported as a net effect, including standard error and significance stars. Some of the most striking results included those who experienced conversion therapy had 3.61 times ($p < .001$) the odds of being outed as LGBQ+ to family compared to those who did not while holding other factors constant. Lesbian and gay adults had 4.96 times ($p < .001$) the

odds of coming out to their family and 3.84 ($p < .001$) times the odds of being outed as LGBQ+ to family compared to other sexual gender minorities and bisexuals while holding other factors constant. Bisexuals had lower odds ratio and the likelihood of meeting all coming out milestones compared with different types of sexual identities, which is in line with what we expected based on the previous literature. Those with an education past high school had lower odds of being outed to their family without consent (AOR = .59; $p < .01$) than those who had only graduated high school or less while holding other factors constant.

Among the age cohorts, the middle and older generations had higher odds of being outed as LGBQ+ to their family without consent than the Youngest cohort. The Middle age cohort had 2.00 times the odds ($p < .001$), while the Older age cohort had 2.09 times the odds ($p < .001$) of being outed. This is what we may have expected to see. Perhaps the social circumstances and increasing awareness and acceptance of the LGBTIQ+ community have helped ensure that fewer sexual identity minorities are being outed to their families without consent. For gender, men compared with women had lower odds of reaching all sexual identity milestones while holding other factors constant. This is slightly surprising and not exactly what we may have expected based on the previous literature. More specifically, men had 0.63 times the odds of ($p < .05$) coming out to their family and .67 times the odds ($p < .05$) of being outed to their family compared to females. The only exception was the bivariate gross effect of 1.62 times the odds ($p < .0001$) compared with women, although this does not consider other factors that may hold more weight. Figures 1 and 2 visualize the adjusted odds ratio for those coming out to family and those outed to their family without consent.

Adverse Childhood Experience scores were significant for first disclosure coming out to a family member and for being outed without consent to a family member. For every one unit increase in an ACE score, the odds of coming out to your family or being outed to your family without consent increased by a factor of 1.11 ($p < .05$ and $p < .01$).

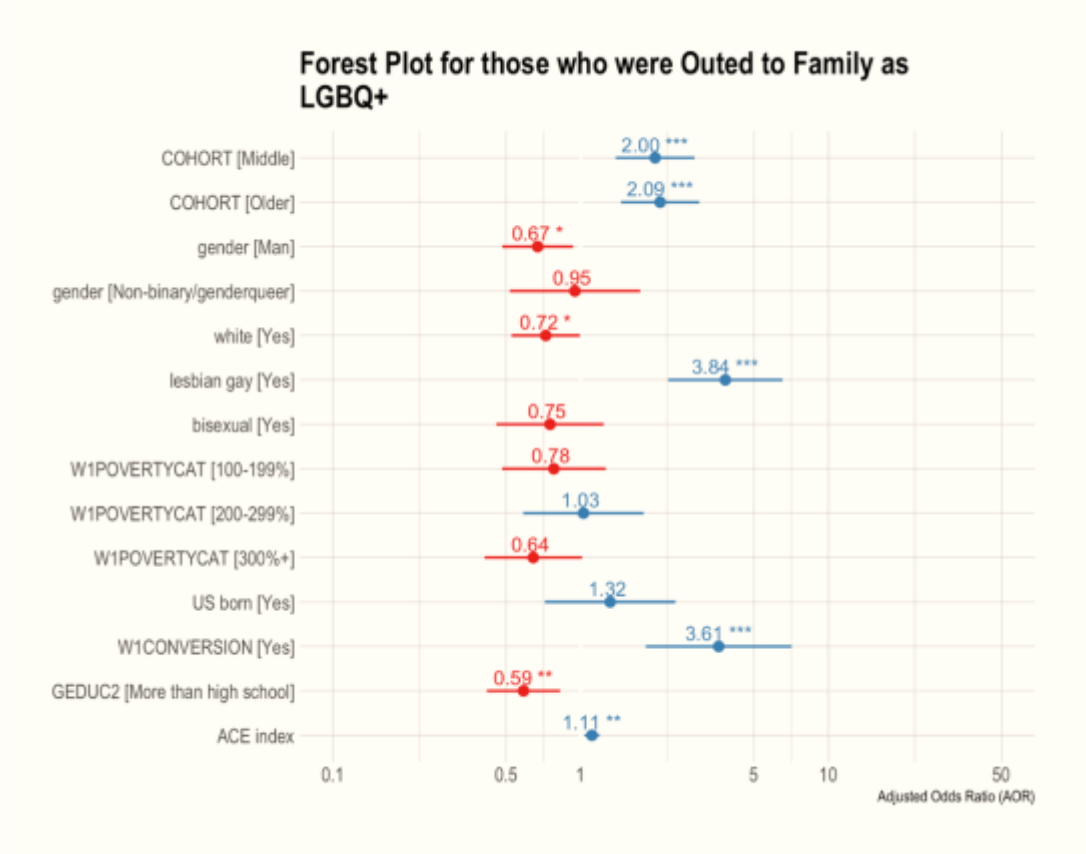

Figure 1: Forest Plot for LGBQ+ persons Who Were Outed to their Family Without Consent

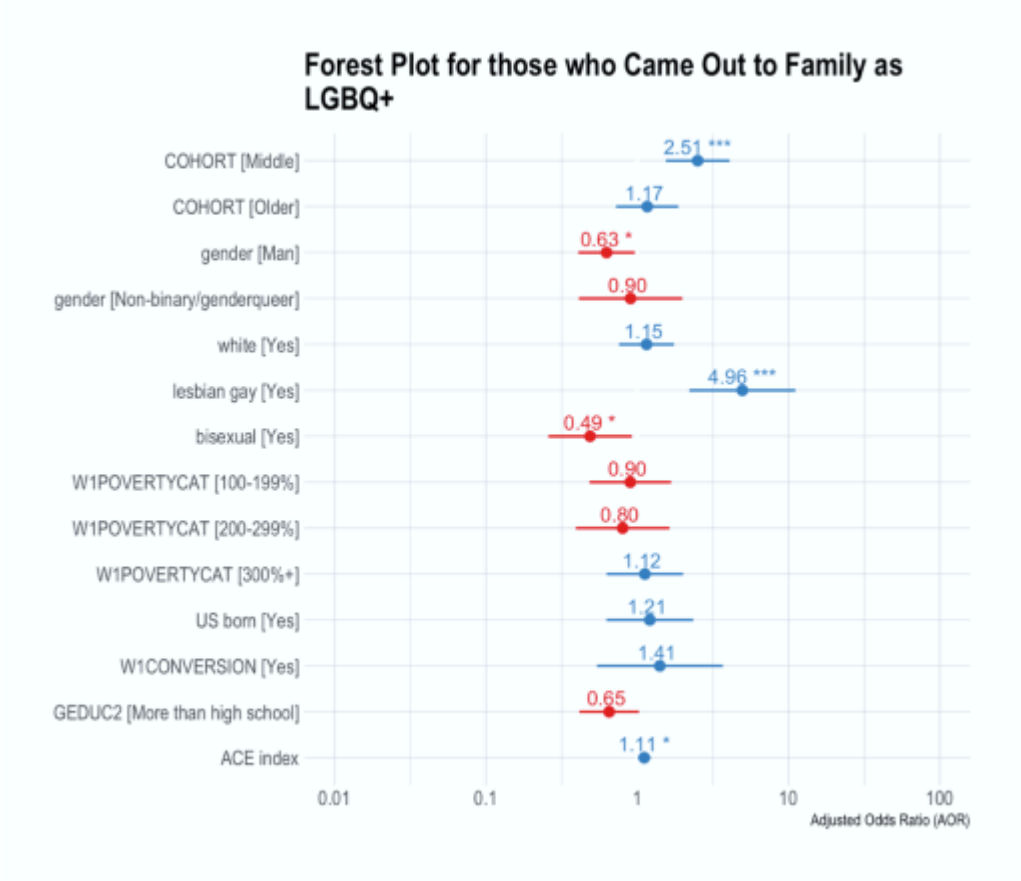

Figure 2: Forest Plot for LGBQ+ persons Coming Out to their Family

Table 3 Logistic regression odds ratios of disclosure to friend, disclosure to family, and being outed to family, the United States LGBQ+ individuals

Covariate [a]	Came out to friend		Came out to family		Outed to family	
	Gross effect [b] OR (SE)	Net effect AOR (SE)	Gross effect OR (SE)	Net effect AOR (SE)	Gross effect OR (SE)	Net effect AOR (SE)
Cohort (Ref. = younger)						
Middle	1.96 (0.407)	1.39 (0.510)	2.72*** (0.212)	2.51*** (0.246)	1.69*** (0.136)	2.00*** (0.187)
Older	0.98 (0.300)	0.51 (0.435)	2.49*** (0.181)	1.17 (0.241)	2.44*** (0.131)	2.09*** (0.185)
Gender (Ref. = women)						
Man	0.61 (0.284)	0.36** (0.366)	1.22 (0.159)	0.63** (0.219)	1.62*** (0.113)	0.67* (0.168)
Non-binary	0.95 (0.626)	1.17 (0.759)	0.75 (0.283)	0.90 (0.402)	0.87 (0.222)	0.95 (0.309)
Lesbian or Gay (Ref. = no)						
Yes	3.15*** (0.301)	3.11 (0.668)	6.68***(.187)	4.96*** (0.411)	4.24*** (0.115)	3.84*** (0.271)
Bisexual (Ref. = no)						
Yes	0.33*** (0.278)	0.42 (0.539)	0.18*** (0.162)	0.49* (0.324)	0.24*** (0.119)	0.75 (0.254)
Race (Ref. = others)						
White	1.15 (0.483)	1.13 (0.382)	1 (0.158)	1.15 (0.123)	0.69** (0.115)	0.72* (0.162)
Education level (ref. = high school or lower)						
Beyond high school	1.52 (0.388)	0.58 (0.434)	1.05 (0.190)	0.65 (0.231)	1.30 (0.137)	0.59** (0.173)
Economic Status (Ref. = poor)						
Low-Income	0.78 (0.454)	0.87 (0.624)	0.81 (0.250)	0.90 (0.317)	0.67* (0.194)	0.78 (0.246)
Middle Income	0.83 (0.497)	0.67 (0.679)	0.86 (0.275)	0.80 (0.364)	0.78 (0.212)	1.03 (0.285)
High Income	1.29 (0.414)	0.90 (0.611)	1.42 (0.225)	1.12 (0.297)	0.80 (0.167)	0.64 (0.231)
Nativity (Ref. = non-US born)						
US born	1.57 (0.483)	1.78 (0.633)	1.75* (0.272)	1.21 (0.336)	1.54 (0.224)	1.32 (0.309)
Ever had Conversion Therapy (ref. = no)						
Yes	1.40 (0.602)	1.75 (0.685)	2.46* (0.399)	1.41 (0.488)	3.19*** (0.255)	3.61*** (0.346)
ACE Index	1.05 (.065)	1.10 (0.084)	1.04 (0.036)	1.11* (0.050)	1.10*** (0.026)	1.11** (0.036)
Pseudo R^2		0.031		0.119		0.173
AIC [c]		426.2902		1092.17		1,692.184
Accuracy		0		.854		.707
Number of observations	1,416	1,416	1,416	1,416	1,416	1,416

Notes: [a] Reference categories of covariates in parentheses; *p < .05, **p < .01, ***p < .001, [b] *Gross effect refers to the bivariate model and the Net Effect refers to the multivariate model. OR = Odds Ratio, SE = Standard Error, AOR = Adjusted Odds Ratio,* [c] *AIC = Akaike Information Criterion*

DISCUSSION

The previous literature hypothesizes that being outed in an unsupportive environment may result in negative health outcomes. This research helps to demonstrate that, especially when assessing the impacts on enrollment in Sexual Orientation Change Efforts (SOCE) for those outed without consent along with higher ACE scores. The findings highlight the importance of understanding and identifying which groups have higher odds of being outed as LGBQ+ to their family members before they are ready and which factors or groups have a higher or lower likelihood of coming out. In line with the previous literature, we see a higher likelihood of coming out milestones for lesbian and gay persons and mixed results among gender categories.

This research will help policymakers and practitioners who work directly with and determine legislation on where to focus support to help reduce disparities for LGBQ+. It also sheds an anthropological and cultural lens on social groups and how factors influence reaching coming out milestones. It helps to understand that while we have made significant progress in making LGBQ+ persons feel more comfortable coming out on their terms, younger cohorts still don't feel safe sharing this with their family members. It also shows that more attention may be needed for bisexuals who tend to come out later in life and that more insight and research need to be explicitly done on non-binary persons to assess qualitatively for that subgroup which was not found to be statistically significant in this research.

The race variable highlights that among people of color, there is a higher tendency to be outed to a family, which may demonstrate why black and Latinx LGBQ+ people face additional hurdles and stigma that white people do not face due to cultural norms. This is an interesting finding as most of the previous literature has found that race was not statistically significant in relation to coming out milestones. However, this is the first paper to assess quantitatively being outed without consent. Lesbian and gay persons had a higher likelihood of coming out to family and being outed to family compared with bisexual and other sexual minorities. This is of interest and in line with previous research where bisexuals may face specific stigma and, since some may be in heterosexual presenting relationships, less likely to tell their family members or be outed.

Our research, in particular, highlights the dangers of outing LGBQ+ persons, especially youth, to their families without consent as we have demonstrated those persons had 3.61 times the odds of being enrolled in SOCE/conversion therapy and correlation of higher levels of Adverse Childhood Experiences. This may help illustrate why many LGBQ+ persons decide not to come out to a family member as they rightfully fear it could result in being enrolled in dangerous and unscientific psychological abuse from SOCE that manifests into long-term mental health issues and negative health outcomes. Currently, in the United States, many states, including Florida, Texas, and other conservative areas, are enacting legislation that would require schools to out LGBQ+ youth to their families without consent. This research quantitatively demonstrates this type of legislation's negative outcomes and how that may result in long-term trauma due to enrollment in conversation therapy and/or higher frequencies of adverse childhood experiences. While being outed to a family member has a lower frequency of occurring compared with coming out to at least one family member by oneself, the issue of being outed without consent is very harmful. This research project has specifically demonstrated these dangers in the correlation to a higher likelihood of being enrolled in conversion therapy when being outed without consent.

While our three outcome variables of interest included coming out to a straight friend, a family member, and being outed to a family member, our discussion and results have focused mainly on the milestones related to the family. This is primarily due to only one covariate of disclosure to at least one straight friend with gender male compared with female, showing statistical significance when holding other factors constant. This is mainly due to the high proportion of participants who have come out to at least one straight friend at 96% frequency. Relatedly, the accuracy rate of prediction for this variable was 0% when using the logistic regression to predict the binary outcome compared with 85% and 70% accuracy among the family related coming out milestones. Therefore, most results and discussions have focused on outcomes 2 and 3.

CONCLUSION

This study sheds light on the sociodemographic correlates of coming out and being outed for sexual identity minorities in the United States. It highlights the diversity and significant differences among sub-populations that must be understood among LGBTIQ+ persons that tend to be lumped together as one group. This study helps contribute to the nascent quantitative literature on sexual identity minorities and rates of coming out, and the dangers of being outed to family without consent.

ETHICAL DECLARATION

The data was publicly available and not individually identifiable; therefore, this research does not constitute human subjects research and is thus exempt from ethical review from an Institutional Review Board. No conflict of interest exists in carrying out this research.

ACKNOWLEDGEMENT

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TNF-A TREATMENT DECREASED PROGESTERONE RECEPTOR-MEDIATED TRANSCRIPTION IN BREAST CANCER CELLS

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ABSTRACT

Breast cancer is the most prevalent cancer in women worldwide. ER+/PR+ breast cancer showed a better prognosis than ER+/PR- breast cancer. However, how PR loses its activity is still unknown. Evidence suggests obese women with breast cancer are likely to have a worse prognosis than non-obese women as obesity can promote the secretion of TNF-α, leading to NF-κB pathway activation. NF-κB activation is associated with the more aggressive ER+ breast cancer. However, the relationship between PR signaling and the NF-κB pathway in breast cancer remains unknown. This study aimed to determine how NF-κB signaling affected PR transcription in PR-positive breast cancer cells.

In order to explore how TNF-α treatment affects PR transcriptional activity in breast cancer cells, T47D (ER+/PR+) breast cancer cells were transiently transfected with PRE2-TK-Luc reporter, and treated with or without 10 nM of R5020, TNF-α at 1, 5, and 10 ng/ml, or 10 nM R5020 in combination with TNF-α at 1, 5, and 10 ng/ml. PR transcription activity was determined by the Dual-Glo luciferase assays. Expression of the representative PR target genes, including CyclinD1, HSD11B2, and FKBP5, were analyzed by RT-PCR. Progestin treatment in combination with TNF-α significantly decreased PR-mediated transcriptional activities and significantly suppressed expressions of PR target genes, including Cyclin D1, HSD11B2, and FKPB5 gene in T47D breast cancer cells.

Our analysis suggests that TNF-α suppressed PR-mediated transcription in breast cancer cells. Therefore, conditions with high pro-inflammatory cytokines levels, such as in obese women, could have low PR transcriptional activity, and that could help explain why obese women are likely to have a worse breast cancer prognosis than non-obese women. Thus, treatment to reduce pro-inflammatory cytokine production in breast cancer patients may help increase PR transcription, and offer better prognosis and survival.

Keywords: *TNF-α, NF-kB, PR, breast cancer, inflammatory, obese*

INTRODUCTION

Breast cancer is a leading cause of cancer mortality and accounts for the greatest number of deaths of all cancers in women worldwide. Breast cancer subtypes are classified by hormone receptor expression, including Estrogen receptor (ER), Progesterone receptor (PR), and Human epidermal growth factor 2 (HER2), resulting in the following six subtypes: Luminal A (ER+, PR+, HER2-), Luminal B (ER+, PR+, HER2-), Luminal-HER2, HER-2 positive, triple-negative (TNBC), and triple-negative nonbasal phenotype. Hormone and HER2 receptors correlate with tumor grade, stage, and metastasis, but not with age, histological subtype, or family history. ER+/PR+ breast cancers showed a good response to hormone therapy, and favorable response was also related to small size, lower grade, and lower risk of mortality. ER+ breast cancers account for up to 75% of all breast cancers, and usually have better clinical outcome than ER- breast cancer. PR+ breast cancers account for 55-65% of all breast cancers and have been shown to have better prognosis than PR- breast cancer, as well. Moreover, progestins have also been used for hormone therapy and treatment of breast cancer metastasis. PR loss is often associated with the more aggressive types of breast cancer [1, 2]. A previous study suggested that loss of PR expression in breast cancer is associated with a lack of ER or genetic/epigenetic changes [3], however the mechanism that leads to loss of PR activity is still unknown.

Recent findings suggest that obesity is correlated with breast cancer progression and patient survival. Obese breast cancer patients had poorer survival than non-obese patients, but no study found that weight loss after diagnosis improved patient survival [4]. In obese individuals, an increase in adipose tissue leads to an increase of inflammatory cytokines, such as TNFα, interleukin (IL)-1β, IL-6, IL-8, IL-10, transforming growth factor-β (TGFβ), and nerve growth factor (NGF). Adipose tissue is one of a major storage depots of inflammatory cytokines. Therefore, obese patients tend to have a higher inflammatory cytokine level than non-obese patients [5]. Adipose tissue is a source of inflammatory cytokines, including adipocytes, stromal-vascular fractions, and activated macrophages [6].

TNF-α is one of the major inflammatory cytokines which has been found to express and secrete in adipose tissue. TNF-α binds to its transmembrane receptors, including TNFR1 (p55) and TNFR2 (p75), and both receptors are found within adipose tissue [7]. TNF-α induces several inflammatory cytokines such as IL-6, monocyte chemoattractant protein (MCP)-1, and NGF. Moreover, TNF-α can also induce plasminogen activator inhibitor (PAI) involved in the inflammation process in obese mice [8]. TNF-α also showed a positive autoregulation in adipose tissue, and that contributes to TNF-α level maintenance in obesity. TNF-α has the ability to regulate NF-kB transcription through JNK family inflammation regulators [9].

In addition, TNF-α in breast cancer is secreted by tumor-associated macrophages and cancer cells themselves. The breast cancer progression and metastasis are activated by inflammation within the tumor microenvironment (TME), including TNF-α. Moreover, the expression of ER and PR are also found to correlate with TNF-α and other inflammatory cytokines [10]. Increased TNF-α was found to correlate with higher tumor grade. In addition, a higher level of TNF-α was found in breast cancer biopsies compared to normal breast epithelial duct cells [11]. Furthermore, TNF-α was correlated with proliferation and survival of breast tumors [11]. Fully 83% of PR+ breast cancers showed TNF-α positive, and 81% of ER+ breast cancers also showed TNF-α positive. In addition, NF-kB was positive in almost all PR+ and ER+ breast cancers [11]. Thus, the high level of TNF-α induced in breast cancer among obese women leads to more aggressive breast cancer than in their non-obese counterparts. In this study, we hypothesize that TNF-α treatment suppresses PR-mediated transcription in PR-positive breast cancer.

METHODS

CELL CULTURE

T47D cell lines were obtained from Dean P. Edwards laboratory [12]. T47D is a human breast ductal epithelial tumor cell that has been widely used in breast cancer studies, and has high PR expression. Thus, T47D was used as a cell model to examine response of PR signaling. T47D cells were cultured in phenol red Dulbecco's Modified Eagle Medium (DMEM; Merck, Darmstadt, German), 10% Fetal Bovine Serum (FBS; Merck, Darmstadt, German), and 1% Penicillin Streptomycin (PenStrep; Hyclone, Logan, USA). Cells were cultivated in humidified tissue culture incubator at 37°C 5%CO_2.

PRE-LUCIFERASE

T47D cells were seed 20,000 cells/well in 96 well plates in 5% Dextran Coated-Charcoal stripped FBS (DCC, Gibco/Life Technologies, Gaithersburg, USA) phenol red free DMEM (Merck, Darmstadt, German) 1%PenStrep, incubated at 37°C 5%CO_2 overnight. Cells were transfected with 10 ng Renilla (pRL-CMV) as a transfection efficiency control and 90 ng Progesterone reporter element luciferase reporter construct (PRE2-TK-Luc) [13]. The transient transfections performed by using Lipofectamine® 3000 Transfection Reagent (Thermo Fisher Scientific, Massachusetts, USA), incubate 37°C 5%CO_2 24h. Next, the medium was removed, and PBS was rinsed twice before replacing with 5% DCC phenol red free DMEM. Next, cells were treated with R5020 10 nM, , TNF-α 0.5 ng/ml, TNF-α 1 ng/ml, TNF-α 5 ng/ml, TNF-α 10 ng/ml, R5020 10 nM+TNF-α 0.5 ng/ml, R5020 10 nM+TNF-α 1 ng/ml, R5020 10 nM+TNF-α 5 ng/ml, R5020 10 nM+TNF-α 10 ng/ml and ethanol (vehicle control) in that order, and incubated at 37°C 5%CO_2 24h. On the following day, cells were lysed, and measured for luminescence absorbances by using Dual-Glo® luciferase assay system (Promega, Wisconsin, USA). Finally, luminescence values were calculated.

REAL-TIME PCR

T47D were seed 200,000 cells/well in 12 well plates in 5% Charcoal stripped phenol red free DMEM, incubated at 37°C 5%CO2 overnight. Next, the medium was removed, and PBS was rinsed twice before replacing with 5% DCC phenol red free DMEM. Next, the cells were treated with R5020 10 nM, R5020 10 nM+TNF-α 0.5 ng/ml, R5020 10 nM+TNF-α 1 ng/ml, R5020 10 nM+TNF-α 5 ng/ml, R5020 10 nM+TNF-α 10 ng/ml, TNF-α 0.5 ng/ml, TNF-α 1 ng/ml, TNF-α 5 ng/ml, TNF-α 10 ng/ml, and ethanol (vehicle control) in that order, and incubated at 37°C 5%CO2 12h and 24h. After 12h, cell lysate was collected, and total RNA was extracted by using Genezol reagent (Geneaid, New Taipei City, Taiwan) 500 µl/well and suspended in Diethyl pyrocarbonate (DEPC) water 30 µl/sample. RNA template 1 µg/sample top up with DEPC water to total volume 20 µl then generate to cDNA using Maxime RT premix (iNtRon Biotechnology, Massachusetts, USA) with PCR machine (Eppendrof) 45°C 60 min. and 95°C 5 min. cDNA was analyzed with real-time PCR for Cyclin D1 gene (Forward primer: 5' ATG TTC GTG GCC TCT AAG ATG A 3', Reverse primer: 5' CAG GTT CCA CTT GAG CTT GTT C 3') using Real-time PCR reagent (Bio-rad Laboratories, California, USA) in Real-time PCR machine (Bio-Rad). A negative control was RNA sample without reverse transcriptase addition to confirm that there was no contamination with other genomic material. After 24h, the same procedure was performed, but with Real-time PCR of 2 PR responsive genes: HSD11B2 gene (Forward primer: 5' CTG ACC CAC GTT TCT CAC TG 3', Reverse primer: 5' CAG GTT CCA CTT GAG CTT GTT C 3') and FKBP5 gene (Forward primer: 5' TGA TGA AGG TGC CAA GAA CA 3', Reverse primer: TGC CAA GAC TAA AGA CAA ATG G). The results of CT were calculated as $2^{-\Delta\Delta CT}$ compared with ethanol (vehicle control) while Gapdh gene (Forward primer: 5' ACA TCG CTC AGA CAC CAT G 3', Reverse primer: 5' TGT AGT TGA GGT CAA TGA AGG G 3') was used as a house-keeping gene.

STATISTICS

Statistical analysis was performed by employing a paired t-test using SPSS statistical software version 20. Values were represented as means±SEM, and p-values < 0.05 were considered as significant.

RESULTS

EFFECTS OF TNF-α TREATMENT ON PR-DEPENDENT TRANSCRITPTIONAL ACTIVITIES.

We examined how TNF-α treatment affected PR transcriptional activities in PR-positve breast cancer T47D cells by transient transfection with a PRE-luciferase reporter construct (PRE2-TK-Luc). 10 nM R5020 (synthetic progestin) treatment induced PRE reporter activities by 8-10 fold, while TNF-α alone failed to induce the PRE-reporter in T47D cells. However, R5020 treatment in combination with an increasing concentration of TNF-α significantly reduced progetin-induced PRE-luciferase activity in a dose-dependent manner, with the strongest inhibition at 10 ng/ml of TNF-α (Figure1). These results demonstrate that TNF-α treatment inhibited PR-mediated transcriptional activities in T47D PR-positve breast cancer cells.

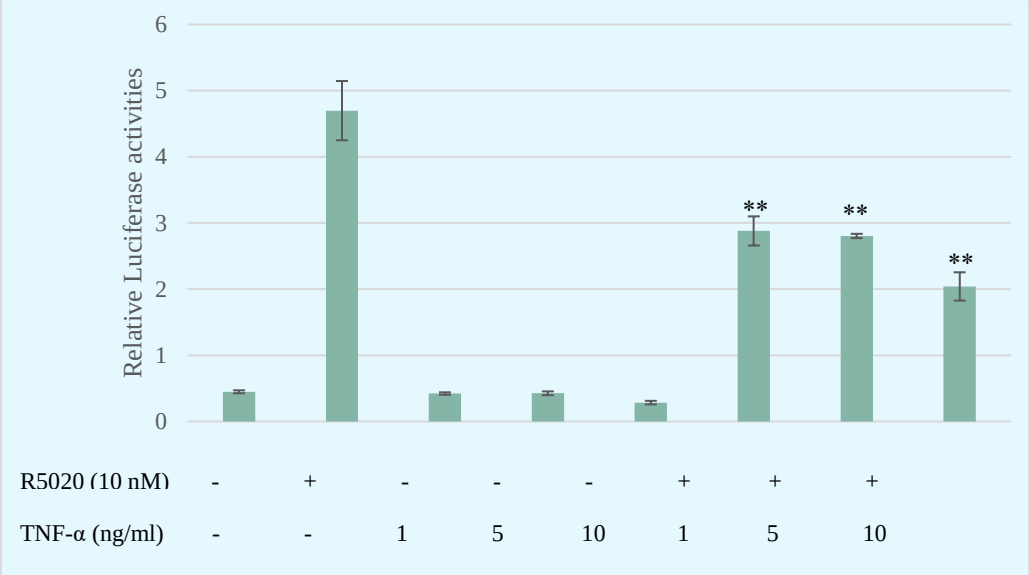

Figure 1: Effects of TNF-α treatment on PR-dependent transcritptional activities

The normalized Firefly luciferase activities of T47D cells after treatment with R5020 10 nM, R5020 10 nM+TNF-α 0.5 ng/ml, TNF-α 0.5 ng/ml, R5020 10 nM+TNF-α 1 ng/ml, TNF-α 1 ng/ml, R5020 10 nM+TNF-α 5 ng/ml, TNF-α 5 ng/ml, R5020 10 nM+TNF-α 10 ng/ml, TNF-α 10 ng/ml, and ethanol (vehicle control)

EFFECTS OF TNF-α TREATMENT ON SELECTED PR TARGET GENES

To further investigate the role of TNF-α and PR-depedent gene transcription in PR-positive breast cancer cells we examined how TNF-α treatment affected expression of three known-PR target genes, including Cyclin D1, FKBP5, HSD11B2. T47D breast cancer cells were treated with 10 nM R5020 or 10 nM R5020 in combination with increasing concentration of TNF-α from 0.5-10 ng/ml for 12 h for Cyclin D1 expression and 24 h for FKBP-5 and HSD11B2 expression. Cells were then lysed, and mRNA levels of PR responsive genes were determined by RT-PCR.

As shown in Figures 2-4, R5020 could activate all of the PR responsive genes tested but TNFα failed to induce their expression. However, TNF-α treatment significantly suppressed PR-induced expression of all PR responsive genes tested, including Cyclin D1, FKBP5, HSD11B2. TNF-α treatment reduced PR-mediated gene transcripition of all concentrations tested, however, the most effective suppresson varied among the three PR responsive genes tested. Cyclin D1 and HSD11B2 showed maximum suppression at 5 ng/ml of TNF-α (Figures 2 & 3) while FKBP5 showed maximum suppression at 10 ng/ml TNF-α (Figure 4).

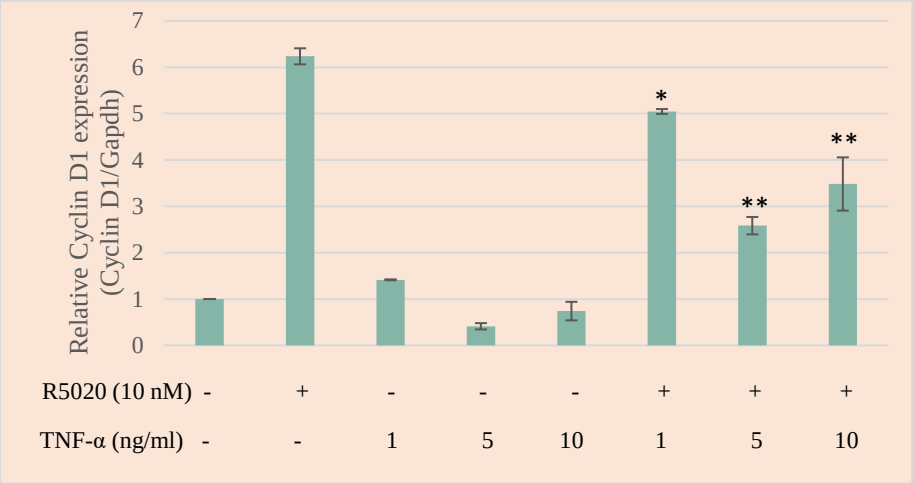

Figure 2: TNF-α treatment inhibited progestin-induced Cyclin D1 mRNA expression in T47D cells

T47D were transfected with PRE2TK and Renilla as an internal control for 24 h. Then cells were treated with 10nM R 5020with or without TNF-α at different concentrations. Total RNA was extracted and reverse transcribed. cDNA was amplified by qRT-PCR using CyclinD1 primers. GAPDH was used as a loading control. Values represent relative gene expression, normalized with GAPDH. Mean ± SEM from three independent experiments were * (p<0 . 0 5) and **(p<0.01) compared with the control group.

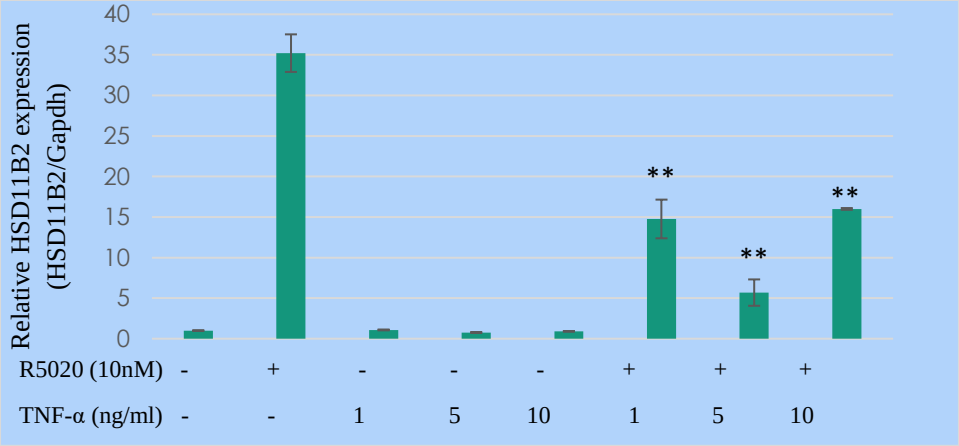

Figure 3: TNF-α treatment inhibited progestin-induced HSD11B2 mRNA expression in T47D cells

T47D were transfected with PRE2TK and Renilla as an internal control for 24 h. Then cells were treated with 10nM R 5020with or without TNF-α at different concentrations. Total RNA was extracted and reverse transcribed. cDNA was amplified by qRT-PCR using HSD11B2 primers. GAPDH was used as a loading control. Values represent relative gene expression normalized with GAPDH. Mean ± SEM from three independent experiments. *(p<0.05), **(p<0.01) compared with control group.

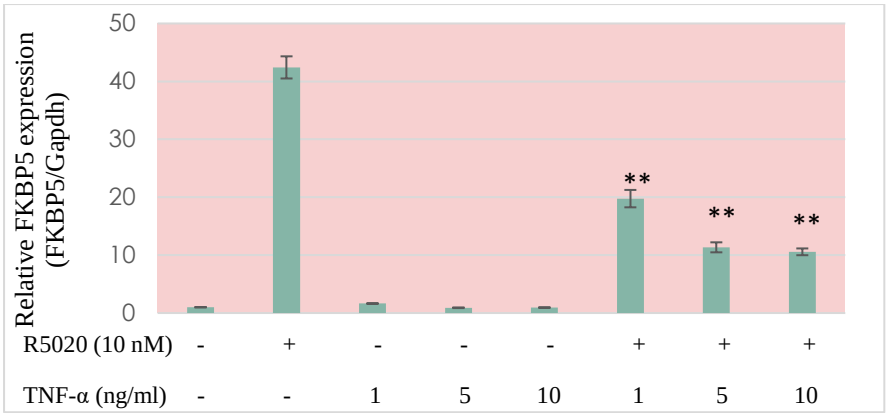

Figure 4: TNF-α treatment inhibited progestin-induced FKBP5 mRNA expression in T47D cells

T47D were transfected with PRE2TK and Renilla as an internal control for 24 h. Then cells were treated with 10nM R 5020with or without TNF-α at different concentrations. Total RNA was extracted and reverse transcribed. cDNA was amplified by qRT-PCR using FKBP5 primers. GAPDH was used as a loading control. Values represent relative gene expression normalized with GAPDH. Mean ± SEM from three independent experiments were * ($p<0.05$) and **($p<0.01$) compared with the control group.

DISCUSSION

A previous study found that expression of hormone receptor was correlated with TNF-α expression in breast cancer tumors [14], but the nature of the relationship between factors was unknown. Our study can confirm a relationship between TNF-α and PR, in that TNF-α treatment was a significant inhibiting PR transcriptional activity, as confirmed with PR responsive gene reduction. Because ER+/PR+ breast cancer is more responsive to Selative ER Modulator therapy (SERMs) than ER+/PR- breast cancer [15], understanding the molecular mechanism that could suppress PR activity may help improve breast cancer treatment and survival.

However, the mechanism of action is still unknown. Normally, NF-kB is an inactive form; it can be activated by DNA-binding protein in Rel family composed of Rel-A, NFKB1, and c-Rel. These DNA-binding proteins are stimulated by TNF-α or IL-1 cytokines. A previous study found that breast cancer cells expressed a higher level of Rel-A, which can activate the NF-kB pathway, more than non-breast cancer cells. In addition, breast cancer cells had a higher level of c-Rel expression, and that can activate the NF-kB pathaway more than in non-cancerous tissue. Rel-A has been shown to inhibit PR transcriptional activity in Hela cells. A high level of Rel-A was also found in breast cancer cells, while other subunits, including NFKB-1 and c-Rel, did not have any effects [16]. Moreover, because PR loss is associated with low estrogen and ER malfunction [17], treatment with TNF-α resulted in a lower level of ER which, in turn, may lead to a decrease or loss of PR expression, or could affect via Rel-A or c-Rel in breast cancer cells.

Be that as it may, additional studies in other PR positive breast cancer cells and/or in animal models will need to be carried out to further validate our findings. In addition, to investigate a mechanism of how TNF-α suppress PR activity in breast cancer, future studies should examine how transcription is mediated by PRA and PRB response to TNF-α treatment, and explore the relationship of other proteins, RNA, or DNA which may be related to this process upon hormone treatment.

CONCLUSIONS

TNF-α suppressed PR-mediated transcription in PR positive breast cancer cells, suggesting that obese breast cancer patients with high pro-inflammatory cytokines level could have low PR transcriptional activity. Our data may help explain why obese women with locally-produced pro-inflammatory cytokines are likely to have a worse breast cancer prognosis than non-obese women.

RECOMMENDATIONS

Based on the findings, this research provides a novel relationship of PR and TNF-α in PR positive breast cancer cells. Thus, treatment to reduce pro-inflammatory cytokine production in obese breast cancer patients may help increase PR transcription and decelerate breast cancer progression, leading to a better prognosis and survival.

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FACTORS ASSOCIATED WITH INTRACRANIAL HEMORRHAGE OCCURRENCE AMONG PATIENTS WITH NON-VALVULAR ATRIAL FIBRILLATION USING NON-VITAMIN K ORAL ANTICOAGULANTS

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ABSTRACT

Background: Intracranial hemorrhage (ICH) is the most devastating complication of oral anticoagulants. While data regarding the risk factors and outcomes of ICH are available in the literature, little is known regarding the development of ICH in Thai patients using non-vitamin K oral antagonists (NOACs).

Objectives: To identify risk factors for the development of ICH along with clinical outcomes after ICH in patients with non-valvular atrial fibrillation (NVAF) using NOACs.

Methods: A non-identifiable database of patients with NVAF from January 2013 to December 2017 from ten hospitals was used as the study cohort. Patients were divided into two groups: those with ICH and those without ICH. Univariate and multivariate analyses were performed to identify risk factors of ICH. The outcome of ICH was also evaluated.

Results: A total of 961 NVAF patients were included in the data analysis with the mean age 74.4 (SD + 10.1) years. There was a total of 12 patients (1.2%) diagnosed with ICH. Most ICH cases were found in rivaroxaban users. After multivariate analysis, only concomitant use of acid-suppressive therapy was significantly associated with ICH (OR 4.72 (95%CI, 1.27-17.53)). For clinical outcomes, patients with ICH had very high mortality rate compared to those without ICH (OR: 22.26, 95% CI: 5.44–91.11; $p < 0.01$).

Conclusion: Concomitant use of acid-suppressive therapy was associated with an increased risk of ICH. This could potentially indicate that either acid-suppressive therapy may interact with NOACs, or its use may be an indicator of the overall heightened risk of bleeding of the patients. Patients with ICH had a very high mortality rate. As a result, attempts should be made to reduce the risk of ICH developed among NVAF patients using NOACs.

Keywords: *atrial fibrillation, intracranial hemorrhage, non-vitamin K oral antagonists, oral anticoagulants, outcomes of ICH, risk factors of ICH*

INTRODUCTION

Oral anticoagulation therapy is the most important strategy to prevent stroke from atrial fibrillation [1, 2]. While the therapy is useful, it comes with side effects [3]. The most deadly side effect is intracranial hemorrhage (ICH) where there is a significant amount of bleeding inside the skull [4, 5]. ICH can frequently lead to death or severe disability [6]. The rate of ICH varies depending on multiple factors, with the reported rate ranging from 0.3-0.6% [7]. The rate of mortality from ICH ranges from 20-55% [8]. The incidence of ICH strongly increases with age, especially at the age of 85 years and above [7, 9, 10]. Among different ethnicities, the rate of ICH is twice higher in the Asian populations compared to other ethnicities [9]. Moreover, male sex, hypertension, diabetes, smoking and low levels of low-density lipoprotein cholesterol (LDL-C) have also been found to be associated with the risk of ICH. Among patients receiving oral anticoagulation therapy, the types of anticoagulants also play a part in the risk of ICH [3, 5-7, 9, 11-19]. Currently, there are two main types of oral anticoagulation therapy, including vitamin K antagonists (VKAs) such as warfarin, and the non-vitamin K oral antagonists (NOACs) such as rivaroxaban, apixaban and dabigatran [1, 2, 20, 21]. NOACs act on single target in the coagulation cascade of action which is more specific than warfarin. In addition, NOACs also have less complex pharmacokinetics and pharmacodynamics profiles compared to warfarin [22]. These advantages partly lead to a reduced bleeding rate compared to warfarin [1, 23]. Data from randomized, controlled trials suggest that VKAs (such as warfarin) had twice higher rate of ICH compared to the NOACs [21, 23-25]. In Thailand, most data regarding ICH was derived from patients using warfarin. However, little is known regarding the risk factors and outcomes of ICH from NOACs since these agents have only recently been introduced into the Thai healthcare system [18, 25-29]. As a result, in this study, we aimed to identify risk factors for the development of ICH along with clinical outcomes after ICH in Thai patients with non-valvular atrial fibrillation (NVAF) using NOACs.

METHODS

STUDY POPULATION AND SETTING

The study population was cases in the existing database of a retrospective multi-center cohort study conducted in ten public tertiary care hospitals across four provinces (Bangkok, Chiang Mai, Nakorn Nayok, and Nakorn Ratchasima) [26]. Seven of the ten hospitals are in Bangkok. The reason why only the tertiary care hospitals were selected as the study sites was that NOACs were available at the tertiary care hospital at the study time. Participants were adult patients with NVAF (age ≥ 18 years old) who received NOACs during January 2013 to December 2017 at participating sites. For this study, data were extracted from the existing database between November 2021 and January 2022. Only apixaban, dabigatran, and rivaroxaban users were included because of the late entry of edoxaban into the Thai market during the study period. Patients were followed up from the first occurrence of ICH, bleeding outcomes, drug discontinuation, and switching of therapy, or at the end of the study period. Participants were classified into two study arms: ICH and non-ICH cases.

Relevant data included social and demographic characteristics (gender, age, body weight), clinical characteristics (creatinine clearance, hepatic impairment, history of stroke and bleeding), comorbidities (stroke, heart failure, coronary artery disease, peripheral arterial disease, vascular disease, dyslipidemia, hypertension, diabetes mellitus, cancer, anemia), concomitant medications, and risk factors for stroke and bleeding (CHA_2DS_2-VASc score, HAS-BLED score). ICH cases were identified using the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10). Clinical outcomes of cases suffering ICH were also collected.

STATISTICAL ANALYSIS

Descriptive analysis was performed for the study population, and baseline characteristics for all patients were reported by descriptive statistics. Continuous variables were reported as means)+ standard deviation(. Qualitative variables were reported as frequencies and percentages. Continuous variables were tested for normality by the Kolmogorov-Smirnov test. A univariate analysis was performed to identify variables that may be associated with ICH. Any variables with a p-value < 0.2 from univariate analysis were then included in a multivariate analysis)binary logistic model regression(to analyze the association between risk factors and the occurrence of ICH. The unadjusted and adjusted odds ratio were calculated and compared. The alpha value of $p \geq 0.05$ was chosen to determine statistical significance. The mortality rates of ICH cases were also compared with non-ICH cases.

RESULTS

A total of non-identifiable 961 patients with NVAF were included in the data analysis. The mean age of patients was 74.4 (SD ± 10.1) years, whereas 478 (49.7%) were males and 483 (50.3%) were females. The mean body weight in kg was 64.6 (SD ± 14.1). There were 510 (53.1%) patients who were older than 75 years of age. There were 456 (47.5%) patients who had a history of warfarin use prior to the use of NOACs. The mean creatinine clearance (CrCl) of patients was 48.0 (SD + 17.6) mL/min, and 227 (23.6%) patients had CrCl ≥ 60 mL/min. The mean estimated glomerular filtration rate (eGFR) calculated by the Modification of Diet in Renal Disease (MDRD) equation was 64.7 (+ 18.8) mL/min/1.73 m^2, and 565 (58.8%) patients had an eGFR value ≥ 60 mL/min/1.73 m^2. The most common comorbidities were previous stroke, heart failure, vascular disease, diabetes mellitus, hypothyroidism, hyperthyroidism, dyslipidemia, hypertension, seizure, cancer, anemia, and a history of bleeding. Out of all underlying conditions, 335 (34.9%), 773 (80.4), 394 (41.0%) and 157 (16.3) patients had previous stroke, hypertension, anemia, and a history of bleeding, respectively, which are the risk factors for ICH according to a literature review (9, 11-13, 16). A total of 114 (11.9%) received aspirin, 53 (5.5%) received clopidogrel, 11 (1.1%) received other antiplatelets, and 160 (16.6%) received other antiplatelet therapy. A total of 454 (47.2%) patients received ACEI/ARB, 615 (64.0%) with beta blockers, 11 (1.1%) with verapamil, 33 (3.4%) with diltiazem, 99 (10.3%) with digoxin, 99 (10.3%) with amiodarone, 7 (0.7%) dronedarone, 30 (3.1%) other antiarrhythmic agents, and 136 (14.2%) with any arrhythmic agents. Furthermore, 689 (71.7%) received statins, 378 (39.8%) received PPI or H2 blockers, and 43 (4.5%) received NSAIDs.

There were 453 (47.1%), 263 (27.4%), and 245 (25.5%) patients who received dabigatran, rivaroxaban, and apixaban, respectively. The mean CHA2DS2-VASc score for stroke risk measurement was 4.1 (SD + 1.7) and 806 (83.9%) of patients had a CHA2DS2-VASc score > 3. The mean HAS-BLED score was 2.0 (SD + 1.1) and the mean ORBIT score was 2.4 (SD + 1.7). A total of 428 (44.5%) patients had an ORBIT score > 3, and 307 (31.9%) patients had a HAS-BLED score > 2. Among 961 patients receiving NOACs, 12 (1.2%) experienced ICH, including 5 rivaroxaban, 4 apixaban, and 3 dabigatran users.

In the univariate analysis, there were three factors that were found to be associated with an increased risk of ICH: age (OR:4.49 95% CI: 0.98–20.60), HAS-BLED score (OR:3.03 95% CI: 0.95–9.62), and PPI or H2 blocker (OR:4.72 95% CI: 1.27–17.53) (Table 1). However, only usage of concomitant medication PPI or H2 blocker showed an increased risk of ICH after multivariate regression analysis (Table 2). Unadjusted and adjusted risks of ICH among OACs users are given in Table 3 (Adjusted OR: 4.715 95% CI: 1.268-17.531). For clinical outcomes, patients with ICH had a very high mortality rate (25.0%) compared to those without ICH (1.5%) (OR: 22.26, 95% CI: 5.44–91.11; $p < 0.01$).

Table 1: Risk Factors of ICH based on the Univariate Analysis

Factor	Odds Ratio (95% CI)	P value
Age (years) ≥ 75	4.40 (0.98–20.60)	0.035
BW (kg) < 60	1.68 (0.53–5.25)	0.366
CrCl < 60 mL/min	3.44 (0.44–26.78)	0.210
eGFR	2.02 (0.64–6.40)	0.992
CHA2DS2-VASc > 2	0.66 (0.21–2.06)	0.470
HAS-BLED ≥ 3	3.03 (0.96–9.62)	0.049
ORBIT data ≥ 3	2.73 (0.87-8.56	0.072
Dyslipidemia	2.18 (0.59–8.1)	0.234
Anemia	2.92 (0.87–9.76)	0.069
Stroke	1.34 (0.42–4.26)	0.619
Diabetes	2.00 (0.64–6.26)	0.223
Hypertension	1.22 (0.27–5.61)	0.799
Cancer	0.99 (0.13–7.75)	0.990
Aspirin	1.32 (0.57–3.61)	0.201
Statin	0.39 (0.13–1.22)	0.093
PPI or H2 blockers	4.72 (1.27–17.53)	0.011

Notes: BW = body weight; CrCl = creatinine clearance; eGFR = estimated glomerular filtration rate; PPI or H2 blockers = proton pump inhibitors or H2 receptor blockers

Table 2: Factors associated with the Dependent Variable by Bleeding Type (multivariate analysis)

Independent variable	Dependent variable	
	ICH	
	B	P-value
PPI or H2 blocker	1.551	<0.05
R^2 = 0.53		

Notes: R^2 = Nagelkerke R Square value in binary logistic analysis; PPI or H2 blockers = proton pump inhibitors or H2 receptor blockers

Table 3: Unadjusted and Adjusted Risk of ICH by OAC Users

Risk Factor	Unadjusted OR	P Value*	Adjusted OR	P Value‡
PPI or H2 blocker	4.72(1.27–17.53)	0.011	4.715 (1.268-17.531)	0.021

Notes: p-value* = p-value for univariate analysis to identify risk factors of ICH; P‡ = p-value for multivariate analysis of factors associated with each bleeding types; PPI or H2 blockers = proton pump inhibitors or H2 receptor blockers

DISCUSSION

This study is the first retrospective cohort study which analyzed the potential risk factors of ICH in Thai NVAF patients using NOACs. Since the data were derived from ten public tertiary care hospitals (seven teaching hospitals and three ordinary tertiary care hospitals), the database has good generalizability. This data represents the largest dataset of NOACs users and analysis of bleeding events. We analyzed all NVAF patients without selecting a targeted sample size so that selection bias could be avoided. There were no missing or incomplete data as the researcher pharmacist had a well-planned study and meticulous data collection.

The key finding of our study is that only the co-administration of PPI or H2 blocker was found to be an independent risk factor for ICH after analysis with logistic regression. Although the other two risk factors, age and HAS-BLED, were also found to be significant risk factors in the univariate analysis, those factors dropped out in the multivariate logistic analysis. The AOR of the co-administration of PPI or H2 blocker had a P value < 0.05. This is in contrast to the known risk factors for ICH, including age, male sex, hypertension, diabetes, smoking, and low levels of low-density lipoprotein cholesterol (LDL-C) [9, 12, 13]. The most likely explanation of this difference is the low number of ICH cases, along with a relatively short follow-up period of 1.3 years. As a result, further studies with a much larger sample size and longer follow-up period are needed to identify a more complete set of risk factors for ICH among Thai NVAF patients using NOACs.

There are two possibilities that may potentially explain the association between the use of acid-suppressive therapies and risk of ICH. One possibility is drug interaction between NOAC and acid-suppressive therapies [30]. The most common PPI used in Thailand is omeprazole, a known substrate and inhibitor of CYP3A4. Since most NOACs undergo metabolism via CYP3A4, there is a possibility of drug interaction, except for dabigatran [31]. The second possibility is that the use of acid-suppressive therapies is just a signal that these patients may be judged to have an increased risk of bleeding based on the clinician's judgment, which led to the prescribing of acid-suppressive therapies in these patients [30, 31]. As a result, this interaction should be further evaluated in a larger study in the future.

Our study has several limitations. First, given its retrospective design, the study may have retained some confounding factors despite any statistical adjustment. Second, there is a potential for missing data due to gaps in the referral system. Third, there is no data on edoxaban in our study, due to the late introduction of this agent into the Thai market.

CONCLUSION

Concomitant use of acid-suppressive therapy was associated with an increased risk of ICH. This suggests that either acid-suppressive therapy may interact with NOACs, or its use may be an indicator of the overall heightened risk of bleeding of the patient. Patients with ICH had a very high mortality rate. As a result, attempts should be made to reduce the risk of ICH among NVAF patients using NOACs.

RECOMMENDATION

Further studies with a larger sample size and longer duration of follow-up time should be conducted to produce a more comprehensive risk factor profile for ICH. Meanwhile, attempts must be made to minimize the risk of ICH by mitigation or elimination of risk, where possible.

ETHICAL DECLARATION

The study protocol was approved by the Institutional Review Board of the Faculty of Dentistry/Faculty of Pharmacy, Mahidol University. The Certificate Exemption No. is MU-DT/PY-IRB 2021/042.1011.

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GENDER-BASED VIOLENCE AWARENESS AND ACCESS TO SOCIAL, LEGAL, AND HEALTH SERVICES AMONG WOMEN IN EASTERN MYANMAR DURING THE MILITARY COUP

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ABSTRACT

One in three women globally has suffered at least one form of gender-based violence (GBV) in their lifetime. GBV is among the most serious yet underrated issues in Myanmar despite the fact that the country has been one of the most dangerous countries for women around the world. Being a country in poverty with economic and political instability, combined with a deeply-rooted patriarchal system, makes women and girls vulnerable to violence. Lives of people became more difficult since the military coup and aftermath starting in February 2021, along with intensified armed conflict. Previous studies explored the determinants of GBV or intimate partner violence, and the consequences of GBV, etc. At the present time, under the cloud of a military coup, people's attention is focused more on politics and survival issues rather than on GBV concerns. Challenges such as human resources, funding limitations, safety, and security issues have discouraged researchers to conduct studies outside their respective field.

Objective To be able to support GBV victims by developing effective strategies in an environment of political crisis, the study explored the situation of social, legal, and health services accessibility of GBV victims during the military coup.

Methodology The study was conducted in the eastern part of Myanmar, where ethnically-diverse people live, and armed-conflicts have been festering before and after the latest military coup. The study applied qualitative analysis of data collected by in-depth interviews with ten female GBV victims and three representatives of service provider organizations which assist victims. Study participants were recruited using purposive sampling through case management organizations. Study participants were from different residential areas, different types of GBV, education, age, and occupation backgrounds.

Results The results of the analysis show that all ten GBV victims sought at least social support from their family or acquaintances. Not all realized that they were a victim of GBV. However, most realized they were reaching a point where they could not bear the psychological burden of the harm they were suffering. Only a few victims sought legal and health support for their condition. The main obstacles to seeking care were financial constraints, collapse of the criminal justice system, safety and security concerns, and erosion of trust of officials in the formal justice system. Cultural norms and awareness of the society played a role in helping victims seek help. The responses of the service providers in this study were consistent with responses of the GBV victims. Very few cases were referred to the legal and health service providers. Safety and security issues, trust issues, and mobility restrictions in the wake of the military coup created challenges in disseminating service information, providing services, and promoting GBV awareness in the community in the study area of eastern Myanmar.

Conclusions The results of the study indicate that the military coup had a major detrimental effect on GBV survivor access to social, health, and legal services. The military coup triggered financial problems, system failure, erosion of trust/safety/security, and other adverse effects which made it difficult for GBV victims to obtain services and for organizations to provide assistance.

Implication of the Research he findings of the study will contribute as evidence-based research in developing a project proposal for service provider organizations. Research on exploring the determinants of seeking health support by GBV victims should be helpful for health care support organizations in developing effective communication and service delivery strategies for victims as well as the general public.

Keywords: *Awareness, Gender-based violence, Military coup, Myanmar, Service accessibility*

INTRODUCTION

The most severe form of violence in the world is gender-based violence (GBV). GBV is "*…a form of discrimination that seriously inhibits women's ability to enjoy rights and freedoms on a basis of equality with men…*" according to The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) General Recommendation. Violence against women (VAW) is a form of GBV that can harm women physically, mentally, and sexually. VAW includes, but is not limited to, physical, sexual, psychological, domestic, intimate-partner, and non-intimate-partner violence [(1)]. According to the World Health Organization (WHO), over one-third of women worldwide have experienced some type of physical or sexual abuse at some point in their life [(2-3)]. The most prevalent form of GBV (which an estimated 30% of women worldwide experience) is intimate-relationship abuse. Myanmar has consistently ranked among the world's most dangerous nations for VAW [(4)]. VAW has been spreading throughout the nation as a result of poverty, patriarchal societal norms, and military conflict. Vulnerability is aggravated if one is a member of a LGBTIQ group, a religious minority, having less education, or living in a conflict zone, among other risks.

As a result of the military takeover in Myanmar, violence in general has increased, and the support systems for victims of GBV have been undermined [(5)]. This study aims to inform strategic approaches for awareness, protection, case management, and support systems for victims of GBV in the context of a political crisis. The approach is to examine the situation of GBV victims' access to legal, social, and health services, as well as public awareness of the problem. This requires a review of relevant information, legal options, weighing the pros and drawbacks of action by/for victims, filing court papers, and/or referring victims to other support providers [(1)]. Clinical treatment, gathering data, and referral are further fundamental components of health services provided to victims. Services for GBV survivors may include a thorough physical examination, treatment of injuries and sexually-transmitted infections (STI), testing for pregnancy, counseling and psychosocial support, and follow-up through subsequent visits. Social support includes family and community understanding and protections, access to a safe space, and refraining from blaming the victim of GBV [(6)].

Prior research focused on the incidence, contributing factors, and effects of GBV around the world [(7-10)]. However, the support system for GBV victims has not received enough attention, with the exception of a few papers that highlighted the gaps in the health sector and the need of GBV victims for psychosocial support and sexual and reproductive health care [(11-13)]. There is even less research into the ease or difficulty with which victims of GBV can access and receive services. Additionally, since 2021, Myanmar has been reeling from the effects of the military takeover, and political and development issues have taken front and center of the public debate. Thus, the subject of GBV and support for women is perceived as a lower priority. This research addressed the vacuum of attention and services related to GBV by looking into how the military junta's political instability affects victims of GBV victims' access to services.

In eastern Myanmar there has been a higher frequency of reports of sexual and GBV because of ethnic diversity and protracted conflict between ethnic-armed groups and the military. The principal author wanted to learn more about women's understanding of GBV in that region of the country. Additionally, this study examined how affected women could access social, health, and legal services, especially during the aftermath of the military coup, beginning in February 2021. The principal author purposively selected ten victims of GBV and representatives from three non-governmental organizations (NGOs) that provide social services to victims. Data were collected by in-depth interview, and processed using content analysis.

METHODS

STUDY DESIGN

In-depth interviews (IDI) with study participants were used to compile the narratives for the qualitative data analysis. Even though they require more time, IDI ensured that participants had the opportunity to provide their individual perspective and without any time constraints.

STUDY PARTICIPANTS

Thirteen key informants were interviewed in total: Three representatives from service provider organizations that have been actively supporting victims of GBV throughout the coup period, and ten adult women who have experienced any type of GBV in the past year and either reported or did not report their experience. Participants under 18 years old were excluded from the study due to the need for parent or guardian consent. Service provider personnel were selected who knew the context of the GBV situation, operational challenges, and had experience working with victims. The ten victims varied in age, socioeconomic status, level of education, and family background, but all were from the same region of eastern Myanmar. Participants ranged in age from 20 to 43. Primary school was the lowest level of educational attainment, while graduate school was the highest level. Occupations of the participants include gambler, farmer, teacher, shop owner, small business owner, and tailor. Additionally, three participants lived in an urban area, two were from a peri-urban area, and five individuals lived in a rural area. Domestic violence, intimate-partner violence, workplace violence, online/internet abuse, physical violence, sexual violence, and psychological violence were the different types of GBV reported by the study participants. Some participants experienced multiple forms of violence, including physical, sexual, psychological, and domestic abuse. Violence of this nature was experienced by participants from the beginning of the military coup until the present. Participants from service provider organizations included case managers, attorneys, and program coordinators who oversee program operations, and had first-hand knowledge of working with GBV victims in the study sites. Organizations that have provided legal, medical, and psychosocial support for situations of GBV were chosen through contacts with the GBV Working Group Network in Eastern Myanmar.

DATA COLLECTION

The IDI were either conducted by the principal author or a trained interviewer. All but one IDI was conducted in-person; the IDI with one representative of a service provider organization was conducted by phone. If the GBV victim spoke a regional dialect (e.g., Shan, PaO) bi-lingual interviewers were trained to conduct the IDI to eliminate the need for a translator. All study participants gave their written informed consent to participate after being told of the study's objectives and protocol. During and after the interview, participants had the option to leave the study at any moment, and they were also free to decline to answer any question for any reason. The IDI guide was developed by the principal author.

DATA ANALYSIS

The inductive approach was used to evaluate transcripts of the IDI. The content analysis involved identifying themes that arose from the IDI. Some of the recurrent themes include financial difficulties, breakdown of the court/justice system, a lack of confidence in governmental institutions, safety and security concerns, cultural influences, normalization of GBV in society, and victim-blaming.

RESULTS

GBV victims encountered obstacles in seeking support, and the majority did not receive adequate legal, social, or health support following the abuse. All victims made an effort to enlist the assistance of the members of their social network, including friends, family, and acquaintances. One-half of the participants attempted to get legal assistance, but none sought medical assistance. Despite outreach efforts by support agencies, those agencies said that the GBV victims did not come to their center for health care. Financial challenges, institutional failure, a lack of trust in formal government institutions, doubts about safety and security (attributable to the military coup), cultural deterrents, normalization of GBV by society, and victim blaming are some of the factors which discouraged victims from seeking formal help. The following is a discussion of some of the more salient obstacles to seeking care and remediation from GBV.

I. Financial constraints

Every GBV survivor and service provider cited financial hurdles as the biggest obstacle to obtaining legal, social, and medical services. Participants claimed that their financial situation worsened after the military coup. In the aftermath of the coup, the cost of living climbed with the rising cost of essential goods, while many family members lost their jobs. Salaried workers had to convert to being farmers, while others resorted

to compulsive gambling. However, because of the escalating conflict in the eastern region of Myanmar, subsistence farmers were also struggling to survive. They had difficulty obtaining loans which are essential to obtaining rice seed and equipment for the planting season. The farmers also feared for their security when out in the relatively isolated fields. Some individuals who could not or did not farm became desperate enough to flee to another country to find work.

These financial pressures probably led to many men to become abusive to their wife or partner. Women who may have wanted to flee the household were reluctant to do so in such a perilous and uncertain environment. If these women fled an abusive husband, they would want to take their youngest children with them. However, they could not see how they would make a living out on their own. Women who were lucky enough to be employed outside the home could not take the chance of losing their job since that income was an important source of survival for the household and their dependents. Some support organizations offered help and financial support to abused women who wanted to take their case to court. However, the consequences of trying and failing to obtain a favorable legal judgment might put them in even more peril than before.

One person who experienced both physical and psychological abuse was halfway through seeking legal assistance when she had to discontinue the effort due to financial constraints. In the words of one of the key informants: "*Even though I reported the assault to the store owner, they did not care, and they even threatened to fire me.*" Another lamented: "*I could not afford to leave my job due to the economic crisis, increasing prices, and the sudden joblessness of my brother and other family members. Even though I had spoken to a lawyer once, I decided against taking legal action because I was afraid of losing my current employment.*"

II. Institutional Failure

Institutional breakdown, particularly of institutions involved in the formal legal system, was another factor that compounded the financial constraints faced by GBV victims. In the wake of the February 2021 coup, security in all aspects of life in Myanmar was tightened. The trauma also spread to persons who felt they had grievances and wanted to pursue justice for their cause. Given the vacuum of law and order, corruption started to spiral out of control. With all this turmoil, it is not surprising that interest in lobbying for victims of GBV was not a top priority of advocates in society, and none of the ten key informants in this study mentioned receiving support from established organizations which help abused women.

S05, a participant who experienced abuse on social media, observed the following: "In normal (i.e., pre-coup) circumstances, I knew that I could report incidents of cybercrime to the police. However, as a result of the military takeover, police stopped taking such cases. Instead, ordinary citizens were being detained on charges of political resistance to the junta. Thus, if anyone would be detained for comments on social media, it would be more likely to be opposition to the generals and not for cyber-bullying against a woman. What is more, if I contacted the police directly, it might also put my safety at risk. That is why I was reluctant to call the police for assistance."

The IDI with representatives of service providers are consistent with the above comments. Organizations assisting GBV victims also have to exercise caution to avoid attracting unfavorable attention from the junta or, worse, be accused of political activity. That is because the society was essentially under a period of martial law, and anyone could be arrested for the slightest charge, even if there was no solid evidence.

"It is not surprising that the number of under-reported instances (of GBV) climbed; the judicial institutions and law enforcement were ordered to focus on crimes against the state. In that context, GBV would be seen as a trivial matter." (Remarks by a representative of a legal and social assistance organization.) In addition, such a punitive environment breeds extortion. There were instances where actors in the legal system demanded money from victims in order to apprehend criminals but then failed to do so.

III. Lack of Trust in Government Institutions

Another issue that surfaced in relation to institutional breakdown of support for GBV victims was the public's faith in governmental institutions. People have seen firsthand how government agencies, operating under the State Administration Council, have treated civilians unfairly by making unauthorized arrests, setting communities on fire, and engaging in corruption. Thus, it is not surprising that few GBV victims were willing to ask for help from staff of government agencies to address their suffering.

S02, a participant who had experienced sexual harassment, relayed the following: "I heard that the current laws don't support such victims like us. They request money simply to do their job. And since the police are preoccupied with the political turmoil, cases like mine are never brought before a judge. That was why I chose not to call the police."

Participant S04 experienced a similar lack of trust: "I feared I could not report the incident to the police. I've heard that police are now not working to solve the crimes in our neighborhood, and they are not interested in my case."

Service groups concurred with the public's lack of confidence in formal institutions. They shared the same sentiment that, until the nation is liberated from this dictatorship, people will continue to be unsure of when and how they will once again trust official institutions to deliver justice.

IV. Security and Safety Concerns

The safety and security concerns following the military coup is another hurdle that service provider organizations highlighted. The accessibility of assistance for victims was adversely impacted by the inability to deliver services as they had before. Due to institutional collapse, issues with public trust in government institutions, and other legitimate concerns, organizations that previously worked in partnership with their government counterparts were unable to fully pursue cases in the justice system. The lack of security also hindered seeking and receiving medical care at public hospitals and clinics, accessing government-owned shelters, and obtaining other essential services for victims of GBV. People no longer trusted one another as a result of wrongful detentions, brutal killings of activists, and opposition to the military takeover.

As a result, numerous NGOs have reduced their activities and kept a low profile. Some groups were forced to suspend operating safe houses (i.e., shelters) for GBV victims, because they were unable to guarantee safety for both the staff and the residents. Before the military takeover, such safe houses used to operate with full cooperation from government agencies (e.g., the department of social welfare, or DSW) to protect the safety of victims. However, after the February 2021 coup, the DSW was no longer able to support victims or collaborate with the relevant NGOs.

Victims also need to have information about service providers in order to report their case and seek help. Before the coup, numerous local and international NGOs organized awareness campaigns and information exchange in the localities. Following the coup, those organizations were unable to enter the areas because locals had lost trust of outsiders, and even their own neighbors. The military would recruit informants from the local residents, and these persons would report any suspicious actions on behalf of the military and civilian defense forces.

V. Community Members' Awareness

There is also the problem of lack of awareness (or denial) in the host community about the problem of GBV. That lack of recognition of the problem pre-dated the military coup. However, the coup only worsened the situation by causing neighbors to become more insular, and studiously avoid probing into the affairs of others in the community. Without community awareness of the GBV that was occurring in their midst, the victims felt even more disempowered to seek legal assistance or treatment for their wounds from spousal abuse. Even when they did ask members of the community to help them, the victims of GBV did not always receive it, primarily due to the cultural norm which considers matters between a husband and wife to be a personal family issue. A dark side of this denial of GBV is victim-blaming, in the belief that any abuse a woman suffers at the hand of her husband must have been brought upon her by her own actions or neglect of her husband's needs.

Even the victims themselves are prone to self-blame. Indeed, only 40% of participants in this study acknowledged that they were victims of GBV. The remaining 60% believed they were dealing with typical issues that come up naturally in a family, between spouses, or in communication with others on social media. In the words of one of the key informants: "*I did not know about GBV, although I had experienced abuse from my boyfriend. After I attended a training on GBV, I started to realize how my rights were being violated, and how I could fight back through legal action*."

Cultural norms in Myanmar dictate that sexual violence, especially between intimate partners, should not be discussed outside the household. This only serves to push the issue of GBV underground and perpetuate lack of awareness among the broader public. Indeed, it may be considered dishonorable to discuss personal conflict outside the family setting (i.e., "*airing one's dirty laundry*"). One key informant expressed her belief that, despite utilizing the Internet and online platforms on a regular basis, people show very little interest in GBV and are unaware of resources to learn more about it. Another respondent observed that many people are ignorant of their rights and the existence of GBV entirely. Additionally, they have no idea where they may obtain more information on the topic.

Usually it is only those who have received training from NGOs, been exposed to community-based awareness campaigns, or viewed TV shows on the topic who are knowledgeable about GBV. As a result, outreach by NGOs is still essential to increase community awareness about GBV. However, such organizations have also encountered difficulties while trying to mount community-based awareness campaigns. After the military coup, those organizations needed to keep a low profile in order not to attract unwanted attention from the junta. In addition, given the broader threat of violence to people generally, GBV was relegated to a lower priority in the public sphere. What is more, because of erosion of trust and security at the community level, support groups found it difficult to plan awareness initiatives, and that severely hampered victims' ability to gain information and help.

DISCUSSION AND CONCLUSIONS

In sum, this study found that the February 2021 military coup in Myanmar had a detrimental effect on the ability of victims of GBV to obtain social, medical, and legal services. The military takeover imposed financial problems, caused systemic failure of government institutions, and eroded trust/safety/security in ways that prevented victims from accessing services, and impeding NGOs from providing outreach assistance. As a result, the majority of those seeking assistance did not get the support they needed and were entitled to.

People were able to make more use of social, health, and legal services prior to the military coup and without having to worry about being arrested. Prior to the coup, women felt safe to venture outside of the home community to seek services and interact with peers. Additionally, service providers and governmental organizations worked together to create a support and referral network for GBV victims. It is true that Covid-19 impeded some outreach and services for victims of GBV, even before the 2021 coup. Still, GBV awareness campaigns were still being conducted freely in 2020. However, after the coup, the number of GBV victims who sought medical assistance drastically declined, and it is unknown how many cases went unreported.

This study also investigated GBV victim awareness. Despite the fact that GBV victims had experienced a range of abuse, their level of awareness was low due to pre-existing conditions, e.g., gender inequality, gender power imbalance, and the cultural norms of the patriarchal society. Women were discouraged from participating in awareness-raising events or accessing information on their own, and these restrictions only intensified after the military coup. Due to safety and security concerns, as well as the erosion of trust, NGOs that had played a critical role in raising community awareness have struggled to effectively carry out their programs ever since February 2021.

Many of the findings of this study are in line with earlier research. First and foremost, political instability brought on by military unrest or domestic conflict has had a significant negative impact on women's and girls' lives in Myanmar, in addition to contributing to a rise in GBV. Research in other nations also found that, in the wake of military upheaval, services for victims of GBV become even more limited. Similar to studies conducted by the United Nations and Amnesty International, this study discovered that access to services for victims was hampered by infrastructure and institutions that were undermined by the armed forces [14-16]. Arbitrary arrests, the destruction of facilities, and the imposition of travel restrictions all contributed to a suppression of the population to seek and obtain essential services. Additionally, GBV victims were not protected by the formal court system and were not given a survivor-centered approach to justice [17].

In this study, the assessment of GBV knowledge was limited to victims rather than the general community because prior studies have addressed public awareness of GBV. That said, certain findings are congruent with the research by Makongoza and Nduna, Yang et al, and Lees et al, which found that victim blaming and a victim-blaming culture are associated with low levels of public awareness [18-20].

Obviously, from the perspective of the principal author, it would be ideal if there was no need for a military coup, or a dictatorship, or political instability in Myanmar, or anywhere else in the world. That way, stronger support could be provided to victims of GBV wherever they are. Until that ideal is realized, the humanitarian and aid organizations need to continue to concentrate on reaching an assisting GBV victims, not only in conflict zones, but also in areas with large settlements of ethnic minorities since they are usually the first to suffer abuse when there is armed conflict. Programs need more effective design of social and behavioral change communication methods in order to reach the most marginalized populations and bridge the gap in services, especially under an environment of military oppression. In order to prevent security threats for both victims and organizations, NGOs should adopt safety rules for service delivery in the current political situation. Additionally, networking and collaboration among NGOs and humanitarian organizations would be an effective and efficient way to support GBV victims by filling the gaps in the infrastructure in the event that working with government departments is not possible.

ETHICAL DECLARATION

Due to the political unrest in Myanmar at the time of this study, both the key informants and the principal author ran the risk of being detained by the military. Thus, informed consent from all respondents was obtained as part of the ethical considerations for this study. Participants were assured by the interviewer that their answers would be kept private, and that any personal information they provided (e.g., name, address, contact information) would not be made available to the general public or anyone else. The principal author assigned codes to the names, addresses, and organizations of the participants in order to protect their privacy and confidentiality. These recorded files were safely stored with secure password

protection. The study protocol was approved by the Institutional Review Board of the Institute of Population and Social Research (IPSR-IRB) in May 2022.

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HUSBANDS' CHARACTERISTICS AND UNMET NEED FOR FAMILY PLANNING AMONG MARRIED WOMEN IN MYANMAR

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ABSTRACT

Background: Unmet need for family planning (UMNFP) in Myanmar is relatively high compared to other countries in Southeast Asia and the Asia Pacific region. Although some studies have examined various factors affecting the UMNFP in Myanmar, knowledge about how a husband's characteristics are influencing UMNFP is still limited. Thus, this study examined the husband's characteristics that influence UMNFP among married women in Myanmar.

Objective: To identify husband's characteristics which significantly influence UMNFP among married women aged 15-49 years in Myanmar.

Methods: This research was a cross-sectional study using secondary data derived from the Myanmar Demographic and Health Survey (MDHS 2015-16). The sample population was 7,870 married women age 15-49 in Myanmar. Multinomial logistic regression was performed to examine the association between the husband's characteristics and multinomial outcomes of UMNFP (unmet need for spacing and unmet need for limiting).

Results: This study found that 17.3% of married women had UMNFP (5.5% for spacing and 11.8% for limiting). The results indicate that unmet need for spacing was higher in women whose husband wanted more children (aOR=2.35, p-value 0.000, 95% CI: 1.76-3.13), and who did not know if their husband desired more children (aOR=2.42, p-value 0.000, 95% CI: 1.61-3.44), compared to women who wanted the same number of children as her husband. For women whose husband was not involved in decisions about her healthcare, the odds of both unmet need for spacing (aOR=1.28, p-value 0.031, 95% CI: 1.02-1.61) and unmet need for limiting (aOR=1.20, p-value 0.023, 95% CI: 1.03-1.40) were higher than for women whose husband was involved in their wife's healthcare decision-making. Women married to a much older (15+ years) man were more likely to experience unmet need for limiting (aOR=1.66, p-value 0.009, 95% CI:1.14-2.43).

Conclusions: This study found that not knowing the husband's desire for children, husband's intention to have more children, and husband's non-involvement in decision-making of his wife's healthcare increases the probability of both unmet need for spacing and limiting childbirth for the woman. Having a husband who is much older (15+ years) was significantly associated with higher unmet need for limiting. Since the husband's characteristics were observed as significant predictors of UMNFP, strategies to address husband's characteristics should be included in reducing UMNFP, and there should be further studies emphasizing the association between husband's characteristics or male involvement and UMNFP to improve understanding of this dynamic.

Keywords: *Unmet need, Family Planning, Husband Characteristics, Married Women, Myanmar*

INTRODUCTION

Family planning is one of the most efficient investments for the development of a country [1], and it offers a variety of potential health advantages, especially in maternal and child health (MCH) as well as potential non-health benefits including expanding opportunities for women's education and empowerment, as well as a country's population expansion and economic development [2]. Family planning also includes a wide range of contraceptive methods such as pills, injections, intrauterine devices, and condoms, etc., as well as the knowledge of pregnancy dynamics and infertility treatment [3]. In 2017, the World Health Organization (WHO) estimated that around 214 million women globally, or one in four women age 15-49 years, living in a low- or middle-income country, did not want to have a pregnancy and were not using any modern contraception. WHO also estimated that this situation might result in over 85 million unwanted pregnancies and high rates of unsafe abortion and maternal deaths [4].

Unmet need for family planning (UMNFP) refers to "the percentage of women who are fecund and sexually active, but are not using any modern contraceptive methods, and report that they want to stop or delay childbearing" [5]. UMNFP can be divided into two components: unmet need for spacing and unmet need for limiting childbirth. If a woman merely wanted to delay pregnancy and was not using any contraception, she is considered as having unmet need for spacing. A woman can be assumed as having unmet need for limiting if she wanted no more children and was not using any contraception [6]. According to the World Population Dashboard by UNFPA, the UMNFP of married women in the less developed regions and least developed countries of the world were 12% and 20%, respectively [2]. UNFPA also estimated Myanmar's UMNFP to be 14% in 2021, which was still higher than average regional unmet need of 9% in the Asia Pacific Region, and also higher than other Southeast Asian countries, such as 5% in Vietnam, 6% in Thailand, 11% in Cambodia, and 11% in Indonesia [2].

During the period between 1991 and 2020, the global contraceptive prevalence rate (CPR) has improved from 16.8% in 1991 to 55% in 2020, and UMNFP has been reduced from 20.6% in 1991 to 15.7% in 2020. Although there have been those international improvements in the family planning sector, Myanmar did not meet its family planning program targets, which are achieving a CPR of at least 60%, and reducing UMNFP to below 10% by 2020 [7]. Accordingly, it is important to study the reasons for not achieving the targets so that any shortcomings can be addressed to improve progress toward the indicator targets in the coming years.

The majority of the published studies found that husband-related factors (e.g., education, desire for children, etc.) had a significant association with UMNFP among married women, together with individual factors of the woman (e.g., age, age at marriage, education, occupation, etc.), household factors (e.g., size, wealth status, gender composition of children, etc.), and community/institutional factors (e.g., place of residence, access to multimedia, visit of healthcare workers for contraception, accessibility of healthcare facilities, etc.) [8-20]. Thus, understanding and addressing the husband-related factors is also crucial for reducing UMNFP. Husbands are usually involved in most of the decisions regarding reproductive health issues of their wife, particularly in developing countries [21, 22]. Myanmar is also one of the developing countries with a strong patriarchal society where men are the main decision-makers for family affairs, including reproductive health issues. Thus, it is important to study the characteristics of husbands as they may influence UMNFP among married women in Myanmar. Although there is previous research about UMNFP in Myanmar, those studies did not focus on the association of husband characteristics and UMNFP. Hence, there is still a need to more fully document the influence of husband characteristics on UMNFP in married women. This study used data from the 2015-16 Myanmar Demographic and Health Survey (MDHS), which is based on a nationally representative sample. The principal aim of this study was to define the husband characteristics which appear to have a significant influence on UMNFP for married women aged 15-49 in Myanmar.

METHODS

STUDY DESIGN, DATA SOURCE

A cross-sectional quantitative study was conducted using the secondary data from the MDHS 2015-16. The MDHS 2015-16 was conducted by the Ministry of Health and Sports (MOHS) from 7/12/2015 to 7/7/2016.

The study sample included 7,870 currently married women aged 15-49 years in Myanmar. This study employed the women's dataset derived from the Woman's Questionnaire of the MDHS 2015-16. The data on husband characteristics were obtained from their wife's responses.

DEPENDENT VARIABLE

The dependent variable of this study is UMNFP. According to definition by Bradley et al [6], the values for this variable is coded into "1= Unmet Need for Spacing," i.e., women who wanted to delay their next pregnancy but are not using contraception; "2 = Unmet Need for Limiting," i.e., women who wanted to stop childbearing altogether, but were not using any contraception; and "0 = No unmet need," i.e., women who were using contraception.

INDEPENDENT VARIABLES

Based on the literature and modified Socio Ecological Model (SEM) by Koren and Mawn (2010) Koren and Mawn [23], the independent variables were categorized into individual level, micro-environment level (which included husbands' characteristics), and macro-environment level.

Individual level factors included woman's age, education, employment status, age at first marriage, knowledge on sources of contraception, and number of living children. Micro-environment level factors comprised of household wealth, spousal age difference, husband's education, husband's occupation, husband's desire for children, husband's involvement in decision-making of women's healthcare, and husband as the head of household. Macro-environment level factors consisted of place of residence, access to mass media, distance to nearest health facility, and patrilocality-based region.

STATISTICAL ANALYSIS

Descriptive statistics were used to analyze the socio-demographic characteristics of participants. To examine the effects of factors on the UMNFP (spacing and limiting), multinomial logistic regression models were applied. Adjusted odds ratios (aOR) with 95% confidence interval (CI) were used for analyzing the independent association between UMNFP and independent variables.

RESULTS

Table 4.1 shows that 17.3% of Myanmar married women had UMNFP (5.5% for spacing and 11.8% for limiting). The majority of the respondents (about 86%) were age 25-49 years while around 14% of respondents were age 15-24 years. Nearly half the sample had completed primary education, although one in seven married women had no formal education. Most of the respondents were working (about 70%) and knew at least one source of family planning services (around 85%). One-fourth of the respondents married before the age of 18 years. Over 60% of women had two or fewer children, while a small minority (6%) had six or more children.

Regarding wealth status, households of married women were roughly evenly distributed across the five wealth quintiles. About two-thirds of women married a man who was within five years younger or older than themselves. A small minority (about 3%) married a man who was much older (15+ years). Three out of four husbands were working in agricultural or manual labor, while 8% were working in a professional or clerical job. Nearly half of the husbands (over 46%) wanted to have more children than their wife, while 38% of husbands wanted to have same number of children as their wife. Two-fifths of married couples made decisions together on healthcare of women, although about 14% of husbands solely controlled decision-making regarding the healthcare of their wife. Regarding household leadership, about 65% of the women respondents said that their husband was the head of the household.

Approximately three out of four women were residing in a rural area. When the states and regions were divided according to the patrilocality index (i.e., high values are where a majority of married couples settle with the husband's family after marriage) the sample of women in the MDHS were distributed almost equally (around 30%) in each of three patrilocality-based regions. In the case of media accessibility, about 85% of respondents were able to access at least one mass media channel (e.g., radio, television, newspaper, magazines), whilst about 15% of women had no access to any kind of mass media. Distance to the nearest healthcare facility was a big problem for about 27% of respondents.

MULTINOMIAL LOGISTIC REGRESSION

Table 2 shows the results of multinomial logistic regression of factors affecting UMNFP among married women in Myanmar, comparing the results of two outcomes (unmet need for spacing and unmet need for limiting), while no UMNFP is the base outcome.

After controlling for other possible cofounders, among husband characteristics, desire for children, involvement in decision-making regarding their wife's healthcare, and being the household head were significantly associated with both unmet need for spacing and unmet need for limiting. A large age difference between husband and wife (i.e., 15+ years-older husband) was significantly associated with unmet need for limiting only, and not with unmet need for spacing.

The results indicate that the unmet need for spacing was higher in women whose husband wanted more children (aOR=2.35,95% CI: 1.76-3.13), and those who did not know if their husband desired more children (aOR=2.42,95% CI: 1.61-3.44), compared to women who wanted the same number of children as their husband. On the other hand, husband's desire for children showed the opposite results, in that, women were around 50% less likely to have an unmet need for limiting when the husband desired more children than their wife (aOR=0.49, 95% CI: 0.41-0.58) or when the wife was not aware of their husband's desires (aOR=0.50, 95% CI: 0.40-0.63).

Table 1 istribution of Background Characteristics of UMNFP and its Influencing Factors among Married Women age 15-49 in Myanmar

Characteristics (n=7870)	Frequency	Percentage
Unmet Need for Family Planning (UMNFP)		
Unmet Need for Spacing	434	5.5%
Unmet Need for Limiting	928	11.8%
No Unmet Need	6,508	82.7%
Individual Level		
Age of woman (years)		
15-24	1,094	13.9%
25-49	6,776	86.1%
Education status of women		
No Formal Education	1,203	15.3%
Primary	3,622	46.0%
Secondary or higher	3,045	38.7%
Employment Status of women		
Not Employed	2,415	30.7%
Employed	5,455	69.3%
Woman's age at first marriage (years)		
Younger than 18	2,029	25.8%
18 or older	5,841	74.2%
Woman's knowledge of a source of contraception		
Does not know	1,148	14.6%
Knows	6,722	85.4%
Number of living children		
2 or less	4,754	60.4%
3-5	2,636	33.5%
6 or more	480	6.1%
Micro-environment Level		
Household Wealth		
Poorest	1,685	21.4%
Poorer	1,620	20.6%
Middle	1,608	20.4%
Richer	1,554	19.8%
Richest	1,403	17.8%
Age difference between husband and wife		
Husband is 5+ years younger than wife	288	3.7%
Husband and wife are age within 5 years of each other	5,195	66.0%
Husband is 5-14 years older than wife	2,174	27.6%

Characteristics (n=7870)	Frequency	Percentage
Husband is 15+ years older than wife	213	2.7%
Education level of husband		
No Education	1,276	16.2%
Primary	3,048	38.7%
Secondary or higher	3,546	45.1%
Husband's occupation		
professional/technical/managerial	639	8.1%
clerical/sales/services/domestic	669	8.5%
agricultural	2,036	25.9%
skilled manual |	1,508	19.2%
unskilled manual	2,936	37.3%
did not work	82	1.0%
Husband's desire for children		
Wants the same as wife	2,993	38.0%
Husband wants more children	3,668	46.6%
Husband wants fewer children	158	2.0%
Don't know	1,051	13.4%
Husband's involvement in decision-making of woman's healthcare		
Not involved	3,536	44.9%
Involved in decision-making together with wife	3,204	40.7%
Dominates decision-making	1,130	14.4%
Husband is head of household		
Yes	5,103	64.8%
No	2,767	35.2%
Macro-environment Level		
Place of residence		
Urban	2,057	26.1%
Rural	5,813	73.9%
Access to mass media		
Yes	6,665	84.7%
No	1,205	15.3%
Distance to healthcare facility		
Big problem	2,109	26.8%
Not a big problem	5,761	73.2%
Patrilocality-based Region		
Low Patrilocality	2,421	30.8%
Moderate Patrilocality	2,939	37.3%
High Patrilocality	2,510	31.9%

Regarding the husband's involvement in decision-making for the healthcare of their wives, the unmet need for spacing was 1.28 (aOR=1.28, 95% CI: 1.02-1.61) times higher in women whose husband was not involved in decision-making compared to women who made health care decisions jointly with her husband. A similar result was found for unmet need for limiting, in that, women whose husband was not involved in decision-making was 1.2 (aOR=1.20, 95% CI: 1.03-1.40) times more likely to have unmet need for limiting than women whose husband jointly made the decision with her.

If the women's husband was the head of the household, the likelihood of having unmet need for spacing or limiting declined. Compared to the women whose husband was not the household head, the unmet need for spacing reduced by 50% (aOR=0.51, 95% CI: 0.40-0.64), while the unmet need for limiting reduced by 25% (aOR=0.75, 95% CI: 0.63-0.89) in women whose husband was the head of the household.

Age difference between spouses was found to be significantly associated with unmet need for limiting but was not significantly associated with unmet need for spacing. A woman whose husband was much older (15+ years older) than her was 1.66 (aOR=1.66, 95% CI: 1.14-2.43) times more likely to have unmet need for spacing than women who were a similar age as her husband.

Husband's education was associated with unmet need at the 0.1 significance level, but husband's occupation was not significantly associated with unmet need. The probability of having unmet need for spacing in women whose husband completed primary education was 25% lower than the women whose husband had no formal education (aOR=0.75, 95% CI: 0.55-1.01). If the

women's husband completed secondary or higher education, the odds of having unmet need for limiting would be 20% lower compared to women with uneducated husbands (aOR=0.80, 95% CI:0.65-0.95).

Table 2: Multinomial Logistic Regression of Determinants of UMNFP among Married Women in Myanmar (N=7,870)

Characteristics	Unmet Need for Spacing (Base Outcome: No Unmet Need)		Unmet Need for Limiting (Base Outcome: No Unmet Need)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Individual Level				
Age of women (years)				
25-49 (Reference)	1		1	
15-24	1.28 (0.99-1.66)	0.065	0.49*** (0.34-0.69)	0.000
Education status of women				
No Education (Reference)	1		1	
Primary	0.84 (0.61-1.16)	0.288	0.85 (0.71-1.02)	0.129
Secondary or higher	1.19 (0.83-1.71)	0.350	0.80 (0.74-1.13)	0.080
Employment Status of women				
Not Employed (Reference)	1		1	
Employed	0.86 (0.70-1.23)	0.178	1.20* (1.02-1.45)	0.029
Woman's age at first marriage (years)				
Younger than 18 (Reference)	1		1	
18 or older	1.12 (0.86-1.44)	0.396	0.95 (0.87-1.15)	0.545

Characteristics	Unmet Need for Spacing (Base Outcome: No Unmet Need)		Unmet Need for Limiting (Base Outcome: No Unmet Need)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Woman's knowledge source of contraception				
Does not know of a source (Reference)	1		1	
Knows a source	0.44*** (0.34-0.57)	0.000	0.71** (0.58-0.86)	0.001
Number of living children				
2 or less (Reference)	1		1	
3-5	0.70* (0.52-0.93)	0.014	2.11*** (1.78-2.51)	0.000
6 or more	0.62 (0.34-1.14)	0.125	3.11*** (2.38-4.07)	0.000
Micro-environment Level				
Household Wealth				
Poorest (Reference)	1		1	
Poorer	0.78 (0.57-1.05)	0.111	0.92 (0.73-1.05)	0.471
Middle	0.78 (0.57-1.08)	0.141	0.87 (0.72-1.05)	0.286
Richer	0.62* (0.43-0.89)	0.010	1.03 (0.72-1.32)	0.796
Richest	0.56* (0.36-0.88)	0.011	1.14 (0.70-1.55)	0.364
Age difference between husband and wife				

Characteristics	Unmet Need for Spacing (Base Outcome: No Unmet Need)		Unmet Need for Limiting (Base Outcome: No Unmet Need)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Husband and wife are age within 5 years (Reference)	1		1	
Husband is 5+ years younger than wife	0.55 (0.27-1.08)	0.085	1.40 (0.98-2.00)	0.062
Husband is 5-14 year older than wife	1.08 (0.86-1.37)	0.491	1.02 (0.86-1.20)	0.799
Husband is 15+ years older than wife	0.84 (0.41-1.71)	0.631	1.66** (1.14-2.43)	0.009
Education level of husband				
No Education (Reference)	1		1	
Primary	0.75 (0.55-1.01)	0.061	0.95 (0.74-1.05)	0.649
Secondary or higher	0.77 (0.56-1.07)	0.107	0.80 (0.65-0.95)	0.065
Husband's occupation				
professional/technical/managerial (Reference)	1		1	
clerical/sales/services/domestic	0.97 (0.81-1.53)	0.923	1.16 (0.81-1.53)	0.448
agricultural	0.81 (0.68-1.17)	0.338	1.04 (0.68-1.17)	0.713
skilled manual |	1.22 (0.85-1.46)	0.350	1.20 (0.85-1.46)	0.285
unskilled manual	0.95 (0.62-1.43)	0.790	1.15 (0.81-1.36)	0.142
did not work	1.61 (0.92-2.82)	0.257	1.52 (0.92-2.82)	0.222

Characteristics	Unmet Need for Spacing (Base Outcome: No Unmet Need)		Unmet Need for Limiting (Base Outcome: No Unmet Need)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Husband's desire for children				
Both want same (Reference)	1		1	
Husband wants more	2.35*** (1.76-3.13)	0.000	0.49*** (0.41-0.58)	0.000
Husband wants fewer	0.30 (0.04-2.19)	0.234	1.07 (0.85-1.81)	0.729
Don't know	2.42*** (1.61-3.44)	0.000	0.50** (0.40-0.63)	0.002
Husband's involvement in decision-making of woman's healthcare				
Involved in decision-making (Reference)	1		1	
Not involved	1.28* (1.02-1.61)	0.031	1.20* (1.03-1.40)	0.023
Dominates decision-making	1.20 (0.88-1.63)	0.234	1.05 (0.92-1.33)	0.671
Husband is head of household				
No (Reference)	1		1	
Yes	0.51*** (0.40-0.64)	0.000	0.75** (0.63-0.89)	0.001
Macro-environment Level				
Place of residence				
Urban (Reference)	1		1	
Rural	1.83*** (1.32-2.52)	0.000	1.03 (0.83-1.27)	0.816

Characteristics	Unmet Need for Spacing (Base Outcome: No Unmet Need)		Unmet Need for Limiting (Base Outcome: No Unmet Need)	
	Adjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Access to mass media				
No (Reference)	1		1	
Yes	1.06 (0.82-1.41)	0.711	0.94 (0.77-1.15)	0.544
Distance to a healthcare facility				
Big problem (Reference)	1		1	
Not a big problem	0.99 (0.86-1.14)	0.576	1.00 (0.85-1.19)	0.968
Patrilocality based regions				
Low Patrilocality (Reference)	1		1	
Moderate Patrilocality	0.84 (0.63-1.09)	0.193	1.10 (0.87-1.14)	0.294
High Patrilocality	1.24 (0.96-1.59)	0.092	1.17 (1.04-1.41)	0.102
Log Likelihood		-4069.032		
Pseudo R^2		0.0914		

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

DISCUSSION

The aim of this study was to identify husband's characteristics which had a significant influence on UMNFP (spacing and limiting) among married women aged 15-49 in Myanmar. This study found that 17.3% of currently married women had UMNFP (5.5% of unmet need for spacing and 11.8% of unmet need for limiting) at the time of data collection (i.e., 2015-16). Total UMNFP (17.3%) was much higher than the regional average of 9% in the Asia Pacific, and it was also distinctly higher than Myanmar's neighbors, e.g., 5% in Vietnam, 6% in Thailand, 11% in Cambodia, and 11% in Indonesia [2]. Moreover, the unmet need for limiting (11.8%) in Myanmar was found to be more than double of unmet need for spacing births (5.1%).

This study identified husband characteristics affecting the two components of UMNFP (i.e., spacing and limiting). Among husband characteristics, desire for children, involvement in healthcare decisions of their wife, and being household head were found to be significantly associated with both unmet need for spacing and unmet need for limiting. Having a husband who was much older (15+ years) had a significant effect on the wife's unmet need for limiting, and husband's education level had a weak association with both unmet need (i.e., at the 0.1 significance level).

Inter-spousal discussion regarding desired family size and contraception is important to reduce UMNFP [24]. This study found that women who did not know their husband's preference for number of children were more likely to have unmet need for spacing. This finding implies that those women did not discuss family planning with their husband. This finding is consistent with the observations of Mulenga, Bwalya [8] that unmet need for spacing is more likely to be observed in women who did not know their husband's fertility desire compared to women who wanted the same number of children as their husband. Not knowing their husband's intentions regarding number of children can reflect a lack of inter-spousal communication on fertility and family planning, and this might lead to UMNFP among married women.

This study also found that husband's desire for more children is an important factor influencing unmet need for both spacing and limiting. Holding other variables constant, a woman's unmet need for spacing is more likely when her husband wants more children than she does. This finding is also supported by other studies in different settings, e.g., that husband's desire for more children increased the likelihood of unmet need for spacing among married women [16, 19]. The possible explanation for this finding is that, when the husband wants more children than his wife, he might object or discourage his wife's use of contraception to space births. This might be especially true in Myanmar where the husband is usually expected to be the dominant decision-maker of the household.

The results also show that both unmet need for spacing and limiting were higher in women whose husband was not involved in the healthcare decisions of their wife compared to women who made healthcare decisions jointly with their husband. A multi-country study in sub-Saharan Africa had similar findings with the MDHS, in that, UMNFP was lower in women who made healthcare decisions jointly with their husband [14].

Age difference between husband and wife was found to be a significant predictor of unmet need for birth limiting among women in the MDHS. When the husband's age is 15 or more years older than his wife, she would be more likely to experience unmet need for limiting compared to a woman whose age is similar to her husband. This finding is also consistent with the results of a multi-country study in sub-Saharan Africa conducted by Magali and Veronique [25] which found that contraceptive use of women who were married to a much older man was lower than the women whose age was closer to her husband's.

This study found that husband's education was weakly associated with UMNFP among married women. Both unmet need for spacing and limiting declined as the husband's education increased. Studies in different settings also found that higher education of husband leads to reduction of UMNFP [8, 20, 26, 27]. This can be explained by the fact that the more educated husbands might have a better understanding of the benefits of contraception and the importance of controlling family size [28].

CONCLUSIONS

This study found that UMNFP among married women aged 15-49 in Myanmar is still high compared to other countries in Southeast Asia. This study also found that the husband's characteristics (e.g., desire for children, involvement in decision-making of women's healthcare, and being household head) were significantly associated with both unmet need for spacing and for limiting. The probability of having unmet need for limiting increases in women who are married to a much older man. The higher education status of husbands helps to reduce the UMNFP, for both spacing and limiting. Thus, it is observed that husband's characteristics are emerging as an important predictor of a woman's unmet need for spacing and limiting

childbirth. Further studies are needed to clarify the association between husband's characteristics and male involvement in family planning and UMNFP.

RECOMMENDATIONS

Current health education programs related to sexual and reproductive health (SRH) and family planning mainly focus on women, assuming that the wife is mainly responsible for use of contraception. Thus, health education programs should also be implemented for husbands to improve knowledge and education about family planning and its benefits so that they can support the contraceptive use of their wife. SRH programs should include activities that promote male involvement in family planning, and encourage spousal communication on fertility issues and family planning.

Joint decision-making between husband and wife regarding women's healthcare, and agreement on the desired number of children lowers prevalence of UMNFP (spacing and limiting). Thus, policies and programs should focus on decreasing the gender gap between husbands and wives in order to reduce UMNFP.

This study was limited to those characteristics of husbands that were included in the MDHS, and are based on the reports of the wife. Future research should study husband's attitudes toward family planning, husband's opposition or approval for use of contraception, and husband's religion, among other potential determinants of UMNFP among Myanmar women. Moreover, qualitative studies should also be conducted to provide more in-depth understanding of the association of husband's characteristics and UMNFP.

ETHICAL DECLARATION

In this study, secondary data were used from the MDHS 2015-16 conducted by the MOHS of Myanmar. The MDHS questionnaires were approved by the MDHS Technical Committee and were translated into Burmese. Regarding the ethics review committee of the Myanmar Department of Medical Research, the MOHS reviewed and approved the survey protocol. The ICF Institutional Review Board also approved this survey protocol. Additionally, the protocol of the current study was reviewed and approved by the institutional review board (IRB) of the Institute for Population and Social Research (IPSR), Mahidol University (COE. No. 2022/05-117).

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REFERRAL PATTERNS OF INTERMEDIATE CARE IN THAILAND DURING 2018-19

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ABSTRACT

Background The main goal of intermediate care is to help patients recover as part of transitioning out of the acute phase of critical care. In Thailand, policies related to acute and long-term care are far more developed than intermediate care, there is limited evidence about the patterns of intermediate care among different contexts/areas of Thailand.

Objective To describe the referral patterns of intermediate care in four 'best-practice' provinces of Thailand.

Methods This study collected data on patients classified by Rehabilitation Impairment Categories (RIC), with a specific focus on patterns of referral for intermediate care during the during a six-month period of post-acute care. Cases were drawn from the discharge and admission databases for 2018 and 2019 for four provincial hospitals and four community hospitals acknowledged as the 'best-practice' hospitals for intermediate care.

Results There were 10,450 cases in this study. The most frequent referral pattern was the discharging of patients from the provincial hospital to the community hospital (89.7%). However, there were sporadic cases of reverse referral, i.e., from a community hospital to the provincial hospital.

Limitations This study purposely selected hospitals recognized as 'best-practice' facilities for intermediate care after the intermediate care policy had been implemented for several years.

Conclusions The most common pattern of intermediate care was discharging patients from a provincial hospital to be then cared for by a community (i.e., district) hospital. Patients who were insured under the Thai Social Security Scheme employed this pattern of referral more than other schemes.

Keywords: *Intermediate care, referral pattern, Thailand, health insurance schemes*

INTRODUCTION

Intermediate care (IMC) is the health and medical service patient receives after the acute-care phase. IMC aims to ameliorate a patient's disability and prevent permanent impairment. IMC mostly occurs after the acute phase when a patient is in a stable condition [(1)]. IMC is also referred to as 'sub-acute' or 'post-acute care.' The patterns of care provided under IMC vary. The IMC setting may be a hospital-based ward, or a nurse-led or physician-led IMC unit as part of the discharge or referral planning [(2)].

In Thailand, IMC policy was launched to develop the IMC service systems as part of the implementation of the *Universal Coverage Fund Management Manual for 2016*. Specifically, IMC services were to be reimbursed by the universal coverage scheme (UCS), administered by the National Health Security Office (NHSO). These services include physical rehabilitation services for the disabled, the elderly, and patients in the post-acute phase [(3)]. In 2019, the Health Administration Division of the Thai Ministry of Public Health (MOPH) issued "*Guidelines for Intermediate Care*" to motivate and assist health professionals in developing an IMC service plan [(4)]. Those guidelines serve as the standard operating procedures (SOP) for implementation of the IMC services in public hospitals throughout the country. The guidelines mention the need for "*seamless care*" which includes the referral experience based on lessons learned from implementation around the country. However, the pattern of IMC and referral was not compulsory for the eligible hospitals or health care providers under the MOPH; the SOP were only a framework for facilities in different types of settings to adapt and apply. Also, the diseases or conditions covered under the IMC uidelines were specified as stroke, traumatic brain injury, and spinal cord injury.

However, the patients who need IMC have diseases of conditions that go well beyond the above three traumas. Khiaocharoen *et al* investigated sub-acute costing and classification related to sub-acute care which covered 19 diagnosed diseases/conditions, coined as Rehabilitation Impairment Categories (RIC). These 19 RIC include stroke, traumatic brain dysfunction, non-traumatic brain dysfunction, traumatic spinal cord dysfunction, non-traumatic spinal cord dysfunction, neurologic conditions, lower extremity fracture, hip & knee replacement, other orthopedic conditions, amputation, osteoarthritis, cardiac disorders, pulmonary disorders, pain syndromes, other major multiple trauma (without brain injury), major multiple trauma (with brain & spinal cord injury), miscellaneous (infections, neoplasms, nutrition with intubation/parenteral nutrition, nutrition without intubation/parenteral nutrition, circulatory disorders, respiratory disorders (ventilator dependent), respiratory disorders (non-ventilator dependent), terminal care, skin disorders, medical/surgical complications, other medically-complex conditions, burn, and deformities [(5)].

As the services provided for IMC had already been implemented in some areas of Thailand, the patterns of IMC care were still based on the readiness and context of the locality, even though the IMC needed to be seamless, and that had implications for the different referral patterns [(6)]. This study aimed to explore the referral patterns of IMC in purposely-selected hospitals that implemented IMC, in order to understand the local situation and prescribe policy directions for IMC in Thailand going forward.

METHODS

STUDY DESIGN

Data for 2018-19 were collected from four provincial and four community (district) hospitals in Thailand which had been recognized by the MOPH as providing "*best practice*" IMC. The study hospitals are located in Nan, Saraburi, Roi-Et, and Trang Provinces. Also, the study compared IMC across the three main public health insurance schemes including the UCS of the NHSO, the Social Security Scheme (SSS), and Civil Servants Medical Benefit Scheme (CSMBS). The study included data for all patients who needed IMC under at least one of the 19 groups of diseases/conditions in the RIC [(7)]. The analysis compared patient referral patterns for IMC to explore the norms of services provided in the first phase of implementation of the IMC policy at that point in time.

INCLUSION AND EXCLUSION CRITERIA

The data for analysis included both inpatients and outpatients, males and females, and all age groups who received IMC. Cases were included if their disease/condition corresponded to one or more of the 19 RIC. Patients who needed continuing care for more than six months were excluded from this study as they would be categorized as being in the "long-term care" group. The time window for inclusion of cases was April 1,

2018 to March 31, 2019. Only new cases of IMC who were treated during this time window were included in the analysis.

DATA COLLECTION

Data included basic demographic information of the patient, type of admittance, type of discharge, length of stay, and other related variables. Patients whose disease/condition fit into the International Classification of Disease (version 10) codes and included in the RIC group were employed. Patient data was tracked for six months, or from October 1, 2018 to September 30, 2019, to review the patterns of IMC received. Patterns were analyzed by whether the patient was referred to/from provincial or community hospitals.

DATA ANALYSIS

The frequency of the number of patients in several potential explanatory variables was explored and presented as figures to show the situation of IMC utilization in the selected areas. Descriptive statistics included percentages, median, and interquartile range (IQR). Inferential statistics included Wilcoxon rank-sum and Kruskal-Wallis test to explain the relationship between variables, and to test for significant differences between selected variables such as gender, health insurance scheme, and setting of the IMC patient. The statistical significance level employed in this study was $p < .01$. The data were analyzed by the Microsoft Excel software and STATA version 14.2.

ETHICAL CONSIDERATIONS

The study protocol was approved by the Institute for the Development of Human Research Protection (IHRP) as COA No. IHRP2020061.

RESULTS

DEMOGRAPHIC CHARACTERISTICS

There were complete data for 14,420 patients which included 7,722 (53.6%) males and 6,698 (46.4%) females. Wilcoxon rank-sum test indicated that the age of male patients (*Mdn*=60.0 years) was statistically-significantly younger than females *(Mdn*=62.6, *Z*=-8.41, *p*<.01). Province # 3 recorded the highest number of IMC patients (37.8%) among the four study provinces. Kruskal-Wallis test indicated that the age of the IMC patients differed significantly across the different health insurance schemes *(H*(3)=378.62, *p*<.01). Also, the age of IMC patients differed significantly across hospitals *(H*(7)=72.87, *p*<.01) (see Table1).

Table1: Patient Characteristics and Statistical Tests with Patient Age

Characteristic	*n* (Percentage)	Median (IQR) Age	Test (Age)	p-value
Gender	14,420 (100.0)	61 (26)		
Male	7,722 (53.6)	60 (27)		
Female	6,698 (46.4)	63 (25)	-8.41[a]	0.00*
Health Insurance Scheme	14,420 (100.0)	61 (26)		
UCS	10,767 (79.9)	62 (25)		
SSS	1,839 (13.6)	61 (26)		
CSMBS	705 (5.2)	68 (21)		
Others	1,109 (1.2)	51 (22)	378.62[b]	0.00*
Hospital-Area	14,420 (100.0)	61 (26)		
PH Province #1	2,868 (19.9)	62 (27)		
PH Province #2	2,694 (18.7)	60 (31)		
PH Province #3	4,678 (32.4)	61 (25)		
PH Province #4	2,483 (17.2)	63 (22)		
CH Province #1	152 (1.0)	66 (27.5)		
CH Province #2	277 (1.9)	62 (25)		
CH Province #3	770 (5.3)	60 (36)	72.87[b]	0.00*

Characteristic	*n* (Percentage)	Median (IQR)	Age	Test (Age)	p-value
CH Province #4	498 (3.4)	58 (49)			

Notes: [a]Wilcoxon rank-sum;
[b]Kruskal-Wallis test; *Sig p<.01;
UCS=Universal Coverage Scheme; SSS=Social Security Scheme; CSMBS=Civil Servant Medical Benefit Scheme
PH=Provincial Hospital; CH=Community Hospital

Table 2: Patients Characteristics by Rehabilitation Impairment Categories (RIC).

RIC	N=14,420 (100.0)	% male	% UCS	Median age (IQR)	*Z*-test	p-value
61 Stroke	984 (6.8)	51.4	82.3	66 (19)		
62 Traumatic brain	462 (3.2)	63.2	56.7	46 (42)		
63 Non-traumatic brain	320 (2.2)	59.7	84.0	48 (38)		
64 Traumatic spinal cord	6 (0.0+)	83.3	75.0	58 (18)		
65 Non-traumatic spinal cord	408 (2.8)	35.8	73.0	61 (12)		
66 Neurological condition	99 (0.7)	59.6	86.2	47 (31)		
67 Lower extremity fracture	161 (1.1)	41.0	78.0	74 (21)		
68 Hip and knee replacement	176 (1.2)	62.5	80.9	51 (31)		
69 Other orthopedic conditions	298 (2.1)	57.4	64.0	51 (31)		
70 Amputation of limb	226 (1.6)	54.0	79.7	57 (20)		
71 Osteoarthritis	331 (2.3)	34.4	73.8	62 (18)		
72 Cardiac Disorders	1,389 (9.6)	58.3	78.9	66 (20)		
73 Pulmonary Disorders	921 (6.4)	63.7	87.4	68 (25)		
74 Pain Syndrome	186 (1.3)	45.2	71.6	52 (25)		
75 Other major multiple trauma (MMT)	75 (0.5)	76.0	64.2	43 (33)		
78 Miscellaneous*	8,342 (57.8)	52.5	81.1	61 (28)		
79 Burns	36 (0.2)	55.6	90.9	8 (52)		
					851.07[b]	0.00*

Noes: *Sig p<.01; [b]Kruskal-Wallis test

Table 2 presents patient characteristics by each RIC. If excluding the rather large group "*miscellaneous*," cardiac disorder had the most patients, and traumatic spinal cord had the least. The Kruskal-Wallis test indicates that the age of the IMC patients was significantly different among RIC groups ($H(16) = 851.07$, $p < .01$). Also, when focusing on gender, there were more male patients than female for 15 out of 19 groups of diseases/conditions; the four exceptions are non-traumatic spinal cord, lower extremity fracture, osteoarthritis, and pain syndrome. Most of the patients were covered for health insurance under the UCS.

REFERRAL PATTERNS OF IMC IN THAILAND

This study found that the most common referral pattern of IMC was discharge from the provincial hospital to the community hospital for on-going care (Figures 1 and 2). When comparing by health insurance scheme, referral within the same provincial hospital (i.e., across wards) was most common for patients covered under the UCS than other schemes (Figure 1). Referral within a community hospital or to the provincial hospital was most common among CSMBS patients. Referral from the provincial hospital to a community hospital was the most common pattern for patients covered under the SSS (i.e., step-down).

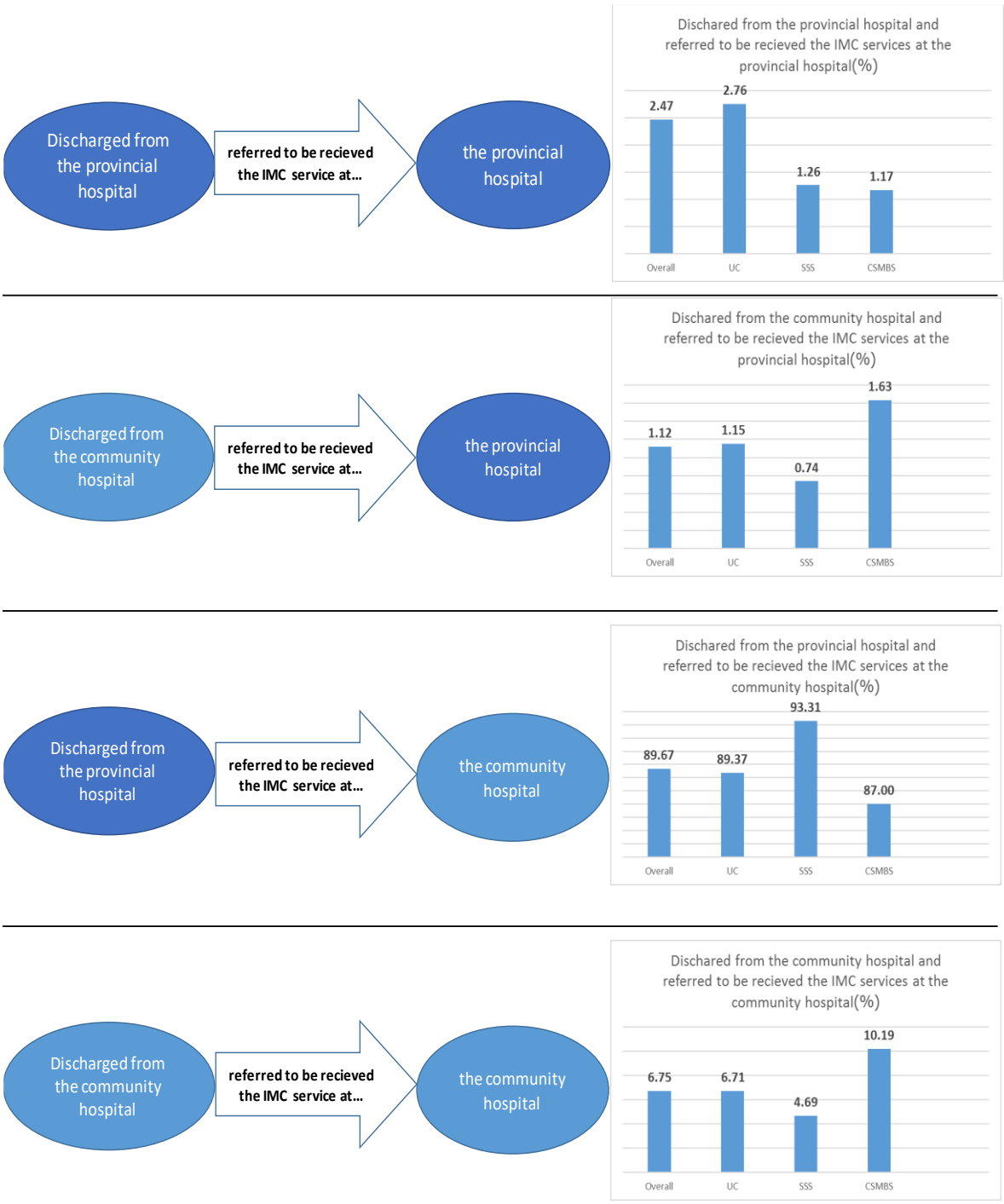

Figure1: IMC Referral Pattern by Three Main Government Health Insurance Schemes

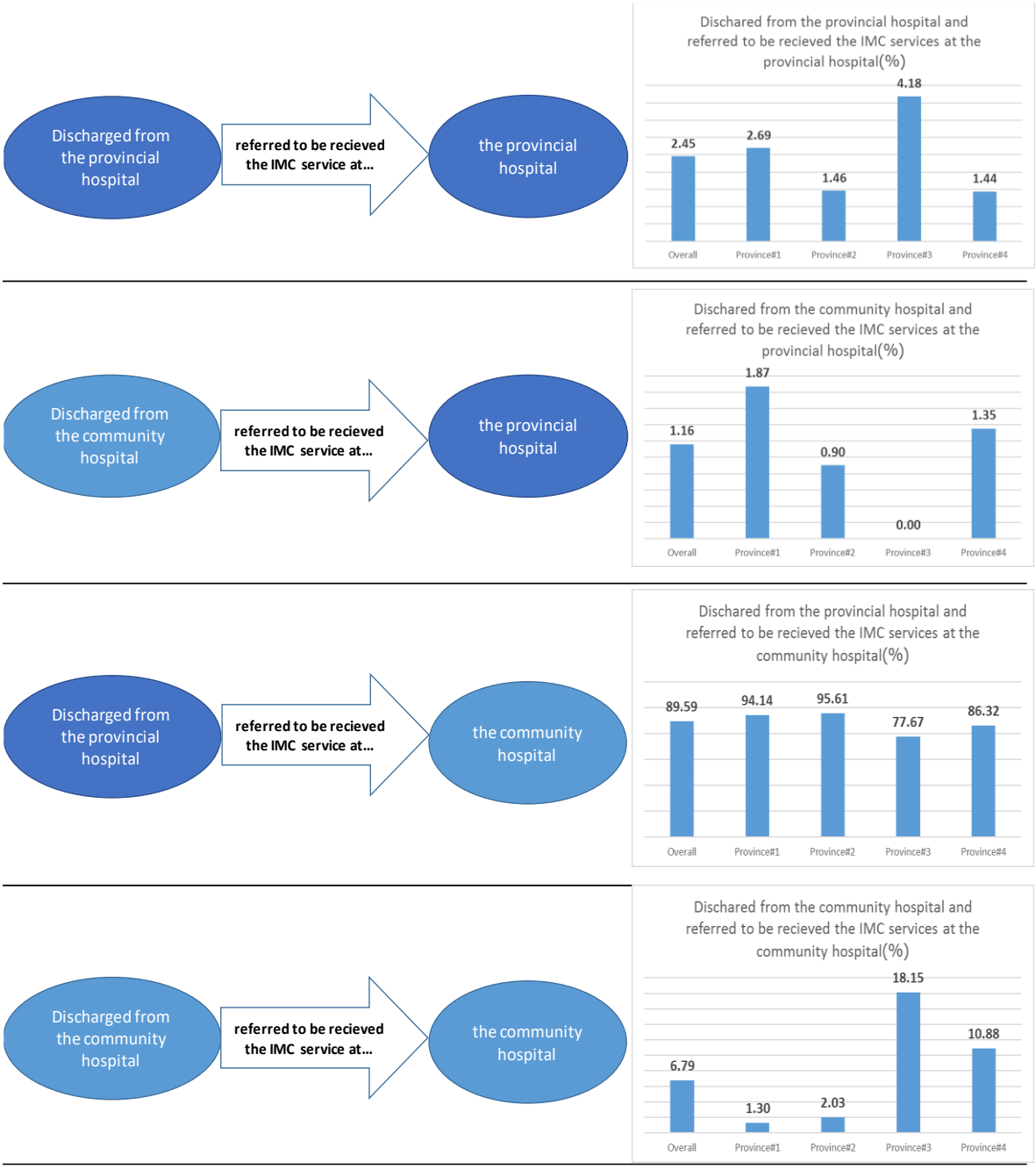

Figure 2: IMC Referral Pattern by 'Best-practice' Hospitals in Four Provinces

When considering the context of each site, Province # 1 had more engagement with IMC services at the provincial hospital level. Provinces # 2 and # 3 tended to provide the IMC services at the community hospital level. In Province # 4, IMC was more loosely integrated with the services in the hospitals. When focusing on the areal perspective (Figure2), referral from the provincial hospital to the community hospital was the most frequent pattern. This pattern accounts for nearly all IMC referrals in Province # 2. By contrast, intra-hospital referral was the most common pattern in Province # 3. IMC referral from the community hospital to the provincial hospital was most common in Province # 1.

DISCUSSION

IMC policy in Thailand is constantly evolving. Accordingly, this study focused only on a specific time period to analyze referral patterns for IMC: 2018-19. This study was also part of the program to develop standards for IMC costing and reimbursement in Thailand.

What we learned from the referral patterns of IMC in Thailand

The study shows that there is a mixture of IMC referral patterns. This study found that IMC referral from the community hospital to the provincial hospital was most common for patients covered under the CSMBS. The median age of the CSMBS patients was highest among the insurance schemes, while the interquartile range was narrow. This finding implies that the CSMBS patients who needed IMC were mostly elderly. The health providers in the community hospitals in this study tended to refer the elderly patients to a higher level of care, perhaps to prevent prolonged hospital admission or hospital readmission at the district level [8-10]. Referral from the provincial to the community hospital was the most common pattern for SSS patients. That finding is consistent with national IMC policy in Thailand that encourages the community hospital to create an IMC ward and, thus, to decentralize care for these patients from the provincial or regional levels [11]. However, in terms of area-based findings, the level of IMC services depended on the capacity of each site. We found that hospitals in Province # 3 seem to be self-sufficient, and there were very few cases of referral from a community hospital to a provincial hospital. That finding is consistent with national IMC policy to reduce the burden on non-essential bed occupancy at the provincial hospital [7]. The relative lack of up- or down-referral in the other provinces implies that those hospitals will have greater rates of readmission after discharge. A costing study would be helpful to compare IMC service outcomes at the different levels of care, as suggested by the Guidelines on Admission and Discharge for Adult IMC Units [12]. In sum, the differential capacity of the province to manage IMC services in the area affects the pattern of referral.

Expanding the target groups for IMC

At the time of this study, IMC policy in Thailand focused on three disease groups. However, this study found that patients who needed IMC (based upon RIC) include a larger number of diseases and conditions, such as cardiac and pulmonary disorders. This means that there might be some groups of patients who needed IMC but could not be served as per national IMC policy and the government health insurance schemes (Table 2). Thus, there is clearly an opportunity to expand the health benefits package, as proposed by the World Health Organization to more adequately cover those in genuine need of IMC [13].

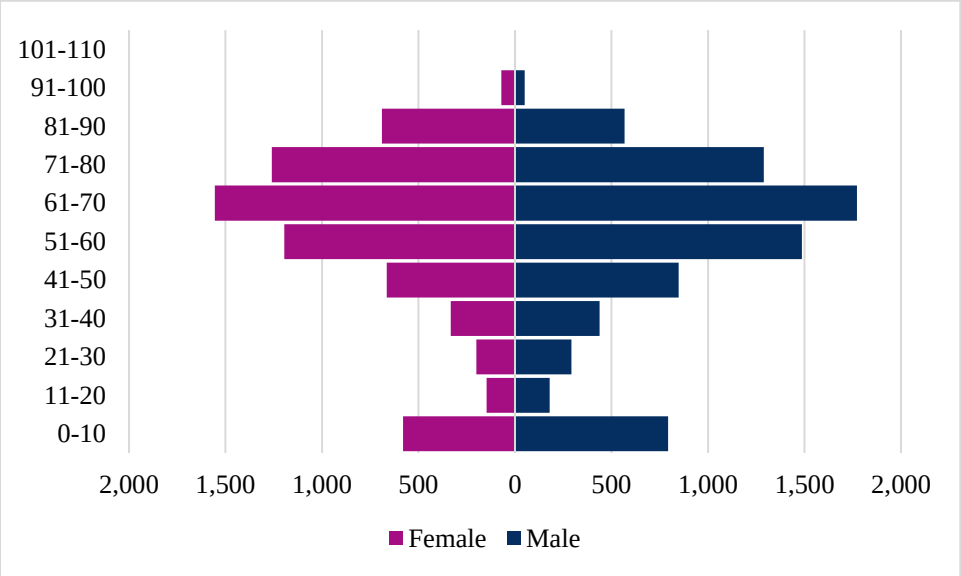

Figure 3: Population Pyramid of IMC Caseload by Gender and Age Groups

In Thailand, females have a higher life expectancy than their male counterparts, and this study found that the number of male IMC patients was higher than females . In addition, even though most of the patients were elderly, there were a significant number of IMC patients in the older cohorts of the working-age population)Figure 3(. Among the elderly)i.e., age 60+ years(, the highest number of IMC patients were age 61-70 years. Thus, people in this age group should be encouraged to practice more active and healthy aging to reduce the burden of preventable geriatric disease and debilitating conditions .It is noteworthy that this

study documented over 500 cases of IMC patients age 0-10 years. Thus, the youngest members of the population should not be ignored by the IMC policy makers.

STRENGTHS AND LIMITATIONS

Other studies have examined patterns of IMC such as those conducted in the US [14, 15]. The present study is pioneering since it is among the first to examine patterns of IMC referral in Thailand, which is still in the early stages of implementing IMC policy. However, this study was limited to "*best-practice*" hospitals at the provincial and community (i.e., district) levels and, thus, the findings are not necessarily representative of the majority of hospitals in the country. In addition, the selected provinces and districts were predominately rural. Thus, this type of study should be repeated on a larger scale and after the national IMC policy and cost-reimbursement system is more widely implemented. The factors affecting the utilization of IMC services in different health insurance schemes should be further studied. Also, the IMC referral patterns should be studied in the more urbanized areas since there may be important environmental factors involved. Finally, the location of the IMC referral patterns should be investigated by referral network, e.g., by the number of community hospitals connected with one provincial hospital, and the multiple levels of IMC providers.

CONCLUSIONS

This study investigated four selected locations which have been recognized as "*best-practice*" facilities for IMC. However, the selected sites were also predominately rural areas. This study found a variety of IMC referral patterns are being implemented, and these patterns differed by capacity of the area and the health insurance coverage of the patient. Discharge from the provincial hospital to receive on-going IMC at the community hospital was the most common referral pattern, and that pattern was most common for SSS patients compared to patients covered by the other health insurance schemes.

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COMPILATION, EXPLANATION, AND RESTORATION OF MOH PHON'S HERBAL PRESCRIPTIONS FOR THE SKIN CONDITIONS CAUSED BY VIRAL, BACTERIAL, AND FUNGAL INFECTIONS

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ABSTRACT

The Traditional Thai Medicine (TTM) prescription of Moh Phon was developed and recorded by Abhakara Kiartivongse or Moh Phon in 1915. This study aimed to elucidate traditional Thai medical wisdom regarding Moh Phon's prescriptions, especially the skin conditions caused by viral, bacterial, and fungal infections. The crude herbal drugs in Moh Phon's Traditional Thai skin recipes are prepared and certified by their vernacular and scientific names. A scientific review and establishment of descriptions of plant species, ethnomedical uses, pharmacological and toxicological activities, and active ingredients were systematically reviewed. The prevalence of plant species used in the formulary was analyzed. Forty-four remedies for 15 skin conditions or diseases caused by viral, bacterial, and fungal infections were found. It was found that medicines were prepared using various parts of the plants, including leaf, root, fruit, bulb, rhizome, milk, gum, peel, and stem. There were 15 methods of medicine preparation, including decoction, crush, pound, burn, rasp, crumble, squeeze, smash, chew, digestion, cut, grind, mix, fried, and broken. All medicines were externally used, including rub, apply, mask, shower, and paste. A total of 35 species were identified and divided into 28 dicots and 7 monocots. The most common families are Leguminosae (8.6%) and Solanaceae (8.6%). Commonly used plant species for skin disorders are *Cocos nucifera* L. (7.1%), followed by *Allium sativum* L. (4.8%), *Citrus aurantifolia* Swing. (4.8%), and *Curcuma longa* L. (4.8%). This study provides the first report on scientific information, and traditional medicinal plant use, including parts used, methods of preparation, pharmacological and toxicological activities, and active ingredients in Moh Phon's prescriptions. This data supports the conservation of traditional knowledge and will facilitate future modern herbal drug development research.

Keywords: *Moh Phon, Traditional Thai medicine, Skin condition, Medicinal plant*

INTRODUCTION

Thousands of years ago, plants became medicines for curing diseases and maintaining health. Since ancient times, people have considered plant medicines' methods and advantages for health care. A long time ago, due to early people's observation and use of plants encountered in life as energy, clothing, housing, and food, humans gradually realized the specific functions of plants. Evidence shows that the phenomenon of plant cultivation as a drug appeared 60,000 years ago. In countries such as China, Greece, Egypt, and India, medicinal plants have become one of the oldest medical sciences. In ancient Persia, plants were often used as medicines, disinfectants, and fragrances [(1)].

Ancient Thai medicine and medical treatment originated from the unique experience of residents in various regions in prehistoric times. It has a deep animism tradition. Before spreading to the Thai, the Mon and Khmer people who occupied the area had animism. The knowledge of Thai medicine and animism, Indian medicine and Khmer experience (knowledge and experience before arriving in Ayurveda), Buddhist medical theories of the Mon people, and China following the spread of Tai Chi people (mainly from southern China), Medical theory (time before the current Traditional Chinese Medicine) [(2, 3)]. At the beginning of the 1900s, people thought traditional medicine was "understood as useless medicine," and Western medicine was trendy. However, in the mid-1990s, the Thai government slowly began to re-promote traditional medicine. The Seventh National Economic and Social Plan from 1992 to 1996 stated: "To improve human health, it is time to search Thai medicine, herbal medicine, and traditional massage, and integrate them into the modern medical and health system." In 1993, the Thai government established the National Institute of Traditional Medicine in Thailand under the Ministry of Public Health management. The institute aims to "systematize and standardize traditional Thai medical knowledge," "collect knowledge, correct, test, classify and label traditional Thai medical knowledge," and "compare and explain the philosophy and basic theories" of Traditional Thai medicine and make textbooks on traditional Thai medicine" [(4)].

The Traditional Thai Medicine (TTM) prescription of Moh Phon was developed and recorded by Abhakara Kiartivongse or Moh Phon in 1915. Moh Phon's traditional Thai medicine formularies were developed and handwritten by the Prince of Chumphon in 1915 and named "The Scriptures Interstellar Paragraph Ancient karma and present karma." Initially, the ancient document was recorded on Thai-style paper made from bark fibers of such plants as Siamese rough bush (Khoi). This Thai textbook is 14 inches long, 5 inches wide, and 2.5 inches thick. It contains 12 formularies for treating various diseases or symptoms such as skin conditions, heart diseases, cancer, diabetes, tuberculosis, fever, respiratory diseases, gastrointestinal diseases, etc. Skin is the largest organ in the human body and is 1.5 to 2.3 square meters. In considering a 60 kg body, the skin is about 3 kg, compared to the liver at 1.5 kg, which is about 2.5% of body weight, whereas skin is 4–6% of the body weight. The epidermis is related to the nerve system form to show the problems of the body nervous internet diseases. The dermis is connected tissue related to different organs such as kidneys, liver, heart, and blood vessels. The skin's subcutaneous tissue is about 10 kg, about 16–17% of the body weight. According to these facts, maintaining healthy skin is vital for a healthy body.

People from not only in Thailand, but in Asia, countries like China [(5)], Korea and Japan [(6, 7)], in Europe, such as Germany [(8)], and the United Kingdom [(9)], and in the Americas [(10)], Oceania [(11)], Africa [(12)], have benefitted from the use of traditional medicine for skin disorders. According to Moh Phon formularies for skin diseases, among the sixty-six species identified, anti-microbial activities were the most common characteristics among the result of the survey from all the frequent families and plant species. In this way, the study of skin diseases related to microbial factors, such as viral, fungal, and bacterial, could be key to focus in the study of the plants among the formularies. Viral infections cannot be cured with antibiotics. Trying to cause the immune system to clear the virus is a common treatment. Therefore, the anti-inflammatory and immune-enhancing effects of herbal medicines in traditional medicine should be of great research value. It is rational to treat bacterial infections with antibiotics. Misuse of antibiotics results in increased bacterial resistance to medication, and the task of using herbal medicines or developing new synthetic drugs from herbal medicines has become urgent and vital. Concerning fungal infections, very few drugs kill fungi and are harmless to human cells, and antifungal herbal or synthetic drugs also have research value [(13)].

According to the idea of search more scientific information, the aim of this study was to document the traditional uses of medicinal plants for treatments of skin disorders or symptoms caused by viruses, bacteria, and fungi in Moh Phon Thai Traditional Formulary, to evaluate the efficacy of the medicinal plant species based on reviews of pharmacology and biological activities, toxicities, to find out the most frequent botanical family and frequent plant species used in remedies for skin diseases and disorders are found in Moh Phon formulary book.

OBJECTIVE

This study aimed to elucidate traditional Thai medical wisdom regarding Moh Phon prescriptions, especially the skin conditions caused by viral, bacterial, and fungal infections.

METHODS

The crude herbal drugs in Moh Phon's Traditional Thai skin recipes are reorganized and certified by their vernacular and scientific names. A scientific review and establishment of descriptions of plant species, ethnomedical uses, pharmacological and toxicological activities, and active ingredients. The prevalence of plant species used in the formulary was analyzed. The source of Moh Phon's traditional Thai medicine formularies used was Moh Phon's traditional Thai medicine formulary second edition, published by Thai Quality Books Company Limited. The remedies for skin symptoms and diseases were investigated. All crude drugs in each remedy were listed by their vernacular name and specified with the scientific name. Worldwide ethnomedical uses of each medicinal plant were searched through databases, such as Google Scholar, PubMed, Science Direct, and Medline. Other publications, namely books, were also investigated. The verifications of the scientific name were performed by expert consultations, herbalists, and plant taxonomists. The efficacy of each medicinal plant species was analyzed based on literature reviews in correlation with biological and pharmacological activities. Frequent plant species were analyzed based on their pharmacology, toxicities, and biological activities to their uses in the formularies related to skin diseases caused by viruses, bacteria, and fungi.

Data and scientific results from the investigation of all herbal plant drugs for skin conditions in Moh Phon traditional Thai formularies were analyzed according to: Fifteen symptoms or diseases in Moh Phon traditional Thai medicine formulary for skin diseases caused by viruses, bacteria, and fungi and the causes.

The data analysis of medicinal plants used for skin conditions in Moh Phon formularies for skin conditions is demonstrated below:

The frequent families were recorded and calculated from the number of times the family was cited (see Table 2) / total species (35) *100

The species frequencies were recorded and were calculated from the number of citations of a species / total number of citations of species *100, e.g., *Cocos nucifera* L., (see Table 4), is (3/42) *100

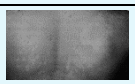
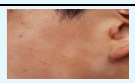
Fifteen symptoms or diseases in Moh Phon traditional Thai medicine formulary for skin diseases caused by viruses, bacteria, and fungi and the plants used with scientific name, families, parts used preparation methods, and application methods.

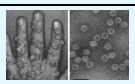
RESULTS

As shown in Table 1, forty-four remedies for 15 skin conditions or diseases caused by viral, bacterial, and fungal infections were found.

Table 1: Fifteen symptoms or diseases in Moh Phon traditional Thai medicine formulary for skin diseases caused by viruses, bacteria, and fungi

NO.	Disease/condition	Cause	Symptom with picture(s)
1	Herpes simplex	Herpes simplex virus type 1 and herpes simplex virus type 2 (HSV-1 and HSV-2) (14)	 (14) Having a cold sore or fever blister
	Herpes zoster (shingles)	Varicella zoster virus (VZV) (15). which also causes chickenpox	  (15) Having cold sores and genital herpes.

NO.	Disease/condition	Cause	Symptom with picture(s)
	Eczema (Eczema herpeticum)	Herpes simplex virus type 1 or "oral herpes" (16)	 (17) An inflammatory skin condition causes itchiness, dry skin, rashes, scaly patches, blisters, and skin infections. Itchy skin is the most common symptom of eczema.
2	Erysipelas (St. Anthony's fire)	Bacteria called beta-hemolytic streptococcal (18)	 (19) Erysipelas predominantly affects the skin of the lower limbs, but when it involves the face, it can have a characteristic butterfly distribution on the cheeks and across the bridge of the nose.
3	Medicines for the treatment of disease rashes	Bacteria, irritation, etc.	With rosacea, the skin might feel rough, bumpy, or warm to the touch.
4	Ringworm (dermatophytosis, dermatophyte infection, or tinea)	Fungal infection of the skin, e.g., *Microsporum canis*, Trichophyton rubrum (20)	 (21) Ring-shaped rash that is itchy, scaly, and slightly raised
	Tinea versicolor	Fungal infection of the skin, e.g., *Pityrosporum orbiculare* (22)	 (23) The fungus interferes with the normal pigmentation of the skin, resulting in small, discolored patches.
5	Tinea versicolor	Fungal infection of the skin	
6	Pityriasis alba	Had atopic dermatitis before (young age, dark skin, overexposure to sunlight, microbiologic factors (*Staphylococcus aureus*, *Propionibacterium acnes*) and parasitic factors (Ascaris) as potential pathogenic elements, etc.(24) or severe food allergies	 (25) The most common sign of pityriasis alba is the skin patches that show up on your face, neck, arms, shoulders, or belly.
7	Ringworm	Fungal infection of the skin. tinea pedis, (athlete's foot); tinea cruris, (jock itch); tinea capitis (ringworm).	 (21) Tinea pedis, (athlete's foot): An itchy, stinging, burning rash on the skin on one or both of your feet. Tinea cruris, (jock itch): Jock itch usually begins with a reddened area of skin in the crease in the groin. It often spreads to the upper thigh in a half-moon shape. The rash may be ring-shaped and bordered with a line of small blisters. Tinea capitis (ringworm): Ring-shaped rash that is itchy, scaly, and slightly raised.

NO.	Disease/condition	Cause	Symptom with picture(s)
8	Impetigo	Fungal infection, warm, humid climate, diabetes, undergoing dialysis, HIV, sunburn or other burns, itchy infections such as lice, scabies, herpes simplex, or chickenpox, insect bites or poison ivy, play contact sports	 (26) Impetigo starts as a red, itchy sore. As it heals, a crusty, yellow, or "honey-colored" scab forms over the sore.
	Ringworm	Fungal infection of the skin. tinea pedis, (athlete's foot); tinea cruris, (jock itch); tinea capitis (ringworm).	 (21)
9	Abscess/purulent	Most abscesses are caused by a bacterial infection. When bacteria enter your body, your immune system sends infection-fighting white blood cells to the affected area. As the white blood cells attack the bacteria, some nearby tissue dies, creating a hole that fills with pus to form an abscess.	 (27) Impetigo starts as a red, itchy sore. As it heals, a crusty, yellow, or "honey-colored" scab forms over the sore.
10	Warts	Human papilloma virus	 (28) The infection causes rough, skin-colored bumps to form on the skin.
11	Vaginal Itching	Irritating substances, infections, menopause, sexually transmitted diseases (STDs), stress or vulvar cancer	Vaginal Itching with irritating.
12	Tinea Cruris (jock itch)	Fungal infection: Trichophyton, Epidermophyton, (29)	 (30) Jock itch usually begins with a reddened area of skin in the crease in the groin. It often spreads to the upper thigh in a half-moon shape. The rash may be ring-shaped and bordered with a line of small blisters.
13	Tetanus (lockjaw)	Infection caused by *Clostridium tetani*	 (31) Tetanus (Lockjaw) is a severe bacterial infection that damages muscles, nerves, and respiratory function.
14	Rotting toe	An injury or a microorganism, the way your toenails naturally grow Bacterial coagulase-negative *staphylococcal*, and *Corynebacterium* species. Fungal *Acremonium* species (32) and Candida spp. (33).	Pain, pressure, redness or change in skin color, swelling, oozing, a bad smell, or feeling hot to touch.

NO.	Disease/condition	Cause	Symptom with picture(s)
15	Athlete's foot (belong to the group of Rotting toe)	Fungal infection, Trichophyton, Epidermophyton, and Microsporum (34)	 (35) Pain, pressure, redness or change in skin color, swelling, oozing, a bad smell, or feeling hot to touch.

As shown in Table 2, it was found that medicines were prepared using various parts of the plants, including leaf, root, fruit, bulb, rhizome, milk, gum, peel, and stem. There were 15 methods of preparing the medicines, including decoction, crush, pound, burn, rasp, crumble, squeeze, smash, chew, digestion, cut, grind, mix, fried, and broken. All medicines were externally used, including poultice (mask, cover, apply), shower, eat, drink, and rub. A total of 35 species were identified, divided into 28 dicots and 7 monocots, in 44 remedies for skin diseases in Moh Phon traditional Thai medicine formulary.

Table 2: Fifteen symptoms or diseases in Moh Phon's traditional Thai medicine formulary for skin diseases caused by viruses, bacteria, and fungi and the plants used with scientific name, families, parts used, preparation methods, and application methods)pm./am.(

Symptom	Plant Scientific name	Plant Family	Plant Part use	pm./am.
Herpes simplex-Herpes zoster (Shingles)-eczema)	Lagenaria siceraria (Molina) Standl.	Cucurbitaceae	Leaf	1. pound/mask 2. burn/grind/apply 3. rasp/ apply 4. broken/cut /apply 5. crush/rub
	Cocos nucifera L.	Arecaceae	Shell	
	Gonostegia pentandra (Roxb.) Miq.	Urticaceae		
	Heliotropium indicum L.	Boraginaceae		
	Clinacanthus nutans (Burm.f.) Lindau	Acanthaceae	Leaf	
	Cyathula prostrata (L.) Blume	Amaranthaceae	Top/tip	
	Azima sarmentosa (Blume) Benth. & Hook. f.	Salvadoraceae	Root	
Erysipelas, St. Anthony's fire	Ipomoea aquatia Forsk	Convolvulaceae	Leaf	1. pound/apply
Medicines for the treatment of disease rashes	Centella asiatica (L.) Urban	Apiaceae/ Umbelliferae	Aerial part	1. decoction/apply
	Acacia concinna (Willd.) DC.	leguminosae	Leaf	
Ringworm, Tinea versicolor	Mimusops elengi Linn.	Sapotaceae	Fresh leaf	grind/apply decoction/apply apply mix/apply smash/apply
	Areca catechu L.	Arecaceae	Fresh fruit	
	Camellia sinensis (L.) kuntze	Theaceae	Leaf	
	Allium sativum L.	Alliaceae	Bulb	
	Cymbopogon citratus (DC) Stapf.	Gramineae	Stem	
	Citrus aurantifolia Swing.	Rutaceae	Fruit (Juice)	
	Solanum melongena Linn.	Solanaceae	Fresh fruit	
Pityriasis versicolor or Tinea versicolor	Indigofera tinctoria L.	leguminosae	Indigo (color)	mix/apply
Pityriasis alba	Ocimum africanum Lour	Lamiaceae/ Labiatae	Leaf	1. crush/apply
Ringworm	Rhinacanthus nasutus (Linn.) Kurz.	Acanthaceae	Leaf	mix/apply chew/apply
	Cassia alata (L.) Roxb.	Leguminosae	Leaf	
	Allium sativum L.	Alliaceae	Bulb	
	Curcuma longa L.	Zingiberaceae	Rhizome	
Impetigo-Ringworm	Curcuma longa L.	Zingiberaceae	Rhizome (Powder)	mix/apply
	Cocos nucifera L.	Palmae	Coconut milk	

Symptom	Plant Scientific name	Plant Family	Plant Part use	pm./am.
	Garcinia hanburyi Hook F.	Clusiaceae	Gum	
Abscess/purulent	Allium ascalanicum L.	Alliaceae	Bulb	pound/mask
	Averrhoa bilimbi L.	Oxalidaceae	Fruit	
Warts	Sesamum indicum L.	Pedaliaceae	Fresh leaf	crumble/mask
	Ocimum tenuiflorum L.	Labiatae	Stem	crush/apply
	Euphorbia tirucalli L.	Euphorbiaceae	Gum/latex	paste
	Colocasia esculenta (L.) Schott	Araceae	Gum/latex	
Vaginal itching	*Mallotus nudiflora* (L.) Kulju & Welzen	Euphorbiaceae	Leaf	digestion/pound/shower/ apply
Tinea Cruris	Datura metel L.	Solanaceae	Fruit	crush/apply
	Cocos nucifera L.	Palmae	Coconut milk	
	Nicotiana tabacum L.	Solanaceae	Leaf	
	Shorea saimensis Miq.	Dipterocarpaceae	Leaf	
Tetanus				cover
Rotting toe	Garcinia mangostana L.	Clusiaceae	Peel	rasp/ apply
Athlete's foot	Citrus aurantifolia Swing.	Rutaceae	Fresh fruit (Juice)	squeeze/apply mix/apply
	Diospyros mollis Griff.	Ebenaceae	Fruit	
	Spondias pinnata)L.f.(Kurz	Anacardiaceae	Fruit (Peel off)	

The most common families are Leguminosae (8.6%) and Solanaceae (8.6%). Commonly used plant species for skin disorders are *Cocos nucifera* L. (7.1%), followed by *Allium sativum* L. (4.8%), *Citrus aurantifolia* Swing. (4.8%), and *Curcuma longa* L. (4.8%). Pharmacology and biological activities of plant species reviews of pharmacological and biological activities of these plant species related to skin diseases, including antibacterial, antifungal, anti-inflammatory, antioxidant, antipyretic, antiviral, and wound healing activity. The review of pharmacology and biological activities of the frequent plant species in reported studies is shown in Table 3. The review of toxicities of the frequent plant species in reported studies is shown in Table 4.

Table 3: Pharmacology and biological activities of frequent plant species in Moh Phon traditional Thai medicine formularies for skin diseases caused by viruses, bacteria, and fungi

Scientific name	Pharmacological and biological activity	Active constituent
Cocos nucifera L.	Anthelmintic Anti-bacterial Anti-inflammatory Anti-hyperglycemic Anti-malarial Anti-oxidant Anti-trichomoniasis Hepatoprotective Renal protective Anti-hypertensive Vasorelaxant Antinociceptive Antipyretic Analgesic, and antipyretic Anti-neoplastic Amenorrhea and dysmenorrhea (36–41)	Lupeol-methyl ether Skimmiwallin Isoskimmiwallin Catechin Flavonoid Saponin a-tocopherol Tannins L-arginine (37)
Citrus aurantifolia Swing.	Antimicrobial, Spasmolytic, Neuroprotective	Monoterpene, hydrocarbons, Sesquiterpene, hydrocarbons, Oxygenated monoterpenes,

	Neuromodulating Antinociceptive Antioxidant Chemopreventive Skin Sensitizing Activity Hypolipidemic (42, 43)	Oxygenated sesquiterpenes, Monoterpene aldehydes, Monoterpene alcohols, Monoterpene ketones, Monoterpene esters, Sesquiterpene alcohols, Aliphatic aldehydes (42)
Allium sativum L.	Lipid-lowering effects (44), Anti-adipogenic (45), Anti-immature (46), Anti-biofilm and Antibacterial (47), Anti-Angiogenesis, Antithrombotic (48), Anti-Proliferation (49), Antiseptic, derivant, vermifuge (50).	S-allyl-L-cysteine sulfoxide (alliin) Eugenol di-glycosides β-carboline alkaloids (31), Diallyl sulphide Allicin Allisatin (36)
Curcuma longa L.	Anti-inflammation, Antioxidants, Immunoprotection, Antitumor, Antiviral, Antibacterial, Insecticidal, Antifungal Antimicrobial, Anti-Inflammatory, Wound Healing, (51-53)	Anthocyanins, Phenols, Tannins Turmerosaccharides Curcuminoids: demethoxycurcumin Bisdemethoxy Curcumin Turmerol, Urmerone, Curcumone (50, 54-56)

Table 4: Toxicity assessment of frequent plant species

Scientific name	Toxicity assessment	Result	Reference
Cocos nucifera L.	1. Brine shrimp lethality assay. 2. MTT assay: Cell viability assay on Hela cells 3. Acute toxicity: Oral administration of Swiss albino mice	1. The LC50 of hydro-alcohol and methanol extract were 432.35 µg/ml and 1173.88 µg/ml, respectively. Non-toxic. 2. IC50 value was found to be 1.77mg/ml. The MTT assay revealed the crude extract toxicity upon HeLa cells 3. The LD50 value of acetone extract was > 5,000 mg/kg, and no mortality in animals.	1. (57) 2. (58) 3. (59)
Citrus aurantifolia Swing.	1. Brine shrimp lethality assay 2. MTT assay: Rhabdomyosarcoma (Rd), laryngeal carcinoma (Hep-2c), and a normal cell line (Vero) 3. Acute toxicity: Oral administration of rat at doses of 10, 100, 1000, 1600, 2900, and 5000 mg/kg.	Stembark (LC50 = 10.0 ± 0.33µg/ml) and C. limon leaf (LC50 = 5.0 ± 0.74 µg/ml) methanolic extracts were observed to be strongly cytotoxic compared to cyclophosphamide (LC50 = 98.76 ± 0.15µg/ml), while the other extracts were either non, weakly, or moderately toxic in BSL assay. The methanolic extract of seed, stem bark, leaf, and juice showed Citrus aurantifolia leaf extract (CC50 = 4.02 ± 2.85µg/ml, CC50 = 5.45 ± 2.8µg/ml) retained comparable cytotoxicity to cyclophosphamide (CC50 = 2.23 ± 0.14µg/ml, CC50 = 2.66 ± 0.8µg/ml) on Rd and Hep-2c human cancer cell lines, respectively. The other extracts	1. 2. (60) 3. (61)

Scientific name	Toxicity assessment	Result	Reference
		exhibited varying degrees of cytotoxicity. The methanolic extract showed no sign of toxicity and mortality at all concentrations.	
Allium sativum L.	1. MTT assay: U-937 (human leukemic monocyte lymphoma cell line), Clone E6-1 (human acute T cell leukemia cell line), and K-562 (human chronic myelogenous leukemia cell line). 2. Acute toxicity: Oral administration of Wistar rats.	1. The methanolic extract showed IC50 values of 105 ± 2.21, 489 ± 4.51, and 455 ± 3.13 µg/ml on U-937, Clone E6-1, and K-562 cells, respectively. In this study, the garlic extract showed cytotoxic effects on all the human leukemic cell lines tested. 2. The aqueous extract showed an LD50 value of more than 5,000 mg/kg, practically non-toxic.	1. (62) 2. (63)
Curcuma longa L.	1. Brine shrimp lethality assay (BSLA) 2. Neutral red cytotoxicity assay: Human hepatocellular carcinoma HepG2 cell line. 3. Sub-chronic toxicity: Oral administration of Wistar rats at 250, 500, and 1000 mg/kg doses for 90 days. 4. 90-Day Sub chronic Oral Toxicity Study in Rats	1. Methanol extract, Lc50 valued 62.10 µg/mL, Curcuma longa can be inferred to have a very strong toxic effect 2. Methanolic extract was 196.12 ± 3.98 µg/ml, while the IC50 value of pure curcumin was 41.69 ± 2.87 µg/ml, exerted anticancer potential. 3. NR-INF-02 standardized extract did not show any mortality or clinical signs of toxicity in rats. 4. NR-INF-02 standardized extract no-observed adverse effect level (NOAEL) was found to be 1,000 mg/kg body weight in albino Wistar rats.	1. (64) 2. (65) 3. (55) 4. (55)

DISCUSSION

According to the result, the common families are Leguminosae (8.6%) and Solanaceae (8.6%). Commonly used plant species for skin disorders are *Cocos nucifera* L. (7.1%), followed by *Allium sativum* L. (4.8%), *Citrus aurantifolia* Swing. (4.8%), and *Curcuma longa* L. (4.8%). They are similar to those obtained by some summary studies [50–52] in their studies on plants used to treat skin conditions. According to research in Songkhla province in Thailand, Leguminosae and Solanaceae are the most cited families for treating skin disorders [53]. Studies in frequent plant species, *Cocos nucifera* L. followed by *Citrus aurantifolia* Swingle and *Allium sativum* L. There was more evidence showing the same medicinal use of the species *Cocos nucifera* L. [56-58], *Allium sativum* L. [59, 60], and *Citrus aurantifolia* Swingle [61].

For the use in skin disorders, therapy and the effect were studied and proved. *Curcuma longa* L. has a long history of being used as an effective treatment for skin problems [54, 66]. In addition, 2014 research reconfirmed the result of studying and reviewing the species above [62]. Active constituents indicated that anti-bacterial and antimicrobial were the common specialties among them, and active components should be carried out with further study. Toxicity tests such as Brine shrimp lethality assay, M.T.T. assay, and acute toxicity were studied, and the results were shown and helped to prove the relative safety of herbal medicine usage. Furthermore, anti-microbial activities were the most common characteristics among the result of the survey from all the frequent families and plant species. And this selective study focuses on the causes of viral, bacterial, and fungal infections and reconfirms the result for the front mentioned. The results relatively supported the effect of herbal medicine in Moh Phon formularies for skin conditions and the herbal medicine to help in finding more useful information for skin conditions caused by viral, bacterial, and fungal infections in the future.

CONCLUSION

It was found that 44 remedies for 15 skin conditions or diseases caused by viral, bacterial, and fungal infections were found. In addition, medicines were prepared using various parts of the plants, including leaf, root, fruit, bulb, rhizome, milk, gum, peel, and stem. There were 15 methods of preparing the medicines, including decoction, crush, pound, burn, rasp, crumble, squeeze, smash, chew, digestion, cut, grind, mix, fried, and broken. All medicines were externally used, including rub, apply, mask, shower, and paste. A total of 35 species were identified and divided into 28 dicots and 7 monocots. The most common families are Leguminosae (8.6%) and Solanaceae (8.6%). Commonly used plant species for skin disorders are *Cocos nucifera* L. (7.1%), followed by *Allium sativum* L. (4.8%), *Citrus aurantifolia* Swing. (4.8%), and *Curcuma longa* L. (4.8%). This study provides the first report on scientific information, and traditional medicinal plant use, including parts used, methods of preparation, pharmacological and toxicological activities, and active ingredients in Moh Phon prescriptions. This data supports the conservation of traditional knowledge and will facilitate future modern herbal drug development research and will be advantaged for further studies.

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DETERMINANTS OF LIFE SATISFACTION AMONG OLDER PERSONS IN MYANMAR

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ABSTRACT

Introduction Over past decades, Myanmar has undergone significant demographic change, and the share of the older population (age 60+ years) has increased. Traditionally, families in Myanmar consider it a filial duty to look after older members of the household. However, like many other rapidly-ageing societies, Myanmar is facing the challenge in providing social protections to the increasing number of older people. As people get older, their physical health and functional ability deteriorates and, as a result, their satisfaction with life also declines in most cases. As the older population Myanmar is projected to increase more rapidly in the future, it is crucial to consider factors that contribute to perception of life satisfaction among this venerable cohort.

Objective This study explored the determinants of life satisfaction among older persons in Myanmar.

Methodology This study analysed data from the 2019 cross-sectional Myanmar Intercensal Survey conducted by the Department of Population. The sample consists of 65,065 older persons, i.e., age 60+ years. Respondents were asked to evaluate their life satisfaction using a 5-point scale. The conceptual framework of this study was constructed based on two theories: The Bottom-Up and Top-Down Model, and Need-Gratification Theory. Binary logistic regression was used to examine the relationship between demographic, socio-economic, health-related factors and the level of life satisfaction of older persons in Myanmar.

Results This study found that women (OR=1.05) were more satisfied with their current life than men. The results show that lack of life satisfaction of older persons in Myanmar is associated with difficulty in hearing, seeing, walking, remembering, self-care, or communication (OR = 0.77), and having very poor health status (OR = 0.04), after controlling for other factors. There are also factors that are positively associated with life satisfaction: Older persons who are well-educated and participated regularly in community activities were more likely to be satisfied with their life compared to those who had less education and/or did not participate in community activities. Similarly, those who received a pension or senior citizen allowance/benefits (OR = 1.19) and those who lived in a higher-income household (OR = 1.42) were more likely to be satisfied with their life compared to those who did not receive any allowance and/or lived in a lower-income household.

Conclusions This study suggests that, in addition to socio-economic factors, life satisfaction of older persons is also associated with health-related factors. The results have policy implications in terms of social protection strategies to improve the sense of well-being among older persons in Myanmar.

Keywords: *life satisfaction, health status, household income quintile, older persons, Myanmar.*

INTRODUCTION

The demographic process in which the share of older people increases and the share of children and youth decreases in a closed population is called the "ageing" of the population. In this century, every country and/or region in the world has or will have experience with the ageing of population. This demographic phenomenon is already posing wide-ranging challenges within each society's social, economic, welfare, and health care systems. The ageing of the population has profound implications related to morbidity, disability, health care burden, access to housing, social protections, and income security for senior citizens around the world [(1)]. Therefore, it is crucial to study and understand the needs of older persons, and evaluate what affects their quality of life and well-being.

Life satisfaction is one important dimension of well-being and is central to concerns about successful ageing [(2)]. In this study, life satisfaction centres on an overall assessment of feelings and attitudes about one's life at a particular point in time, ranging from negative to positive. The level of satisfaction among older persons affects not only their psychological adjustment to ageing, but also their perception of their physical and social well-being. Indicators of life satisfaction have been widely used in other studies, and a number of reliable determinants of satisfaction have been identified, including the following: demographic factors [e.g., age [(3)], marital status [(4)]]; socio-economic factors [e.g., education [(5)], community participation [(6)]]; and health-related factors [e.g., functional difficulties [(7)], self-rated health status [(8)]].

This study defined "older person" as someone age 60 years or older. For Myanmar, the projected population of older persons in 2019 was about 5.1 million (or 10.1% of total population). That number is expected to exceed 13 million by 2050 [(9)]. In the near future, Myanmar will begin to experience the effects of an ageing population, driven by the combination of reduced fertility and increased longevity. However, even at this early stage of population ageing, Myanmar is already confronting the challenge of providing adequate social protections to the increasing number of older people. As people get older, their health and functional ability deteriorate and, as a result, their life satisfaction will decline in most cases. The decline in life satisfaction can be expected to intensify with advanced age, and may be exacerbated by a relatively lower level of education and socio-economic status (SES). Thus, it is urgent and imperative to understand the determinants of life satisfaction among older persons in Myanmar today. Accordingly, this study identified some of the factors that are statistically significantly associated with the life satisfaction of older persons in Myanmar.

METHODS

The author analysed data from the 2019 Myanmar Intercensal Survey, which was conducted by the Department of Population. The survey was cross-sectional and included a nationally-representative sample from 3,960 Enumeration Areas. Of these, a response rate of 95% among sampled households was achieved [(10)]. This survey covered only the persons who were living in conventional households at the time of the survey.

MEASUREMENTS

The sample of this study consists of 65,065 older persons who responded to self-rated question: "*Are you basically satisfied with your life?"* Response options included a ranking on a 5-point scale (i.e., *All of the time* = 1, *Most of the time* = 2, *Some of the time* = 3, *A little of the time* = 4, and *None of the time* = 5). In addition, the author developed the conceptual framework for the study based on two theories: Bottom-Up and Top-Down Model, and Need-Gratification Theory. According to the Bottom-Up model, overall life satisfaction is the outcome of cumulative satisfaction in relevant life domains. In the Top-Down model, life satisfaction is an influencer of domain-specific satisfaction. The Need-Gratification theory is based on Maslow's five-hierarchical model of human needs, which holds that higher-need gratification produces more profound happiness than lower-need gratification.

DATA ANALYSIS

STATA was used to analyse the data. Descriptive statistics were used to show frequency distributions of variables. Binary logistic regression was applied to examine whether there is a significant association between the dependent and independent variables. The dependent variable is binary: '*Satisfactory*' vs '*Not satisfactory*'. Culturally, Myanmar people are reluctant to respond in the negative when asked a question by a

stranger. Therefore, the above 5-point scale was converted to a binary outcome, as applied by other studies [11]. Those who responded '*All of the time/most of the time'* were classified as having a *'Satisfactory'* level of well-being. Those who responded '*Some of the time/A little of the time/None of the time'* were classified as having a level of well-being that is '*Not satisfactory'*. In this study, the independent variables were demographic, socio-economic, and health-related factors.

RESULTS

Table 1 presents the descriptive statistics of the dependent variable, i.e., life satisfaction. Among the total sample, 71.6% said they were satisfied with their life at the time of the interview, while 28.4% said they were not.

Table 1: Satisfaction with Life among Myanmar Older Persons

Life satisfaction of older persons	Number	%
All of the time	14,671	22.5
Most of the time	31,949	49.1
Satisfactory	46,620	71.6
Some of the time	13,583	20.9
A little of the time	4,376	6.7
None of the time	486	0.8
Not satisfactory	18,445	28.4
Total	65,065	100.0

Table 2 presents the descriptive statistics for the independent variables. Among age groups, the youngest cohort (60-64 years) were the most numerous (35.2%). More than half the sample was female, and the majority were married. By the geographical region, the highest proportion (39.4%) lived in the central part of the country. In terms of living arrangements, the majority (71.3%) lived with one or more children.

Table 2: General Characteristics of the Sample of Myanmar Older Persons

Variables	Number	%
Demographic factors		
Age group (years)		
60-64	22,923	35.2
65-69	16,829	25.9
70-74	11,421	17.6
75-79	6,517	10.0
80+	7,375	11.3
Sex		
Male	27,139	41.7

Variables	Number	%
Female	37,926	58.3
Marital status		
Never married	4,581	7.0
Married	38,178	58.7
Widowed	21,448	33.0
Divorced/separated	858	1.3
Place of residence		
Urban	19,434	29.9
Rural	45,631	70.1
Geographical region of residence		
Mountainous	13,034	20.0
Coastal	13,747	21.1
Central	25,611	39.4
Lower	12,673	19.5
Living arrangement		
Living alone	3,569	5.5
Living only with spouse	6,372	9.8
Living with at least one adult child	46,396	71.3
Living with a grandchild and no adult children	3,097	4.8
Other	5,631	8.6
Socio-economic factors		
Formal education		
No education	19,976	30.7
Primary	26,299	40.4
Secondary	7,985	12.3
Post-secondary	7241	11.1
Other	3564	5.5
Employment status		
Not working	41,839	64.3
Employee	2,783	4.3
Employer	2,049	3.2

Variables	Number	%
Self-employed	14,753	22.7
Working for the family business (without pay)	3,223	5.0
Other	418	0.6
Receiving a pension, senior citizen allowance/benefit		
No	55,943	86.0
Yes	9,122	14.0
Participate in community activities		
No	40,015	61.5
Yes	25,050	38.5
Household income quintile		
Lowest	14,350	22.1
Low	12,800	19.7
Middle	12,854	19.8
High	12,053	18.5
Highest	13,008	20.0
Housing type		
Wooden or brick house	46,444	71.4
Apartment	3,023	4.6
Bamboo or temporary house	15,598	24.0
House ownership		
No	2,611	4.0
Yes	62,454	96.0
Health-related factors		
Functional difficulty (hearing, seeing, walking, remembering, self-care, or communication)		
No difficulty	35,007	53.8
Difficulty	30,058	46.2
Health status		
Very good	3,569	5.5
Good	27,026	41.5

Variables	Number	%
Fair	26,966	41.4
Poor	6,664	10.2
Very poor	840	1.3
Total	65,065	100.0

Among the older persons, 40.4% had completed primary education. Over three in five (64.3%) were not working at the time of the survey, and 22.7% were self-employed. Only 14.0% were receiving any type of pension or senior citizen allowance/benefit. Nearly two in five (38.5%) participated regularly in community activities (e.g., recreation and sports; socializing; political meetings; art or cultural; educational; religious; humanitarian). As for household income status, 18.5%were in the highest income quintile, while 22.1% were in the lowest quintile. The majority of the sample (71.4%) lived in a wooden or brick house, and 96.0% own their dwelling. Regarding health-related factors, 46.2% of this sample of older persons said they have some functional difficulty in hearing, seeing, walking, remembering, self-care, or communication. Just over two in five (41.5%) rated their health status as "*good*."

BINARY LOGISTIC REGRESSION ANALYSIS

Table 3 presents the results of the logistic regression. The analysis of satisfaction by age group reflects an inverted U-shaped relationship. In other words, those age 70-74 had the highest probability of being satisfied with their current life, while those in the oldest cohort (80+ years) had the lowest probability of being satisfied with their current life, when other variables are held constant. Women were 1.05 times more satisfied with their life than their male counterparts, however, the single older persons were more likely to be satisfied with their life than those of other types of marital status. By geographical region, older persons living in the central and lower regions were more likely to be satisfied with their current life than those living in the mountainous area (1.67 and 1.17 times, respectively). For living arrangement, the older persons who lived with at least one adult child were 1.1 times more satisfied with their life than those who lived alone.

Table 3: Binary Logistic Regression: Factors Associated with Life Satisfaction

Life satisfaction		Odds ratio	Robust Std. Err.
Age group (years)	60-64 (Ref)	1	
	65-69	1.008	0.025
	70-74	1.067*	0.031
	75-79	0.985	0.034
	80+	0.919*	0.033
Sex	Male (Ref)	1	
	Female	1.047*	0.023
Marital status	Single (Ref)	1	
	Married	0.992	0.054
	Widowed	0.903*	0.048
	Divorced/Separated	0.783**	0.071
Place of residence	Urban (Ref)	1	
	Rural	0.956	0.024
Geographical region	Mountainous (Ref)	1	
	Coastal	0.944*	0.027
	Central	1.669***	0.045
	Lower	1.169***	0.036

Life satisfaction		Odds ratio	Robust Std. Err.
Living arrangement	Living alone (Ref)	1	
	Living only with spouse	0.891*	0.047
	Living with at least one adult child	1.102*	0.047
	Living with a grandchild and no adult children	1.035	0.060
	Other	0.954	0.054
Educational level	No formal education (Ref)	1	
	Primary	1.084***	0.025
	Secondary	1.193***	0.041
	Post-secondary	1.396***	0.059
	Other	1.153**	0.050
Employment status	Not working (Ref)	1	
	Employee	0.844**	0.041
	Employer	1.156*	0.071
	Self-employed	1.078**	0.028
	Working in the family business (without pay)	1.005	0.046
	Others	0.815	0.090
Receiving a pension, senior citizen allowance / benefit	No (Ref)	1	
	Yes	1.189***	0.037
Participates in community activities	No (Ref)	1	
	Yes	1.195***	0.024
Household income quintile	Lowest (Ref)	1	
	Low	1.114***	0.031
	Middle	1.127***	0.032
	High	1.269***	0.039
	Highest	1.420***	0.045
Housing type	Wooden or brick house (Ref)	1	
	Apartment	1.135*	0.058
	Bamboo or temporary house	0.871***	0.020
House ownership	No (Ref)	1	
	Yes	1.242***	0.063
Functional difficulty	No difficulty (Ref)	1	
	Difficulty with one or more of the six dimensions (i.e., hearing, seeing, walking, remembering, self-care, or communication)	0.765***	0.016
Health status (self-assessed)	Very good	1	
	Good	0.348***	0.026
	Fair	0.120***	0.009
	Poor	0.057***	0.004
	Very poor	0.037***	0.004
Constant		8.184***	0.929

Life satisfaction	Odds ratio	Robust Std. Err.
Number of observations	65,065	
Pseudo R Squared	0.1218	

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

The logistic regression suggests that level of formal education had a positive and statistically-significant impact on life satisfaction. The odds of being satisfied in life increased by 8% for those older persons who completed primary education, 19% for completing secondary education, and 40% for completing post-secondary education, compared to those older persons with no formal education. Being an employer of others or self-employed was positively and statistically-significantly associated with life satisfaction. Older persons who received any kind of pension, and those who participated in community activities were more likely to be satisfied in life than those in their respective reference groups (p<0.001), with odds ratios of 1.19 and 1.20, respectively. For household income status, the older persons in the lowest quintile were the least likely to be satisfied in life. By housing type, those who lived in an apartment were 1.14 times more likely to be satisfied with their life than the reference group. What is more, older persons who owned their dwelling were 24% more likely to be satisfied with their life compared to their counterparts who did not own their dwelling. Regarding health-related factors, the older persons who had at least one type of functional difficulty were less likely (OR = 0.77) to be satisfied in life than those who had no difficulty. Older persons who rated their health as "*very poor*" were least likely (OR = 0.004) to be satisfied in life.

DISCUSSION

This study found that age had a generally inverted U-shaped relationship with life satisfaction. That finding is consistent with some previous studies [3]. When individuals are transitioning through their " sunset years," income and social support are usually declining. This may cause increased dependency and loss of close relationships. As a result, these factors may exacerbate deteriorating health and reduce energy which, in turn, erodes overall life satisfaction. Men are less satisfied with life than women, and that finding is consistent with some studies [12]. Women are generally more willing to show their emotions and express both happiness and sadness. In the patriarchal system of Asian society, men are expected to be the principal breadwinner of the family and act as the household head. When men are saddled with the sole responsibility for household expenditures, regardless of their age, that burden may impair life satisfaction.

This study found that being single was associated with greater life satisfaction among the national sample of older persons. In Myanmar society, it is customary for households to have multiple generations living together. Thus, even single older persons are likely to receive both physical and mental support from their extended-family members on a daily basis. Also, being single gives these older persons more flexibility to leave the household to visit friends and engage in social activities outside the home and neighborhood. That can translate into higher life satisfaction.

Life satisfaction differed by geographical region of residence. The older persons from the central and lower regions had higher life satisfaction, and that may be related to better transportation and easier access to basic infrastructure and amenities than those in the mountainous region. In addition, there are more plentiful goods, services, and employment in the central and lower regions.

Older persons living with at least one adult child were more likely to be satisfied with their life than their counterparts who did not. That finding is consistent with previous studies [13]. Older people in Myanmar mostly live with their adult child(ren) or niece/nephew. The tradition of filial piety is still strong in Myanmar and, thus, the working- age population (especially daughters) has been conditioned to believe that they have a duty to care for older relatives [14]. The knowledge that they will be cared for if they become dependent can increase the older person's sense of life satisfaction.

This study also found that educational attainment of the older person is positively associated with life satisfaction at the time of the survey. That result is consistent with some previous studies [15]. The more highly- educated persons tend to have had more employment opportunities and a more lucrative earnings history, which should have led to a sustainable income in their retirement years. The more educated older persons are also more likely to remain gainfully employed over age 60 years. Accordingly, the study also found that older persons who were still (voluntarily) in the labour force were more likely to be satisfied with life, and that is supported by the findings of other studies [16]. Among different types of employment status, those who worked as an employer and those who were self-employed were more likely to be satisfied with their life situation. Presumably, that

satisfaction is related to the greater degree of control they have over their work life [17].

Understandably, those older persons who have a pension or senior citizen's allowance have a higher level of life satisfaction, and that finding is consistent with other studies [18]. Having a sustainable income in older age is crucial to feeling a sense of security and independence. The pensioned older persons may also feel less of a burden on working-age members of the household and/or take pride in their ability to contribute to the household income.

This study found that older persons who participate in community activities are likely to be more satisfied with life, and that finding coincides with other studies [6]. Older people derive positive effects of participation in the broader community, such as a sense of autonomy and social acceptance. Community activities are a way to stay in contact with peers and others in the neighborhood, and this confers a sense of belonging. That also provides an incentive to remain healthy and physically active, and those are attributes that are often correlated with life satisfaction.

According to the findings, household income quintile has a positive effect on life satisfaction of old persons in Myanmar. This is consistent with the above finding about a pension, in that, financial security – whether one's own or one's household – is important for seniors. That finding is consistent with a previous study [19]. Also, older persons who live in an apartment had a higher level of life satisfaction, and that could reflect ability to live independently [20]. What is more, better housing is not just a source of shelter but can facilitate access to employment and recreational facilities to live a healthier and safer lifestyle. Regarding house ownership, older persons who live in a house they own (or the family home) are more likely to report being satisfied with their life. This finding is consistent with other studies [20]. Living in one's own home means there is no fear of eviction, and can also reflect a greater sense of control over one's daily life, and reflect a sense of life fulfilment.

For health-related factors, functional difficulty has a significant effect on the life satisfaction, and that finding is consistent with previous reports [7]. Older persons with functional difficulty rate their life satisfaction lower than their counterparts without difficulty. Having the option of receiving assistance from others and/or as well as from devices can help ameliorate the functional deficiencies, at least for a period of time. One of the most significant determinants of life satisfaction is the perception of one's health status. Consistent with expectations as well as with previous research [8], self-rated good health in this national sample survey of Myanmar older persons was significantly related to being more satisfied with life in general. It can be assumed that if the individual has regular experience with negative life events, such as functional difficulty and poor health status, the psychological distress can become chronic and, in turn, erode the overall level of life satisfaction.

CONCLUSIONS

Life satisfaction is very important for older persons' quality of life, and is a summary indicator of successful ageing. According to the findings from this study, health-related factors were negatively associated with life satisfaction of older persons in Myanmar. Older persons who have more educational attainment and those who receive a pension and/or live in higher-income households are more likely to have greater satisfaction with their current situation. This study suggests that, in addition to socio-economic factors, health-related factors and geographical region of residence are significantly related to a sense of well-being among Myanmar seniors. In any case, the relentless ageing of society presents a public health challenge to many countries in the region and around the world, including Myanmar. Therefore, effective social security schemes are required to help reduce the adverse impact of socio-economic inequality, especially as people enter their "sunset years."

RECOMMENDATIONS

These findings have several policy implications regarding social protections for older persons in Myanmar. The results suggest that life satisfaction can be maintained or promoted by providing economic security and access to essential public health services for older persons. The government should promote equality across geographic regions so that all older persons have access to a minimal level of social security and universal health care coverage. At the policy level, the Myanmar government should implement a national program of support for older persons to encourage and facilitate active participation in social and economic activities of the home community, and help them to live their senior years with purpose, dignity, and peace.

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PREVENTIVE HEALTH CARE AND HEALTH CARE SERVICES UTILIZATION OF VIETNAMESE OLDER PERSONS: RESULTS FROM THE NATIONAL HOUSEHOLD LIVING STANDARDS SURVEY 2018

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ABSTRACT

Background As many countries are aging rapidly, improving older persons' health and reducing the burden of disease are important goals. In Vietnam, self-rated health of older persons shows signs of worsening health. Moreover, non-communicable diseases (NCD) occupy seven spots in the top ten causes of Vietnam's disease burden. Vietnam still lacks effective policies in the area of preventive health care as well as health services utilization, especially for older persons. By providing empirical evidence regarding the use of health care services of older persons, this study supports the creation of policies aiming to expand equal access to quality health services with a focus on preventive health care in the current aging population context.

Objectives (1) To determine the health status by severe injury report and health care service needs of Vietnamese older persons; and (2) To investigate the factors associated with the use of health check-up services of Vietnamese older persons.

Method This study used a cross-sectional design and employed secondary data from the Vietnam Household Living Standards Survey (VHLSS). The VHLSS has been carried out since 1991, and applies the "Living Standards Measurement Study" method of the World Bank. The VHLSS is conducted every two years by the Vietnam General Statistics Office. By using data from 2018 VHLSS, this study has a sample of 5,037 older persons with 6,030 responses regarding health care facility visits**.** The study determined health status by severe injury report, as well as health care service needs of older persons**.** With a focus on preventive health care, this study used multinomial logistic regressions to analyze the predisposing factors **(**including age, gender, marital status, education level, employment status, ethnicity, living arrangement**)**, and enabling factors **(**including place of residence, socioeconomic regions, health insurance scheme, income per capita**)** associated with health care services utilization **(**no use of any services, at least one health check**-**up, medical treatment only**).**

Results This study found that 15.9% of older persons had a severe injury over the 12 months prior to the survey. In general, most of older persons seek a health care service only when having a health problem, with 53.3% of health care visits for medical treatment. The percentage of older persons reporting no use of any health care services, use for at least one health check-up, and use for medical treatment were 35.6%, 18.3%, and 46.1%, respectively. The results show that being older, female, more highly educated, and covered by a health insurance scheme were significantly and positively associated with the likelihood of using health check-up services as compared to not using any services. In contrast, being from a minority group and co-residence with family members were negatively associated with the likelihood of using health check-up services.

Conclusions The health status of Vietnamese older persons by severe injury report needs closer attention. The main motivation for the elderly to seek health care services is medical treatment, while the proportion of Vietnamese older persons who use preventive health care (i.e., health check-up services) is quite low. The main barriers are related to demographic characteristics (e.g., age, education, ethnicity), and not having health insurance. Policies are needed to increase coverage of health insurance for older persons, and extend targeted programs which focus on younger-older persons (age 60-69), and minority groups.

Keywords: *aging population, health check-up, older persons, VHLSS, Vietnam.*

INTRODUCTION

Population aging has become a key challenge for societies around the world. The global population continues to grow older rapidly, as fertility rates have fallen to low and very low levels in most regions, and people are living longer [1]. According to UN data, the older population (age 65 years or older) accounted for 9.3% of the total world population in 2020. Very quickly, by 2050, this number is projected to be 15.9% [2]. The consequences and challenges posed by aging societies are enormous, especially in the health care sector. Aging has important implications for the organization and delivery of health care, caregiver availability and constraints, society, and policies [3]. Non-communicable diseases (NCD) associated with the aging process—such as arthritis, cardiovascular disease, stroke, macular degeneration, cancer, diabetes, and Alzheimer's disease—are expected to become the leading causes of death and disability among older persons all over the world in the coming decades [4].

Vietnam has witnessed a marked decrease in the fertility rate from the 1960s until 2010 [5]. Up to now, the population and family planning slogan ("*Each family should have only 2 children")* has been one of the most successful population policies of Vietnam. The average number of children per woman of reproductive age decreased from 2.3 in 2000 to 2.0 in 2010. At the same time, after the Vietnam War and the subsequent country reunification in 1975, the average life expectancy has steadily increased. That phenomenon is a partial result of economic development [6]. In the field of economics, when the "*dependency ratio*" declines to 50 or less, it means that 100 working-age people have the "burden" of less than 50 dependents or, in other words, every two working-age people have no more than one dependent, and this is referred to as a "*gold*" population structure [7]. According to surveys on population change, the labor force, and family planning in Vietnam, in 2006, the dependency ratio was only 49.9. That means that Vietnam's population had entered the period of "*gold*" population structure. Note that this is only "*gold*" in quantity, not necessarily quality. That said, Vietnam only has a short time to take advantage of the golden population structure before becoming an aging society (after which the trend in the dependency ratio will reverse course). In the period 2009-19, the elderly population increased from 7.45 million to 11.41 million, equivalent to 8.7% and 11.9% of the total population, respectively. The increase of the elderly population accounts for nearly 40% of total population increase [8]. This not only creates a burden for people of working age, but also poses a challenge in terms of population policies and health care systems to accommodate the growing number of aged persons.

At present in Vietnam, unmet health care needs persist in parts of the country and for a range of NCD and other health conditions [9, 10]. In recent years, inequality in health care has also increased with regard to health care services for older persons. Evidence shows that, on the supply side, health providers have unsatisfactory knowledge of geriatric care, and may have false confidence in their competency [11]. Moreover, there have not been many studies in Vietnam that focus on the care of an aging population. Most of the available research on geriatric care is drawn from developed countries [12]. Developing a universally-applicable care model in Vietnam that focuses on organized eldercare seems to be a distant goal, given the existing socioeconomic and regional disparities on the needs of care for the elderly [12]. Vietnam is still in the early stage of coping with concerns and challenges about its aging population, and the government and policymakers tend to focus on conventional and local approaches, such as promoting community and family-based models of care. However, some voices are sounding the alarm of the need to pay more attention to the emerging economic and care burden as the population ages with increasing speed [13].

Like most of Asian countries, one of the great difficulties in measuring health status in Vietnam is that one cannot rely only on self-reports of health status [14]. However, data on empirical health measurement reports is lacking. As a result, meeting health needs is hindered, especially for NCD, which occupy seven spots in the top ten causes of Vietnam's disease burden. Thus, expanding screening and preventive care for NCD and debilitating conditions of aging is of the utmost importance. However, Vietnam still lacks effective policies in the area of preventive health care for citizens in general and older persons in particular. For example, a 2020 survey found that only one in four mountainous people had a medical check-up in the past 12 months [15]. A 2016 survey in Hanoi found that only half the sample had a health exam in that year [16]. In sum, there are not many Vietnamese studies focusing on preventive health care of older persons, especially in the use of health check-up services.

As Vietnam faces the challenges of an aging population, the health system also faces a challenge in terms of limited capacity or willingness to further increase public expenditure, address shortages of human resources for healthcare, as well as building capacity and quality in the service infrastructure. Thus, Vietnam needs to urgently prepare for better health care for the aging population by creating accessible health services, adapting to the growing need for NCD case management, reducing disease risk, improving healthy lifestyles, and promoting quality aging [17, 18].

METHODS

DATA AND DATA COLLECTION

This cross-sectional study employed secondary data from the bi-annual VHLSS of the Vietnam General Statistics Office. The VHLSS has been carried out since 1991, and applies the "Living Standards Measurement Study" method of the World Bank. The VHLSS uses a cluster-randomized stratified sample to collect data, so that the respondents are representative of the larger population, both nationally and regionally. This study analysed data from the VHLSS 2018 (as the most recent round of available data when this research was conducted).

The 2018 VHLSS includes information on living conditions, education, health status, health care, employment, income, expenditure, etc. The data from the VHLSS 2018 are mainly used to study poverty, the labor force, and markets as well as productivity of agricultural activities. However, analysis of the health data from the VHLSS is still limited.

Information was collected via face-to-face interviews with household heads, household members, and key officials at the commune level. The questionnaire covers demographic and socioeconomic characteristics of each member of the household and individual health-seeking and health utilization behavior over the past 12 months. The VHLSS 2018 has a total of 38,811 respondents from 9,096 households in 3,133 communes/wards which are representative of the national, regional, urban, rural, and provincial levels. Given the focus of this research on the health care situation of older persons, this study harvested VHLSS data only for respondents age 60 years or older, i.e., "older persons" as defined by the Elderly Law of Vietnam [19]. That reduces the sample to 5,037 older persons with 6,030 responses regarding health care facility visits (an individual may provide multiple responses) in the 2018 VHLSS.

VARIABLES AND MEASUREMENTS

For the first objective, health status of older persons by severe injury report was determined by the answer of respondents regarding severe injury (i.e., had to lie down in a place and be taken care of by a bedside caregiver or had to stop working or studying/could not participate in normal activities). If a respondent reported having severe injury, the interviewer probed for details on each severe injury during the prior 12 months. Health care service needs were assessed by the reasons older persons sought a health care service. Reasons were classified into four groups: (1) No use of any service; (2) Health check-up; (3) Medical treatment for non-severe illness; and (4) Medical treatment for severe illness. A health care facility visit is the unit of analysis in this study.

For the second objective, this study followed the Behavioral Model of Health Services Use developed by Ronald M. Andersen (1995 revised version) [20] to select the dependent and independent variables. This model identifies three main groups of factors that can affect health services utilization: Predisposing, enabling, and medical need factors. Predisposing factors are those that exist before an individual has a need for medical services. They include both demographic characteristics and social structure factors such as age, gender, marital status, education level, occupation, ethnicity, etc. Enabling factors are related to family income, health insurance, and place of residence, and represent the resources available to people to choose health services. Finally, medical need factors include illness level as perceived by the individual themselves or as assessed by health professionals [21].

Based on availability of data in the VHLSS, this study identified predisposing and enabling factors that are associated with the purpose of health services utilization. The purpose of health services utilization is classified into three groups: (1) No use of any services; (2) At least one health check-up; and (3) Medical treatment only. Given the emphasis on preventive health care, the study focused on the differences between Group (1) and Group (2) to explain how the predisposing and enabling factors are associated with the use of health services for health check-up as compared to no use of any health care services. For this part of the analysis, the individual is the unit of focus. Predisposing factors include demographic characteristics (e.g., age, gender, marital status, ethnicity), and socio-economic profile (e.g., educational attainment, employment status, living arrangement). Enabling factors include family income, health insurance, urban/rural area, and region of residence. Older persons were classified into three age groups (60-69, 70-79, and 80+ years). Gender was coded as male/female, while marital status was coded as married, widowed, other. An older adult's level of education was classified into five categories: Less than complete primary school, primary school, junior high school, high school, college or higher. Employment status was coded as working/not working. Living arrangement included four categories: Living alone, living with spouse only,

living with children (with or without spouse), other. Ethnicity was classified into majority/minority. The area of residence was coded as urban/rural, and by six socioeconomic regions of Vietnam. The health insurance variable was classified into four statuses: Not covered, Medicaid, public health insurance, private health insurance. Personal income was divided into five quintiles in which 1 is the lowest and 5 is the highest.

DATA ANALYSIS

The VHLSS 2018 records multiple health visits by an older person over the prior 12 months. Descriptive statistics were used to assess visits as the unit of analysis. For the second objective, the unit of analysis is the individual level (5,037 observations) with three types of health care services: No use of any services, at least one health check-up, and medical treatment only. The study used multinomial logistic regression to analyze the predisposing and enabling factors associated with the purpose of health care services utilization. Results are expressed as relative risk ratio (RRR) of the use of health services for health check-up, and for medical treatment only as compared to no use of any health care services (base group), with a 95% confidence interval (95% CI). All data analysis was done by Stata software version 16.

RESULTS

SAMPLE CHARACTERISTICS

As shown in Table 1, the proportion of women (57.7%) was much larger than that of men (42.3%). The higher proportion of women is similar to the overall national rate (ranging from 58.7% to 61.1% over the past two decades). More than half of the total older people were in the younger older group (age 60-69). Most (two-thirds) resided in a rural area; 11.5% were a member of an ethnic minority. Three out of five (60.6%) had completed primary school education or higher. Fully 7.3% of older persons were not covered by any health insurance scheme, and that percentage was lower compared to the results of the 2016 VHLSS. The majority of this sample of Vietnamese older persons lived with one or more adult children (70.1%) or with a spouse only (21.1%). This pattern is in line with the culture traditions of Vietnam.

Table 1: Demographic and Socio-economic Characteristics of Vietnamese Older Persons

Variables	Number of older persons	Percentage
Predisposing factors		
Age *(years)*		
60-69	2889	57.4
70-79	1258	25.0
80 or older	890	17.6
Gender		
Male	2130	42.3
Female	2907	57.7
Marital status		
Married	3281	65.1
Widowed	1577	31.3
Other	179	3.6
Educational attainment		
Less than primary school	1984	39.4
Primary school	1088	21.6
Junior high school	1154	22.9
High school	562	11.2
College or above	249	4.9
Employment status		
Working	2539	50.4
Not working	2498	49.6
Place of residence		
Urban area	1614	32.0
Rural area	3423	68.0
Socioeconomic region		

Variables	Number of older persons	Percentage
Red River delta	1280	25.4
Northern midlands and mountain areas	688	13.6
North Central and Central coastal areas	1148	22.8
Central Highlands	251	5.0
Southeast	513	10.2
Mekong River Delta	1157	23.0
Ethnicity		
Majority	4459	88.5
Minority	578	11.5
Living arrangements		
Living alone	361	7.2
Living with spouse only	1063	21.1
Living with children and spouse (or without spouse)	3530	70.1
Others	83	1.6
Enabling factors		
Having health insurance		
Not covered	368	7.3
Medicaid	635	12.6
Public health insurance	3965	79.1
Private health insurance	49	1.0
Income per capita quintile		
1 lowest	1010	20.0
2	1006	20.0
3	1007	20.0
4	1007	20.0
5 highest	1007	20.0
Total	5037	

HEALTH STATUS OF VIETNAMESE OLDER PERSONS BY SEVERE INJURY REPORT

Over the 12 months prior to the survey, there were 800 older persons (15.9% of the sample) who had severe injury (i.e., had to lie down in a place and be taken care of by a bedside caregiver or had to stop working or studying/could not participate in normal activities), with 59.8% having only one episode of the severe injury, 20.5% having two episodes, and 19.7% having three or more episodes of severe injury.

Table 2: Number of Severe Injuries of Vietnamese Older Persons in the past 12 Months

Times	Number of older persons	Percentage
1	478	59.8
2	164	20.5
3 or more	158	19.7
Total	800	

HEALTH CARE SERVICE NEEDS OF VIETNAMESE OLDER PERSONS

In general, most of the older persons sought health care when they felt they needed medical treatment. Of the total of 6,030 health care visits, 53.3% were for medical treatment, 17.0% were for health check-up, and 29.7% said they did not use any health care services over the past 12 months.

Table 3: Health Care Service Needs of Vietnamese Older Persons

Health care service needs	Number of older persons	Percentage
No use of any services	1,792	29.7
Health check-up	1,023	17.0
Medical treatment for non-severe illnesss	2,246	37.2
Medical treatment for severe illness	969	16.1
Total	6,030	

HEALTH CARE SERVICES UTILIZATION AND ASSOCIATED FACTORS

The sample included 5,037 older persons with 6,030 responses regarding health care facility visits. Of these, 1,792 older persons (35.6%) did not use any health care service as part of the visit, 923 (18.3%) used health care services for at least one health check-up, and 2,322 (46.1%) used health care services for medical treatment only.

Table 4: Health Care Services Utilization by Purpose

Health care services utilization	Number of older persons	Percentage
No use of any services	1,792	35.6
At least one health check-up	923	18.3
Medical treatment only	2,322	46.1
Total	5,037	

Table 5 presents maximum likelihood estimates of the multinomial logistic model. Older persons who did not use any health care service are the base group. The table presents the Relative Risk Ratios (RRR) of having at least one health check-up and having medical treatment only.

Age, gender, educational attainment, ethnicity and living arrangement were the predisposing factors that are associated with the likelihood of the use of health check-up. The results show that higher age, being female, and having higher education were positively associated with the likelihood of using a health check-up service compared to not using any service. In detail, those age 70-79 compared to age 60-69 had a RRR of 1.4 (95% CI: 1.1-1.7), females compared to males: RRR of 1.2 (95% CI: 1.0-1.4), primary/junior high/ secondary/college or higher compared to less than primary have RRRs: 1.3(95% CI:1.0-1.6), 1.4 (95% CI: 1.1-1.9), 1.3 (95% CI: 1.0-1.8), 1.4 (95% CI: 1.0-2.3), respectively.

In contrast, co-residence with family members and being a member of a minority group were negatively associated with the likelihood of using a health check-up service. In detail, living with spouse only and living with children compared to living alone have the following RRRs: 0.5 (95% CI: 0.4-0.8), and 0.4 (95% CI: 0.3-0.6), respectively, and being from a minority group compared to the majority group has an RRR of 0.6 (95% CI: 0.5-0.9).

Availability and beneficial levels of health insurance were the only enabling predictors of using health care services for a check-up. The RRRs of using a health check-up service over no use by older persons who had medicaid, public health insurance, or private insurance were 4.3 times (95% CI: 2.7-6.8), 4.5 times (95% CI: 3.0-6.8), and 3.6 times (95%CI: 1.6-8.4), respectively, compared to those without health insurance. Place of residence (urban/rural) and socio-economic region were not significantly associated with the choice of using a health check-up service.

Table 5: Multinomial Logistic Regression Analysis Focusing on the Use of a Health Check-up Service

Variables				The use of a health check-up service over no use		The use of medical treatment only over no use	
	No use of any service (%)	At least one health check-up (%)	Medical treatment only (%)	RRR	95% CI	RRR	95% CI
Predisposing factors							
Age (years)							
60-69	39.6	18.2	42.2	1.0		1.0	
70-79	30.0	19.6	50.4	1.4	1.1-1.7***	1.4	1.2-1.6***
80+	30.6	17.0	52.4	1.1	0.9-1.5	1.2	1.0-1.5**
Gender							
Male	37.4	18.4	44.2	1.0		1.0	
Female	34.2	18.3	47.5	1.2	1.0-1.4*	1.1	0.9-1.2
Marital status							

Variables				The use of a health check-up service over no use		The use of medical treatment only over no use	
	No use of any service (%)	At least one health check-up (%)	Medical treatment only (%)	RRR	95% CI	RRR	95% CI
Married	37.1	18.9	44.0	1.0		1.0	
Widowed	32.5	17.2	50.3	1.0	0.8-1.3	1.0	0.8-1.2
Others	34.6	18.4	47.0	0.9	0.5-1.5	0.7	0.5-1.1
Educational attainment							
Primary school or less	33.4	13.3	53.3	1.0		1.0	
Primary school	33.3	16.5	50.2	1.3	1.0-1.6*	1.1	0.9-1.3
Junior high school	40.3	23.8	35.9	1.4	1.1-1.9***	0.9	0.7-1.1
High school	38.4	23.5	38.1	1.3	1.0-1.8*	0.8	0.6-1.0*
College or above	34.9	28.5	36.6	1.4	1.0-2.3**	0.7	0.5-0.9**
Employment status							
Working	40.6	18.8	40.6	1.0		1.0	
Not working	30.5	17.9	51.6	1.1	0.9-1.4	1.4	1.2-1.6***
Place of residence							
Urban area	31.5	19.9	48.6	1.0		1.0	
Rural area	37.6	17.6	44.8	0.9	0.7-1.1	0.9	0.7-1.0*
Socioeconomic region							
Red River delta	40.9	25.5	33.6	1.0		1.0	
Northern midlands and mountain areas	51.3	21.1	27.6	0.9	0.7-1.3	0.9	0.7-1.1
North Central and Central coastal areas	36.1	20.8	43.1	1.1	0.9-1.3	1.5	1.3-1.9***
Central Highlands	39.5	15.9	44.6	0.9	0.6-1.4	1.7	1.2-2.3***
Southeast	27.7	13.3	59.0	0.9	0.7-1.3	2.7	2.1-3.4***
Mekong River Delta	22.5	9.0	68.5	0.9	0.7-1.2	4.0	3.2-4.9***
Ethnicity							
Majority	33.4	18.8	47.8	1.0		1.0	
Minority	52.2	14.9	32.8	0.6	0.5-0.9***	0.7	0.5-0.9***
Living arrangement							
Living alone	19.9	23.5	56.6	1.0		1.0	
Living with spouse only	32.9	22.9	44.2	0.5	0.4-0.8***	0.5	0.3-0.7***
Living with children and spouse (or without spouse)	37.9	16.5	45.6	0.4	0.3-0.6***	0.4	0.3-0.5***
Other	38.6	16.9	44.5	0.4	0.2-0.9**	0.3	0.2-0.6***
Enabling factors							
Having health insurance							

Variables				The use of a health check-up service over no use		The use of medical treatment only over no use	
	No use of any service (%)	At least one health check-up (%)	Medical treatment only (%)	RRR	95% CI	RRR	95% CI
Not covered	59.5	7.3	33.2	1.0		1.0	
Medicaid	40.8	19.4	39.8	4.3	2.7-6.8***	2.7	2.0-3.7***
Public health insurance	32.5	19.1	48.4	4.5	3.0-6.8***	3.2	2.5-4.1***
Private health insurance	38.8	24.5	36.7	3.6	1.6-8.4***	3.6	1.6-8.4***
Income per capita quintile							
1 lowest	40.2	18.3	41.5	1.0		1.0	
2	36.5	16.2	47.3	0.9	0.7-1.2	1.2	1.0-1.5*
3	35.5	15.8	48.7	0.9	0.7-1.2	1.2	1.0-1.5
4	34.3	17.8	47.9	0.9	0.7-1.2	1.2	1.0-1.5*
5 highest	31.4	23.4	45.2	1.2	0.9-1.6	1.3	1.0-1.6**

Notes: RRR is the relative risk ratio measuring the relative likelihood ratio of the use of health services for health check-up, or for medical treatment only as compared to no use of any health care services; *p < .1; **p < .05; ***p<.01

DISCUSSION

Although the percentage of older persons who were injured enough to have to lie down in a place and be taken care of by a bedside caregiver was not very high, repeat injury (twice or more) is common in the elderly. This means that home-based care or long-term care will become a growing need in Vietnam. Vietnamese older persons usually seek a health care service only when they feel they need medical treatment**.** This study provided more evidence that older persons have not been practicing adequate prevention of NCD since only 17**%** of the sample used health care services for a health check-up**.** Unless this changes, untreated risk of NCD or debilitating conditions will become a major barrier to good health and quality of life for older persons, and threatens to become an unbearable burden for the economy and health care system of Vietnam

This study found that age (older), gender (female), education (higher), and having health insurance were significant positive correlates of health care service utilization for a health check-up. That finding generally conforms with many studies in the world, i.e., the older the age group, the higher the health services utilization (22-27). In Vietnam, although more than half of the total older persons in the VHLSS were in the younger group (60-69 years), this group has the lower odds of having a health check-up. This creates a disadvantage in terms of early diagnosis and treatment of NCD before they become debilitating. What is more, Vietnamese older persons in ethnic minority groups had less opportunity (or willingness) to have a health check-up compared to those from the ethnic majority. Evidence shows that being a member of an ethnic minority could be a barrier to having a health check-up, and that might delay the early diagnosis of severe health problems among these groups [25]. This finding suggests that there remains inequality in access to standard health care among vulnerable groups in Vietnam [28].

Older persons who have more knowledge of social health insurance use more health care services, including health check-ups [23, 29, 30]. Several studies in other countries found that not having health insurance could be a barrier for older persons to access any health care services [25]. This study confirms the importance of health insurance, which has a significant impact on having a health check-up. It is necessary to highlight that there are still approximately 7% of older persons who are not covered by any health insurance scheme in Vietnam. Therefore, interventions should address the main barriers that prevent those older population from a having health insurance.

This study found that personal income was not associated with health services utilization in terms of having a health check-up. This is contrary to many studies which found that higher income is related to higher odds of utilizing all types of health care services [23, 25, 29, 31]. However, in Vietnam, one possible explanation is that health insurance (with at least 80% coverage for all health expenses) might play an important role in health-seeking behavior of older

persons. Instead, this study provides evidence that education and living arrangement are associated with the decision whether to use a health check-up or not. Similar to several studies [24, 25, 31-33], Vietnamese older persons with higher education are more likely to take advantage of preventive health care services (i.e., health check-up). This may be related to better health literacy in the higher-educated. It is important to note that policies should create equality and ease of access to health, including health information, even if the person's education level is different. Remarkably, older Vietnamese who were living with their spouse or their adult children had *lower* odds of using a health check-up service compared to older persons living alone. Part of the reason may be complacency about the need for preventive health care when living with their family, and assuming they will have support from family members if a health problem occurs. This finding suggests that an innovative reform which targets older persons, even sub-groups of the older age community, for preventive health care is needed to address the diverse needs of older people.

CONCLUSIONS

The health status of Vietnamese older persons is threatened by the potential for severe injury. The main motivation for the elderly to seek health care services is medical treatment. While the health system in Vietnam has a full range of medical care (from public to private health services), the proportion of older persons who use preventive health care (i.e., check-up services) is quite low. The main barriers come from the differences in individual characteristics (e.g., younger age, less education, ethnic minority, not having health insurance). This study highlights several key implications about the health-seeking behavior of older persons, with a focus on preventive health care. There is an urgent need for policies and programs to increase coverage of health insurance for older persons, and campaigns to motivate older persons to use screening and preventive health care services. The results also have implications for targeted programs which focus on certain groups of the older population, such as younger-older persons (60-69 years) and members of minority groups.

RECOMMENDATIONS

This study employed secondary data, and due to time limitations, the researchers could not access the latest survey of VHLSS (VHLSS 2020). In addition, the researchers could not examine the role of social support, such as accessing health information and health literacy of older persons in health services utilization. Future studies on health care utilization of older persons should re-examine these issues using the latest survey data.

ETHICAL DECLARATION

This study is an analysis of secondary data. The dataset is publicly available from the General Statistics Office of Vietnam. The authors declare no potential conflicts of interest with respect to the research or authorship.

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LGBTQ+ HEALTHCARE ACCESS IN NEPAL DURING THE COVID-19 PANDEMIC

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ABSTRACT

The COVID-19 epidemic has had a significant negative impact on Nepal's ability to obtain healthcare and the delivery of healthcare services. Although COVID-19 is a health pandemic that might affect everyone, due to the current health inequalities, LGBTQ+ people could be significantly affected. The LGBTQ+ community is particularly vulnerable to the COVID-19 pandemic because of a variety of factors, including stigma and discrimination, financial hardships, access to healthcare, immunocompromised state if they are HIV positive, and effects on psychosocial wellness. This study looks at how LGBTQ+ people were able to receive healthcare during the COVID-19 outbreak. Through this study, the variables affecting healthcare access during the COVID-19 pandemic are also observed. The Blue Diamond Society (BDS), a Nepalese LGBT rights organization, provided a database of LGBTQ+ survey results. The data covers 172 samples of Nepalese LGBTQ+ people that were polled in August 2020. To determine the variables that affect the sample's ability to get healthcare, binary logistic regression is used. The study found that members of the LGBTQ+ community who have jobs are 2.673 times more likely to receive healthcare than those who don't. Regarding the age factor, those between the ages of 18 to 24 and 25 to 34 are both less likely to receive healthcare than people aged 35 and up. The results are not optimal for the variables "discrimination and abuse" and "stress/depression," as they do not align with the hypothesis. Following the binary logistic regression analysis, it was discovered that LGBTQ+ individuals who had encountered "discrimination and abuse" because of the COVID-19 epidemic were 2.411 times more likely to obtain health care than those who had not. Similarly, the "stress/depression" variable showed that LGBTQ+ were 2.031 times more likely to obtain healthcare than those with neither stress nor depression. The fact that several groups, like the Blue Diamond Society (BDS), were involved in helping and supporting the LGBTQ+ community during the COVID-19 pandemic can be used to support the findings for "discrimination and abuse" and "stress/depression," even though they are not conventional. Since the survey respondents interacted with community-based organizations (CBOs) that support the BDS, it is likely that if they were suffering from "discrimination and abuse" or from "stress/depression," their reach and access to healthcare increased. Therefore, age, employment, past experiences with abuse and prejudice, as well as stress or depression, can have an impact on LGBTQ+ people's access to healthcare. The results suggested that health promotion initiatives should be specially created to address the needs of each LGBTQ+ population group.

Keywords: *LGBTQ+, COVID-19, healthcare access, pandemic*

INTRODUCTION

Since early 2020, COVID-19 has had a disastrous global impact. The COVID-19 pandemic has severely hampered access to healthcare and the delivery of health services in Nepal. The Nepalese government issued a statewide curfew in March 2020, before the community-level transmission of COVID-19 was detected. The economy was significantly hit by the lockdown, which hampered companies, transportation, educational institutions, and even outpatient service delivery throughout the country [(1)]. As a direct effect of the lockdown, increasing unemployment, poverty, increased inaccessibility to healthcare, and food insecurity has all resulted in undernutrition [(2)]. Healthcare facility closures, combined with a lack of awareness, misinformation, and stigma around COVID-19, have resulted in limited access and concerns about COVID-19 transmission, resulting in healthcare shortages [(3)]. During the first wave of the pandemic, inefficiency and late coordination across the federal, provincial, and local governments interrupted health service use, resulting in 50% of COVID-19 cases and deaths in Nepal's Province 2 in the southeast [(3)]. In the second wave of the pandemic, which began in June 2021, Nepal's case count increased by 137%, a significant and worrying upsurge given the country's already failing healthcare infrastructure [(3)].

The COVID-19 pandemic is a public health emergency that could affect anyone. Owing to the pandemic's lockdown and social isolation, people's regular routines have been disrupted, and social connections have been limited. This is challenging since everyone is struggling to adapt to the newly formed laws and regulations. Although there is no evidence that LGBTQ+ people are more likely to catch COVID-19, several variables indicate their vulnerability from a financial and medical aspect [(4)]. It is a well-known reality that LGBTQ+ people are more likely to face psychosocial stress, such as chronic stress, anxiety, mood disorders, and trauma, which is often overlooked and not spoken about [(5)]. Some common characteristics that tie this diverse population are LGBTQ+ individuals' experiences of discrimination in the form of healthcare disparity, stigma, and a lack of awareness of healthcare requirements among healthcare practitioners [(6)]. In many nations throughout the world, sexual and gender minorities such as lesbian, gay, bisexual, transgender, and queer people face violations of human rights such as healthcare [(7)].

Historically, LGBTQ+ people have had difficulty obtaining health care. Because structural barriers are interrelated and explain the disparity encountered by the LGBTQ+ population on numerous levels, such as socioeconomic, homelessness, and increased incarceration, health equity is a significant factor when barriers are mentioned. The 'Health Stigma and Discrimination model' explains how drivers and facilitators such as societal judgment, socio-cultural factors, and so on lead to stigma based on gender, race, and sexual orientation, which manifests in the form of experienced stigma and practiced stigma, which leads to health-related outcomes [(8)]. Additionally, the LGBTQ+ population's susceptibility during the COVID-19 pandemic might range from stigma and discrimination to economic hardships, healthcare access, immunocompromised status if HIV positive, and psychosocial wellbeing [(8)]. The LGBTQ+ community in Nepal has faced severe suffering as a marginalized and poor element of society during the global epidemic. Because of the COVID-19 pandemic, Nepal's strict lockdown has left a large portion of the LGBTQ+ community facing not only a financial and livelihood crisis but also psychological stress, as many LGBTQ+ people have had to return to their parental homes or communities where they previously faced discrimination [(9)]. The goal of this study is to fill a research gap on the impact of COVID-19 on LGBTQ+ health care access in Nepal.

METHODS

The secondary data used in this study was a survey of LGBTQ+ people in Nepal done by the Blue Diamond Society (BDS), an LGBT rights group in Nepal. The survey, conducted by Christian Aid and Women's Fund Asia and addressed to BDS-affiliated community-based organizations (CBOs), ran from August 20 to 27, 2020. The BDS encompasses 54 CBOs dispersed across Nepal's seven provinces: Bagmati, Lumbini, Gandaki, Madesh, Karnali, Sudurpaschim, and Province 1. The study aimed to look at healthcare access for LGBTQ+ people during the COVID-19 pandemic and the factors that determine healthcare access for LGBTQ+ people during the COVID-19 pandemic. The dependent variable of the study was healthcare access. The independent variables were factors related to sexuality and mental health, which included gender identity, the experience of gender discrimination and abuse, and experience of stress/depression; the demographic and socioeconomic variables included age, education, caste, housing, employment, income loss due to COVID-19 and health information. For the analysis, a quantitative research method was chosen. The measurement tool was an interview questionnaire using 152 questions during the BDS survey. The sample's healthcare access situations were investigated using the Chi-square test. A multivariable logistic regression using binary logistics was used to study factors influencing the sample's

healthcare access. The software used for the analysis was SPSS (version 23).

RESULTS

Table 1, which shows the relationship between factors related to healthcare access for LGBTQ+ in Nepal, is presented below. The results of Table 1 show that when adjusting independent variables such as discrimination and abuse, gender, stress/depression, age, education, caste, employment, health information, housing, and loss of income owing to COVID-19 were contrasted; statistically significant differences in healthcare access were obtained. When discrimination and abuse were compared, we discovered that 8.1% of the respondents suffered discrimination and abuse but did not obtain healthcare. Likewise, 22.1% of those who identified as 'other gender identities' had problems accessing healthcare compared to 33.1% of transgender people who could not access healthcare. In the stress/depression factor, 34.3% who suffered stress or depression had problems accessing healthcare. Regarding age factors, 15.1% of 18- to 24-year-old respondents had problems accessing healthcare. Similarly, of those aged 25 to 34, 21.5% had problems accessing healthcare. Finally, among those aged 35 and up, 18.6% had problems accessing healthcare.

We did not notice a substantial increase in healthcare access by education level for both lower and secondary education categories, with 31.4% of respondents with secondary education unable to access healthcare. In the caste factor, the middle-caste category had the most significant percentage difference between respondents who could receive healthcare and those who could not, at 19.2% and 29.1%, respectively. The difference of 9.9% in the caste variable was not significant, as evidenced by the chi-square and *p* values of 1.964 and 0.375, respectively. In the housing variable, respondents who lived in rented housing were 39.5% had problems accessing healthcare during the COVID-19 pandemic. For the employment variable, 34.9% of respondents had problems accessing healthcare, compared to 20.3% of self-employed or unemployed respondents. Health information is the second-to-last variable in the demographic and socioeconomic variables. 30.2% of respondents who were aware of the government's health information experienced problems accessing healthcare compared to 25.0% of respondents who did not know about health information. In the COVID-19 income loss category, 27.3% of respondents who lost their jobs had problems with healthcare access, whereas 27.9% of respondents who lost their jobs experienced problems.

Table 1: Distribution of healthcare access among LGBTQ+ individuals by independent variables

Variables			Problems in Healthcare access		Total	Chi-square value	*p* value
			No	Yes			
Discrimination and abuse	No	Number	63	58	121	8.792	.003*
		Total %	36.6%	33.7%	70.3%		
	Yes	Number	14	37	51		
		Total %	8.1%	21.5%	29.7%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Gender	Other gender identities	Number	30	38	68	0.19	.890
		Total %	17.4%	22.1%	39.5%		
	Transgender	Number	47	57	104		
		Total %	27.3%	33.1%	60.5%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Education	Lower education	Number	9	15	24	1.129	.569
		Total %	5.2%	8.7%	14.0%		
	Secondary	Number	42	54	96		
		Total %	24.4%	31.4%	55.8%		
	Higher education	Number	26	26	52		
		Total %	15.1%	15.1%	30.2%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Caste	Higher caste	Number	29	27	56	1.964	.375
		Total %	16.9%	15.7%	32.6%		

Variables			Problems in Healthcare access		Total	Chi-square value	*p* value
			No	Yes			
	Middle caste	Number	33	50	83		
		Total %	19.2%	29.1%	48.3%		
	Lower caste	Number	15	18	33		
		Total %	8.7%	10.5%	19.2%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Housing	No rental housing	Number	30	27	57	2.132	.144
		Total %	17.4%	15.7%	33.1%		
	Rental housing	Number	47	68	115		
		Total %	27.3%	39.5%	66.9%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Employment	Employed	Number	50	60	110	0.58	.809
		Total %	29.1%	34.9%	64.0%		
	Self-employed or unemployed	Number	27	35	62		
		Total %	15.7%	20.3%	36.0%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Age	18 to 24	Number	29	26	55	5.511	.640
		Total %	16.9%	15.1%	32.0%		
	25 to 34	Number	34	37	71		
		Total %	19.8%	21.5%	41.3%		
	35 and above	Number	14	32	46		
		Total %	8.1%	18.6%	26.7%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Health information	I know	Number	46	52	98	0.434	.510
		Total %	26.7%	30.2%	57.0%		
	I don't know	Number	31	43	74		
		Total %	18.0%	25.0%	43.0%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Stress/ Depression	No stress or depression	Number	46	36	82	8.136	.004*
		Total %	26.7%	20.9%	47.7%		
	Stress and or depression	Number	31	59	90		
		Total %	18.0%	34.3%	52.3%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		
Income loss due to COVID-19	Yes	Number	25	47	72	5.054	.025
		Total %	14.5%	27.3%	41.9%		
	No	Number	52	48	100		
		Total %	30.2%	27.9%	58.1%		
Total		Number	77	95	172		
		Total %	44.8%	55.2%	100.0%		

The findings in Table 2 show that those who were not stressed or depressed were roughly 66% less likely to have access to healthcare than those who were stressed or depressed. The odds ratio of 0.341 was less than one, yet the confidence interval excluded one. Furthermore, the *p* value was less than .05, indicating that the result was statistically significant. Regarding the age variable, it noted that people in younger age groups

(25–34 or 18–24) were less likely to have access to healthcare than those in older age groups (35+). When it came to income loss due to COVID-19, those who had income loss due to COVID-19 were more likely to have healthcare access than those who did not have any income loss due to COVID-19 (odds ratio is greater than 1, the confidence interval does not include 1, the *p* value is less than .05). Technically, there is no evidence of a link between discrimination, gender, education, housing, or caste and healthcare access since their odds ratios were not significant. However, you might theoretically conclude that people with health information had a better adjusted odds ratio or are more likely to get healthcare, even though this was not statistically significant.

Table 2: Factors related to healthcare access for LGBTQ+ (Multivariate analysis)

Variables	Ranges	Odds Ratio (OR)	95% Confidence Interval		*p* value
			Lower	Upper	
Discrimination and abuse	No	0.049	0.188	0.996	.490
Gender	Other gender identities	0.741	0.347	1.579	.437
Stress/depression	No stress and or depression	0.341	0.166	0.700	.003*
Age	18–24 years	0.406	0.159	1.037	.060
	25–34 years	0.451	0.185	1.100	.080
Education	Lower education	0.933	0.273	3.181	.911
	Secondary	0.964	0.441	2.108	.927
Employment	Employed	2.673	1.049	6.808	.039*
Housing	No rental housing	0.624	0.296	1.313	.214
Caste	Higher caste	0.904	0.331	2.468	.844
	Middle caste	2.064	0.771	5.527	.149
Income loss due to COVID-19	Yes	3.791	1.573	9.133	.003*
Health information	I know	1.112	0.529	2.340	.779

DISCUSSION

Healthcare access was affected by various independent variables. According to this report, 33.1% of transgender people had trouble getting medical care during the COVID-19 pandemic. As transgender persons encounter substantial health disparities in various circumstances, actual or perceived stigma and discrimination within biomedicine and the provision of health care may influence transgender people's willingness and capacity to seek sufficient care [(10)].

The study demonstrates that LGBTQ+ people are more likely to obtain healthcare when they have experienced gender discrimination and abuse. The fact that the Blue Diamond Society (BDS) contacted its community-based organizations (CBOs) for the survey through which they contacted the respondents might be used to explain why there is a negative link. In lower middle-income countries (LMICs), financing plays a significant role in providing health care services [(11)]. The NGOs are commonly used to accomplish public health objectives. This leads to better healthcare access.

For stress/depression, the findings revealed a correlation between increasing healthcare availability and stress/depression symptoms. According to the results, those who are not stressed out or depressed have a 66% lower likelihood of having access to healthcare than those who are. This is perhaps because several organizations, like Mitini Nepal and the BDS, worked to protect LGBTQ+ people during the pandemic. From existing literature, we found that NGOs have a significant amount of power to shield LGBT people from prejudice that could harm their mental health [(12)], which supports this study's finding. According to the findings, LGBTQ+ people aged 18 to 34 had a worse time accessing healthcare than those 35 and older. In comparison, people aged 35 and older, and those between the ages of 18 and 24, are 59.4% less likely to receive healthcare, while those between the ages of 25 to 34 are 54.9% less likely. Due to their stage of development and shifting gender and sexual orientation identities, LGBTQ+ adults between the ages of 18 to 29 are found to have lower rates of healthcare access than other age groups, according to a study published in the LGBT Health journal [(13)]. This finding is in line with prior studies.

The Fundamental Cause Theory (FCT), which contends that socioeconomic factors like education are "fundamental" causes of disease and poor health

because they affect people's access to a wide range of healthcare options, is supported by the analysis' findings that 8.7% out of 14.0% of respondents in the lower education category and 31.4% out of 55.8% of respondents in the secondary education category had trouble accessing healthcare [14].

According to the results, 39.5% of respondents with rental property had the most access to healthcare issues. Financial hardship may have prevented LGBTQ+ from accessing healthcare during the COVID-19 pandemic because they were under stress from not being able to pay their rent and because they are more likely than heterosexuals to encounter housing discrimination [15]. According to the findings, middle-caste LGBTQ+ people were 2.064 times more likely than lower-caste people to have access to healthcare issues, which is contrary to the prediction. The above result may be because the disparity in access to health facilities based on an individual's age, gender, ethnicity, and economic status continues to be a significant barrier preventing people from achieving the highest standard of health possible, leading to subpar health standards and impeding efforts to achieve healthy lives for all [16].

According to the findings regarding the employment factor, LGBTQ+ respondents who were employed had more access to healthcare than those who were jobless or self-employed. People who identify as LGBTQ+ are more likely to work in "highly affected industries" [17]. Additionally, health inequities arise when LGBTQ+ people are less able to get or afford health insurance due to unemployment. Therefore, there is a link between employment and disparate health outcomes. According to research, those who experienced income loss because of COVID-19 are 3.791 times more likely to have access to healthcare than those who did not. Organizations that were involved during the COVID-19 epidemic, including the BDS, FHI360, and Mitini Nepal, particularly for LGBTQ+ afflicted by the pandemic in Nepal, have likely improved access to healthcare. The Adam's Love online support intervention showed that having participants regularly communicate with eCounselors during the lockdown period made them feel less stressed and anxious. Participants also used the real-time eCounseling support for advice on COVID-19 prevention, assistance with health insurance and HIV clinic relocation, ART refill and clinic schedule, and psychosocial support [18], which shows the contribution of non-profits towards healthcare access.

The study's findings in health information indicate a higher adjusted odds ratio of 1.112, which suggests that LGBTQ+ people were 1.112 times more likely to have access to healthcare. Given that it disseminates health information, health information plays a significant role in expanding healthcare access [19]. The result supports the premise that respondents with knowledge of government-provided health information have easier access to healthcare than respondents without such information.

CONCLUSION

The study found that experience of discrimination and abuse, the experience of stress and or depression, and income loss due to COVID as negatively but significantly associated with healthcare access, i.e., LGBTQ+ who experienced discrimination and abuse, stress and or depression, and income loss due to COVID-19 have increased healthcare access. Employment shows a positive association with healthcare access, and health information, although not statistically significant, shows a positive association with healthcare access. All other factors, including gender, age, caste, education, and housing, are not statistically significant and therefore show no association with healthcare access.

RECOMMENDATIONS

Governmental and non-governmental organizations should work together to address discrimination and abuse by having an emergency hotline number to report such instances. For issues of mental health, online counseling can be provided. Health information about the testing center, COVID-19 designated hospital, and vaccination center should be provided. Hormones and dignity kits should be provided on the community level. Community-based housing should be made available for homeless LGBQT+ people by collaborating with governmental and non-governmental groups, the BDS, and its CBOs. Finally, further study is required to properly understand the needs of the LGBTIQ people in Nepal.

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TOOL DEVELOPMENT TO ASSESS CAPACITY BUILDING IMPACT OF THE OPHELIA PROCESS IN LEYTE, PHILIPPINES

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ABSTRACT

Background The Ophelia process is a widely used co-creation process to develop health-literacy responsive interventions for the full diversity of health literacies. The Ophelia approach gathers patients, practitioners and policy makers to identify the health literacy needs of the community by deploying a Health Literacy Questionnaire. This information is used to develop interventions to address needs through case vignettes. Currently, there is no tool to evaluate the health literacy capacity building impact of the Ophelia process.

Objectives The purpose of this research was to evaluate staff capacity building and development of the Ophelia approach, implemented by EpiMetrics, among the staff, participants, and all others involved in Leyte, Philippines. The study also developed and pilot-tested evaluation tools to compare the capacity building impact of the Ophelia process on health literacy competencies of health providers versus health providers who did not participate in the workshops.

Methods This paper reviews and synthesizes approaches to evaluate health literacy responsiveness (HLR) from the literature and proposes a framework for evaluating HLR practice capabilities of personnel. This is a descriptive study which used triangulation of qualitative and quantitative methods to identify health literacy competencies and to validate the quantitative questionnaire. Data were collected using the developed tool and open-ended interviews from 29 Ophelia and non-Ophelia participants. The qualitative and quantitative data were matched to validate the information derived from each method.

Results Participants who scored lower for the confidence ranking questions derived from the tool, reported feeling shy and intimidated in their practice. In comparison, participants who scored high in the confidence ranking questions reported feeling at ease when communicating with patients due to their level of experience and comfort. Results confirm that specific practical competencies necessary for improving HLR were increased throughout the workshops within personal skill domains and interactions with patients and the community. The analysis shows that participants in the Ophelia process did not share the information they learned in the workshops with their colleagues.

Conclusions The qualitative data confirms the usefulness of the tool that was developed as part of this research. The tool may be tailored and used to evaluate the capacity building impact of the Ophelia workshops in other parts of the world. Upcoming workshops should emphasize sharing the learned skills from the workshops to increase staff capacity throughout the entire health system.

Keywords: *Health literacy, Health practitioner competencies, Non-communicable diseases, Philippines*

INTRODUCTION

Health literacy (HL) is defined by WHO as the "*ability of individuals to gain access to, understand and use information in ways which promote and maintain good health*" [(1)]. Research shows that people with low HL may have higher rates of hospitalization, less knowledge about their illness and treatment, and worse health outcomes than the rest of the population [(2)]. The power of HL allows persons to take control of their health decisions and prevent and manage diseases. HL is a key determinant to leading a healthy life.

The way in which health providers and systems make information, environments, supports, resources, and communication available and accessible to diverse patients and communities is described as HL responsiveness (HLR) which is critical to address health equity. It is essential that research focuses on HLR capacity building for both health workers and agencies. Assessing the HLR and capacity of healthcare workers may be more important than assessing HL of each and every patient or community member [(3)]. To be HL-sensitive, health care workers need to be HL-competent. HL competencies are defined by Coleman [(4)] as the "*knowledge, skills, and attitudes which health professionals need in order to address low HL among consumers of health care and health information*."

BACKGROUND

The OPtimising HEalth LIteracy and Access to Health information and services (Ophelia) Process was created as an approach to "improve health and equity by increasing the availability and accessibility of health information services in locally-appropriate ways" [(5)]. It is a bottom-up approach which focuses on understanding and responding to HL diversity rather than as an average. The process is separated into three phases. Phase 1 employs the HL Questionnaire (HLQ) or equivalent, to determine diverse HL strengths, weaknesses, and preferences of people within the community. Phase 2 uses simple stories (vignettes) illustrating the locally-identified HL profiles in order to engage various local stakeholders in developing responses to the identified strengths and weaknesses. During Phase 3, these health interventions are then implemented through various improvement cycles, and evaluated [(5)]. Originating and applied throughout Australia, Ophelia interventions are now implemented throughout the world in higher-, middle-, and lower-income countries.

The Philippines faces a triple burden of disease threat including a rise in non-communicable diseases (NCDs), communicable diseases, and the impact of climate change and globalization on health [(6)]. Of the top ten causes of death and causes of disability-adjusted life years (DALYs) in 2017, the 6th- and 7th-rank causes are NCDs. Although the country has seen recent health improvements (as per national reports), these findings often hide the inequalities when measuring several health outcomes. Addressing HL can ultimately lead to making health-related, and healthy decisions regarding prevention and management of NCDs. Thus, HL is extremely important to address, specifically in the Philippines.

EpiMetrics, a Philippines-based health research institution focuses on advancing health equity [(7)], and it was awarded a grant in 2017 by the Department of Health of the Philippines to research HL within the country. EpiMetrics teamed up with Ophelia researchers to employ the Ophelia process in the Philippines. At the time of this research, the project was in the transition from Phase 2 and 3 of the Ophelia approach in Leyte [(7)]. This site was chosen by EpiMetrics due to the city's willingness to work with the health research organization, and given its human development index score (HDI), which is similar to the region's HDI score. During Phase 1 EpiMetrics used the HL questionnaire (HLQ) to identify different profiles of HL strengths, weaknesses, and preferences. These issues include having difficulty engaging with health care providers, having sufficient information to manage their conditions effectively, not feeling supported by their health care providers, and not being able to understand the health information they are provided with [(7)]. Health care providers, including school nurses, municipal health officers, nutrition officers, midwives, and barangay health workers (local community health staff) participated in HL training workshops with the objectives of increasing knowledge and understand of HL, gaining knowledge and understanding of the Ophelia process, and measuring the HL of the participants.

This paper reviews and synthesizes approaches to evaluation of HLR from the literature, and proposes a framework for evaluating the HLR practice capabilities of personnel. The paper also presents a pilot test of an approach to HL capability assessment that can be integrated into the Ophelia approach, one of the most widely used approaches to build HLR practice.

METHODS

Part A: Review of frameworks and tool-sets for increasing HLR in organizations

The purpose of this aspect of the research was to identify and review all commonly-used frameworks and toolkits that are applied for the assessment and improvement of organizational HLR. Selected frameworks needed to have associated tools for evaluation and improvement rather than being simply conceptual. Tools were identified by searching for review articles on "health literacy responsiveness", "organizational health literacy", "health literate hospital" and "health literate heath care," as well as by consulting with leading HL experts. Both the conceptual frameworks and the most commonly used assessment tools were analyzed and the results are presented in Table 1.

Part B: Proof of concept of an approach to HLR capability assessment within the Ophelia process

The analysis of frameworks and tools identified a gap related to the assessment of health provider competencies for HLR practice. A key aspect of these competencies was identified as the ability to adapt practice to respond appropriately to a person's different HL strengths, weaknesses, and preferences. Since the vignettes created in the Ophelia process capture this HL diversity in the local community, we considered that assessing people's ability and confidence to respond to diverse vignettes would be one approach to assessing competencies for HLR practice. To test the feasibility of this approach, two very different case vignettes were selected for this study regarding age group, sex, health issues, and HL profiles. The vignettes were fictional characters, Belen and Cardo, that represented two of the eight HL profiles identified through the Ophelia process. The vignettes were the same as those used in the Ophelia process. The vignette for Cardo was considered to be more complex and more challenging for HLR practice than the vignette for Belen.

The created tool was split into two parts, a quantitative section that asked subjects to rank different aspects of their confidence, and a set of short questions. This questionnaire comprised 15 confidence-ranking statements, with ranking on an 11-point scale, with 0 disagreeing as strongly as possible, and 10 agreeing as strongly as possible with the statement. The short-answer section of the tool asked questions regarding what the subjects thought about Belen and Cardo's main issues in accessing health services, what their HL strengths and weaknesses were, and if they would provide health advice in different ways to the two characters. The second part of the tool consisted of semi-structured interviews comprised of eight open-ended questions.

Both parts of the tool were reviewed and approved by an external expert from Mahidol University, by two human research ethics committees, and by the staff of EpiMetrics.

The quantitative confidence results were averaged for each participant to determine an overall average score on a scale from 0-10 for the confidence-ranking portion of the tool. The surveys quantified the scales used to rank participants' confidence levels. Statistical Package for the Social Sciences (SPSS) and Excel tables and graphs were developed to present the responses. The overall average confidence scores were grouped into three levels to represent high, medium, and low confidence (Table 2). Tertile ranks were matched with interview responses to examine the relationship between the scores from the questionnaire and what subjects spoke about. The surveys were compared between those who participated and those who did not participate in the Ophelia process.

Analysis of the interviews took place following the transcription of the audio recordings and notes taken during the interview. The steps of analysis included the following: (1) Reading and summarizing main features of each interview; (2) Coding responses to identify positives and negatives about the HL competencies identified in Table 1; (3) Using the codes identified based on the HL competencies in Table 2 to develop themes; and (4) Connecting the themes to construct a narrative based on the headings in Table 2. The researchers examined the HL competencies in Table 1 within each narrative to assess the capacity built among participants in the Ophelia project. The researchers sought expertise from a qualitative research specialist from the EpiMetrics team who was not involved with the Ophelia project in Leyte, to double code the transcriptions to validate the results.

As proof-of-concept for the feasibility of using Ophelia vignettes, the researchers were looking at the following indicators:

Training participants were more equally-confident in dealing with both the simple and the more complex vignette than non-participants; People with high levels of experience in education for behavior change were more equally-confident than those with low levels;
Confidence levels on the rating scales were supported by qualitative data such as their ability to identify specific strategies.

In matching the quantitative and qualitative data, the researchers compared the confidence scales with the narratives provided in the interviews to see if the confidence levels recorded by the participants matched the answers provided in the interview. For example, the researchers explored whether the level of confidence

that was identified matched what the participants said they learned and gained from going through the process. This helped confirm the validity of the responses to both the questionnaires and the interview questions by making sure both responses aligned and supported each other.

POPULATION AND SAMPLE SIZE

This study recruited and interviewed 29 people. The inclusions criteria were (1) Having participated in the Ophelia process (based on EpiMetrics records) during Phase 1 and 2; and (2) Being on site in Leyte, but not participating in the process (based on records of the Rural Health Office). The researcher recruited 14 Ophelia participants and 15 non-Ophelia participants. The positions of the interviewees were categorized as shown in Table 2.

Ethical Declaration

Ethical approval of the study protocol was sought through the Saint Cabrini Medical Center-Asian Eye Institute Ethics Review Board in the Philippines, and the Thammasat University Ethics Review committee before the start of the field work phase. Informed consent was obtained before the interviews and surveys were deployed. Anonymity of participants was protected at all times.

RESULTS

Part A: Review of frameworks and tool sets for increasing HLR in organizations

Table 1 shows seven frameworks for conceptualizing and assessing HLR that also had commonly-used tools for self-assessment and improvement. Most of the assessment tools were focused at the organizational level, with the exception of a few tools that assessed very particular communication skills (teach-back and cross-cultural communication). There were no tools that broadly assessed practitioners' competency for HLR practice.

Table 1 HL Approaches & Evaluation Methods

Different Approaches	Competencies of a HL practitioner	Evaluation Methods
Ten Attributes to Health Literate Health Care Organizations (8)	• Integration of HL into policy, planning, evaluation • Preparation of workforce to be health literate • Use of HL strategies during effective communication to ensure understanding • Meets a wide range of HL needs • Provides easy access to health information and services • Explains cost and coverage of health plans • Addresses HL in high-risk situations • Materials designed are easy to use & understand	• CAHPS HL Item Sets • Various organizational audit tools
Organizational HLR Framework (9)	• Data collection & community needs identification • Community consultation & enabling consumer participation • Provides health information, health education programs • Provides supportive service environment	• Organizational HL Self-Assessment Tool • HLE 2 Assessment Tool • CAHPS HL Item Sets
Vienna Framework (10)		• Vienna Health Literate Organization (V-HLO) questionnaire
Teach-Back Method (11)	• Uses plain language • Uses non-shaming, open-ended questions • Asks patient to explain directions or conversation back in their own words • Able to explain again and re-check if the patient does not teach back correctly • Uses reader-friendly materials	• Conviction and Confidence Scale (for clinicians) • 'Are You Using Teach-Back?' Survey • Teach-Back Self-Evaluation and Tracking Log

Different Approaches	Competencies of a HL practitioner	Evaluation Methods
Cultural Competency (12)	• Acknowledgement of cultural beliefs and values • Inclusion of family members • Increase knowledge about attitudes, beliefs and values of cultural groups • Enhances self-awareness of attitudes towards minorities • Patient-centered communication	• HL Questionnaire • Cultural competence questionnaires
Universal Precautions Toolkit (13)	• Patient-centered communication • Clearly-written communication • Self-management and empowerment • Supportive systems	• Primary Care HL Assessment
Undergraduate Curricula (14)	• Distinguish HL levels among different people • Patient-centered communication • Clearly-written communication • Self-management and empowerment • Uses teach-back to check comprehension and retention	• Integrated into many clinical undergraduate programs; however there is no core curriculum widely used • Tool for Assessing Cultural Competence Training (TACCT)

Part B: Proof-of-concept of an approach to HLR capability assessment within the Ophelia process

The mean difference in scores for the Ophelia and non-Ophelia groups for Belen was 0.125, and -0.622 for Cardo. The mean difference in scores was much smaller for Belen than they were for Cardo. The overall average confidence-ranking scores were higher for the case study about Belen, with a mean of 8.75 compared to a mean of 8.26 for Cardo. The mean standard deviation for Belen was 1.28 compared to 1.49 for Cardo.

A majority of the responses fell within the confidence-ranking range of 7-10. Every confidence-ranking statement had consistently over 14% (at least 4 out of 29 subjects) of the responses with a confidence ranking of 10. The lowest score recorded for the confidence-ranking portion of the tool was one out of ten for 2 separate statements by a community health volunteer who did not participate in the Ophelia program. The lowest overall average was 6.07 combined score for both of the case studies by a different community health volunteer who did not participate in the workshops either.

Participants were asked what HL meant to them. Fully 22 out of 29 participants gave suitable responses, while seven had forgotten or did not know what the term meant. Of these, four were non-Ophelia participants but, significantly, they include three subjects who participated in Phases 1 and 2 of the Ophelia process, but did not know what the term meant or failed to recall the significance of HL.

In response to the question to Ophelia participants, "*What did you learn from the workshops*?" the following themes emerged; Communication skills (4 responses); How to make patients feel more comfortable (4); How to extract patient information more effectively (1); and Age-specific communication approaches (3). The remaining 15 subjects who did not participate in the Ophelia process were asked if their colleagues ever shared the information learned in the workshops with those who did not participate; 14 answered negatively. One non-Ophelia participant said she remembered seeing the workshops in the Rural Health Office and asked her coworker what was going on, but they did not discuss anything more.

Participants were asked, *"What techniques do you use to ensure that the community members understand you?"* to better understand how practitioners approach their patients. This was analyzed to determine if the subjects used different approaches for different patients, if any at all. The responses were analyzed thematically and coded into seven themes with the responses quantified as follows: Uses the teach-back method (5 responses); Uses visual aids (9); Gives examples while explaining (3); Uses basic language and is to-the-point while explaining (9); Builds trust with patients (9); Shows consideration of language and cultural differences (4); and Seeks patient feedback (1). In comparing interview responses across confidence-tertile rankings, the main difference was that participants in the highest confidence level reported they felt confident and at ease when communicating with patients. They attributed this to their experience and comfort. Those who scored low reported they felt shy and intimidated.

Almost all participants expressed that some of the challenges they faced are external, such as patient attitude and condition. Although the subjects highlighted some challenges they face in their everyday communication with patients, those who scored high on the confidence-ranking questions provided examples of how they work through these challenges and the techniques they use. Alternatively, the low-scoring subjects tended not to provide examples of how they overcome these challenges. Instead, those respondents did not accept full responsibility for their communication techniques and interactions with their patients, and often blamed the patient instead.

Table 2 Confidence Score Groupings by Role of Subjects

	Community Health Volunteers		Midwives/ Nurses		Supervisory Role		Total	Total Ophelia	Total Non-Ophelia
	Ophelia	Non-Ophelia	Ophelia	Non-Ophelia	Ophelia	Non-Ophelia			
High	-	3	2	1	3	1	10	5	5
Medium	-	-	6	3	1	-	10	7	3
Low	-	3	2	4	-	-	9	2	7
Total	-	6	10	8	4	1		14	15

DISCUSSION

This study identified the fact that, while there is a large range of tools to assess organizational HL, there is a lack of tools to assess the HLR practice competencies of individual practitioners. Those tools that do exist are focused on a limited range of specific skills rather than assessing people's ability to respond flexibly to diverse HL strengths, weaknesses, and preferences. This is a limitation for activities to improve HLR in general and for evaluation within Ophelia projects in particular.

This project tested a simple model of assessing participant's confidence and planned responses to two widely-different HL profiles produced within the Ophelia process as an indicator of their ability to respond flexibly to different HL profiles. There was evidence of some relationship between reported confidence, ranked at three levels, and their planned responses.

There were many limitations to the design given that the study occurred approximately one year after the original workshops. In addition, the number of sample participants was small, and the groups who did and did not participate in the Ophelia workshops differed in many respects. For these reasons most emphasis was placed on the results of the qualitative data collection. Despite these limitations there is evidence of differential responses to the two vignettes in terms of both confidence and qualitative responses, suggesting that the ability to respond to different vignettes may be a useful means to evaluate people's ability to be responsive to different HL strengths, weaknesses, and preferences.

CONCLUSIONS AND RECOMMENDATIONS

There is a lack of tools for assessing capabilities of health personnel for HLR practice. Quantitative and qualitative assessment of people's ability to respond to vignettes of diverse HL profiles has potential in assessing these capabilities. However, the process needs to be tested more thoroughly, including the following:

There should be before-and-after assessment of confidence in relation to the vignettes for people participating in Ophelia workshops and training

Researchers should use at least four vignettes to identify people's ability to respond to a larger range of HL profiles

There should be prior selection of participants and non-participants.

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THE DETERMINANTS OF HAPPINESS AMONG FOOD DELIVERY RIDERS IN THE BANGKOK METROPOLITAN AREA DURING THE COVID-19 PANDEMIC

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ABSTRACT

COVID-19 has spread rapidly around the world. According to the guidelines, working from home and keeping a social distance is one of the most effective ways to reduce exposure to COVID-19. As a result, food delivery services have grown rapidly; however, the psychological effects such as the happiness of certain groups like food delivery riders have not been revealed. This cross-sectional study was conducted from April to May 2022 among food delivery riders who worked in the Bangkok metropolitan area to ascertain the happiness among Thai food delivery riders who work in the Bangkok metropolitan area, and to determine the predictors of their happiness. Happiness was measured on a Likert scale single-item question and categorized into two categories. Descriptive statistics, chi-square test, bivariate analysis, and multiple logistic regression were performed. A total of 422 completed data were used for analysis. Over half of the participants were male (68%) and worked full-time jobs as food delivery riders (55.9%). One-third (33.2%) of participants indicated they have high happiness. The multiple logistic regression identified that being female (AOR = 2.14; 95% CI = 1.32, 3.47), more than 30 years (AOR = 2.11; 95% CI = 1.33, 3.36), sleeping well within the last seven days (AOR = 1.69; 95% CI = 1.04, 2.75), and feeling less stressed (AOR = 3.09; 95% CI = 1.92, 4.97) are more likely to report high level of happiness. This study's findings emphasize the importance of promoting vaccine boosters, motivating precautionary measures for COVID-19, and providing social support from food delivery companies and families to riders. In particular, this support is essential among young riders aged 18 to 29.

Keywords: *COVID-19, Food delivery, Happiness, Riders, Thailand*

INTRODUCTION

The 2019 novel coronavirus (COVID-19) rapidly spread worldwide and was classified as a global pandemic by the World Health Organization (WHO) in March 2020 [1]. According to the WHO Thailand situation report, Thailand has faced five waves of COVID-19 as of May 2022 and reported 4,337,568 total cases and 29,196 total deaths [2]. In the interim, the WHO recommended prevention measures for COVID-19 infection, such as hand hygiene, a physical distance of at least one meter, and isolation [3]. Working from home is one of the effective preventive methods to reduce virus infection exposure; therefore, several Thai workers were allowed to work from home and reduce their outside home activities [4].

Food delivery services (FDSs) became a necessary means during the COVID-19 pandemic due to online purchases [5] and kept with social distancing requirements [6]. The use of FDSs by residents in the Bangkok metropolitan area increased 1.6 times from 2.42 to 3.90 meals per week during the COVID-19 pandemic [7]. The FDS has grown rapidly, and the presence of food delivery riders is indispensable. Although riders are in high demand, as mentioned above, they have an increased risk of infection due to the high chance of personal contact. However, the psychological impact on riders during the COVID-19 pandemic is unclear.

It has been reported that Thailand ranks high in happiness levels compared to other countries [8]. Nevertheless, Thais were psychologically affected by COVID-19. A study that compared the psychological effect of COVID-19 in seven Asia countries revealed that Thai participants had the highest score in depression, anxiety, and stress during COVID-19 [9]. However, their participants were the general public, so riders' psychological effects are not apparent. Additionally, there are limited studies considering factors associated with riders' happiness. Hence, this study aims to ascertain the happiness level among Thai riders in terms of psychological. Furthermore, it assessed the predictors of happiness during the COVID-19 pandemic.

METHODS

STUDY DESIGN

This study was a quantitative cross-sectional study. Participant responses were collected through an online questionnaire.

STUDY POPULATION

This survey subjects were food delivery riders who worked in the Bangkok metropolitan area. These regions have reported increased demand for FDSs during the COVID-19 pandemic [7]. Therefore, our study recruited food delivery riders who worked in the Bangkok metropolitan area, could read and write Thai, and worked as a rider for at least four months.

RESEARCH INSTRUMENT

The questionnaire was developed from previous literature and translated to Thai by a professor in public health. Three professors working in public health approved the contents of the questionnaire. It consisted of six parts: 1) personal characteristics, 2) COVID-19 preventive behaviors, 3) health conditions, 4) work conditions, 5) economic conditions, and 6) happiness level. This study measured happiness by a single question, "What is your happiness now?" After measuring on the five-point Likert scale, it fell into two categories: low happiness level (1 = very unhappy, 2 = unhappy, and 3 = neither happy nor unhappy) and high happiness level (4 = happy, and 5 = very happy).

DATA COLLECTION PROCEDURES

Data collection was conducted after approval by the Ethical Committee of the university. The questionnaire was revised to measure internal consistency with the pre-test and clarify the questionnaire before collecting data. The e-form questionnaire was distributed by research assistants who worked as riders from April to May 2022.

DATA ANALYSIS

A total of 422 completed questionnaires were used, and data were analyzed by the IMB SPSS version 21. Descriptive analysis was performed to explain happiness level, personal characteristics, COVID- 19 preventive behavior, health, work, and economic conditions. Additionally, the study used a chi-square test to identify the association between the independent variable and the happiness level. The variables with a *p* value of < 0.25 in the bivariate analysis were selected to identify the predictors of riders' happiness in the multiple logistic regression. A *p* value < 0.05 was considered statistically significant.

ETHICAL APPROVAL

The research proposal received ethical approval from Mahidol University IRB in April 2022. This study certificate of approval number is 2022/047.1104. The participant's ethical consent was obtained by answering and collecting the e-form.

RESULTS

Table 1 shows the socio-demographic and happiness level. The majority of respondents were male (68%). The average age of the respondents was 31.53 years, ranging from 18 to 60 years (*SD* = 8.37). Most respondents (98.3%) had at least one COVID-19 vaccination, with an average number of vaccinations of 2.46 (*SD* = 0.91). Our results revealed that riders with high happiness levels during the COVID-19 pandemic were 33.2%.

Table1 General Characteristics of Participants and Happiness Level (n = 422)

Individual characteristics	Number (n)	Percentage (%)
Sex		
Male	287	68.0
Female	135	32.0
Age		
18–29	189	44.8
30–39	163	38.6
Over 40	70	16.6
(*M* = 31.53, *SD* = 8.37 [18, 60])		
Number of family members		
Alone	30	7.1
2	60	14.2
3	72	17.1
4	120	28.4
5	72	17.1
Over 6	68	16.1
(*M* = 4.02, *SD* = 1.88 [1, 12])		
Registered company		
Company A	191	34.9
Company B	164	30.0
Company C	133	24.3
Company D	41	7.5
Company E	6	1.1
Company F	6	1.1
Company G	5	0.9
Company H	1	0.2
Working experience (year)		
1	145	34.4
2	117	27.7
More than 3	160	37.9
(*M* = 2, *QD* = 1 [1, 10])		
Working hours		
Less than 5	112	26.5
6–10	247	58.5

Individual characteristics	Number (n)	Percentage (%)
More than 11	63	14.9
(*M* = 7.65, *SD* = 3.01 [1, 18])		
Type of work		
Full-time	236	55.9
Part-time	186	44.1
Number of vaccinations (dose)		
Never	7	1.7
1	59	14.0
2	131	31.0
3	184	43.6
4	41	9.7
(*M* = 2.46, *SD* = 0.91 [0, 4])		
Experience of COVID-19 positive		
Yes	139	32.9
No	283	67.1
Self-rate risk to COVID-19		
Very high	36	8.5
High	74	17.5
Moderate	67	15.9
Low	123	29.1
Very low	122	28.9
Happiness level		
Low	282	66.8
High	140	33.2

Table 2 presents the association between factors and happiness levels from the chi-square test. The factors of sex, age, the experience of COVID-19 positive, self-rated risk of COVID-19, and the frequency of wearing a mask were associated with happiness level ($p < .05$). In addition, health, work, and economic conditions were found to be significantly associated with happiness levels ($p < .05$ and $< .001$).

Table 2 Chi-Square Test on Factors Associated with Happiness Levels (n = 422)

Individual characteristics	Happiness levels				
	Low n (%)	High n (%)	Pearson Chi-Square		*p* value
Sex			8.578		.003**
Male	205 (71.4)	82 (28.6)			
Female	77 (57.0)	58 (43.0)			
Age			4.950		.029*
18–29	137 (72.5)	52 (27.5)			
More than 30	145 (62.2)	88 (37.8)			
Number of family members			0.340		.560
0–3	111 (68.5)	51 (31.5)			
More than 4	171 (65.8)	89 (34.2)			
Working experience (years)			0.698		.404
≦2	179 (68.3)	83 (31.7)			
> 3	103 (64.4)	57 (35.6)			
Working hours			2.886		.089
0–6	95 (61.7)	59 (38.3)			
More than 7	187 (69.8)	81 (30.2)			
Type of work			0.022		.883
Full-time	157 (66.5)	79 (33.5)			
Part-time	125 (67.2)	61 (32.8)			

Individual characteristics	Happiness levels				
	Low n (%)	High n (%)	Pearson Chi-Square		*p* value
Number of vaccinations (doses)			1.735		.188
0–2	138 (70.1)	59 (29.9)			
3–4	144 (64.0)	81 (36.0)			
Experience of COVID-19 positive			5.977		.014*
Yes	104 (74.8)	35 (25.2)			
No	178 (62.9)	105 (37.1)			
Self-rate risk to COVID-19			6.619		.010*
Moderate-High	106 (59.9)	71 (40.1)			
Low	176 (71.8)	69 (28.2)			
COVID-19 preventive behaviors					
Wearing a mask			7.975		.005*
Low-Moderate	17 (45.9)	20 (54.1)			
High	265 (68.8)	120 (31.2)			
Handwashing			1.907		.167
Low-Moderate	16 (55.2)	13 (44.8)			
High	266 (67.7)	127 (32.3)			
Social distancing			0.427		.513
Low-Moderate	21 (61.8)	13 (38.2)			
High	261 (67.3)	127 (32.7)			
Using of spray hand sanitizer after delivery			1.614		.204
Low-Moderate	20 (57.1)	15 (42.9)			
High	262 (67.7)	125 (32.3)			
Avoiding crowded areas			0.105		.746
Low-Moderate	39 (65.0)	21 (35.0)			
High	243 (67.1)	119 (32.9)			
Health, work, and economic conditions					
BMI (kg/m²)			0.167		.682
< 22.9	155 (67.7)	74 (32.3)			
≧23.0	127 (65.8)	66 (34.2)			
Regular drug taking			5.309		.033*
No	257 (68.7)	117 (31.3)			
Yes	25 (52.1)	23 (47.9)			
Experience with traffic injury within the last 12 months			5.011		.025*
No	181 (63.3)	105 (36.7)			
Yes	101 (74.3)	35 (25.7)			
Perceived self-health status			1.407		.236
Poor	24 (58.5)	17 (41.5)			
Good-Excellent	258 (67.7)	123 (32.3)			
Frequency of sleeping well within the last 7 days			15.991		< .001***
Never-Sometimes	167 (75.6)	54 (24.4)			
Always	115 (57.2)	86 (42.8)			
Frequency of feeling stressed			36.800		< .001***
Always	169 (80.9)	40 (19.1)			
Sometimes-Never	113 (53.1)	100 (46.9)			
The control of the job			21.151		< .001***
Poor-Neutral	24 (40.7)	35 (59.3)			

Individual characteristics	Happiness levels			
	Low n (%)	High n (%)	Pearson Chi-Square	*p* value
Good	258 (71.1)	105 (28.9)		
Frequency of feeling pressure during delivery of customers' food			9.027	.003**
Always-Neutral	188 (62.5)	113 (37.5)		
Never	94 (77.7)	27 (22.3)		
Self-rate risk of accident and injury			11.379	.001**
High-Moderate	68 (54.8)	56 (45.2)		
Low	214 (71.8)	84 (28.2)		
The extent of being afraid of losing a job			7.983	.005**
High	160 (73.1)	59 (26.9)		
Low-Moderate	122 (60.1)	81 (39.9)		
The extent of salaries' reflection on work			0.015	.902
Not reflect	47 (66.2)	24 (33.8)		
Neutral-Reflect	235 (67.0)	116 (33.0)		
Satisfaction with salary			0.243	.622
Low-Moderate	154 (65.8)	80 (34.2)		
High	128 (68.1)	60 (31.9)		
Frequency of concern about providing for family or own life			25.370	< .001***
Always-Neutral	108 (54.5)	90 (45.5)		
Never	174 (77.7)	50 (22.3)		

Note: *p <.05, ** p <.01, *** p <.001

Table 3 shows that riders with high happiness levels were females (AOR = 2.14; 95% CI = 1.32, 3.47), more than 30 years (AOR = 2.11; 95% CI = 1.33, 3.36), vaccinated with 3 to 4 doses (AOR = 1.87; 95% CI = 1.33, 3.89), felt a low risk of COVID-19 transmission (AOR = 0.42; 95 % CI = 0.26, 0.70), and wore a mask frequently (AOR = 0.39; 95% CI = 0.20, 0.78). In addition, regarding the health, work, and economic conditions, riders with high happiness level were those who slept well within the last seven days (AOR = 1.69; 95% CI = 1.04, 2.75), less stress (AOR = 3.09; 95% CI = 1.92, 4.97), felt good control of their job (AOR = 0.38; 95% CI = 0.21, 0.70), and were never concerned about providing for family or their own life (AOR = 0.47; 95% CI = 0.29, 0.76).

Table 3 Predictors of Happiness Levels by Bivariate Analysis and Multiple Logistic Regression (n = 422)

Individual characteristics	Happiness levels			
	COR (95%CI)	*p* value	AOR (95%CI)	*p* value
Sex (Ref: Male)				
Female	1.88 (1.23, 2.88)	.004**	2.14 (1.32, 3.47)	.002**
Age (Ref: 18–29)				
More than 30	1.60 (1.06, 2.42)	.027*	2.11 (1.33, 3.36)	.002**
Working hours (Ref: More than 7)				
0–6	1.43 (0.96, 2.18)	.090	1.27 (0.81, 1.99)	.294
Number of vaccinations *(Ref: 0-2)*				
3–4	1.32 (0.87, 1.98)	.188	1.87 (1.33, 3.08)	.015*
Experience of COVID-19 positive *(Ref: Yes)*				
No	1.75 (1.16, 2.76)	.015*	0.63 (0.39, 1.01)	.055

Individual characteristics	Happiness levels			
	COR (95%CI)	*p* value	AOR (95%CI)	*p* value
Self-rate risk to COVID-19 *(Ref: Moderate-High)*				
Low	0.56 (0.39, 0.88)	.010*	0.42 (0.26, 0.70)	< .001***
COVID-19 preventive behaviors				
Wearing a mask (Ref: Low-Moderate)				
High	0.39 (0.20, 0.76)	.006**	0.39 (0.20, 0.78)	.008**
Handwashing (Ref: Low-Moderate)				
High	0.59 (0.27, 1.26)	.171	0.80 (0.32, 1.98)	.630
Using of spray hand sanitizer after delivery *(Ref: Low-Moderate)*				
High	0.64 (0.32, 1.28)	.207	0.68 (0.31, 1.59)	.390
Health, work, and economic conditions				
Regular drug-taking *(Ref: Yes)*				
No	0.50 (0.27, 0.91)	.023*	0.58 (0.30, 1.14)	.114
Experience with traffic injury within the last 12 months *(Ref: Yes)*				
No	0.60 (0.38, 0.94)	.026*	1.23 (0.74, 2.05)	.430
Perceived health status *(Ref: Poor)*				
Good-Excellent	0.67 (0.35, 1.30)	.238	0.50 (023, 1.08)	.079
Frequency of sleeping well within the past 7 days *(Ref: Low)*				
High	2.31 (1.53, 3.50)	< .001***	1.69 (1.04, 2.75)	.033*
Frequency of feeling stressed *(Ref: High)*				
Low	3.74 (2.42, 5.79)	< .001***	3.09 (1.92, 4.97)	< .001***
The control of the job *(Ref: Poor-Neutral)*				
Good	0.28 (0.16, 0.49)	< .001***	0.38 (0.21, 0.70)	.002**
Frequency of feeling pressure during delivery of customer's food *(Ref: Always - Neutral)*				
Never	0.48 (0.29, 0.78)	.003**	0.72 (0.42, 1.26)	.254
Self-rate risk of accident and injury *(Ref: High-Moderate)*				
Low	0.48 (0.31, 0.74)	.001**	0.81 (0.49, 1.33)	.401
The extent of being afraid of losing the job *(Ref: High)*				
Low-Moderate	1.80 (1.20, 2.71)	.005**	1.08 (0.67, 1.74)	.749
Frequency of concern about providing for family or own life *(Ref: Always-Neutral)*				
Never	0.35 (0.23, 0.53)	< .001***	0.47 (0.29, 0.76)	.002**

Notes: *p < .05, ** p < .01, *** p < .001, Crude Odds Ratios = COR, Adjusted Odds Ratio = AOR, and CI = Confidence Interval

DISCUSSION

To the best of our knowledge, this study is the first to identify the association between Thai food delivery riders' happiness and predictors during the COVID-19 pandemic. It revealed that about one-third of riders (33.2%) had high happiness levels during the COVID-19 pandemic, and in particular, females over 30 years had high happiness levels. A study about individuals' mental well-being during the COVID-19 period used large-scale longitudinal data from 16 to 95 years old in the United Kingdom and found that younger adults had increased psychological distress than other generations. Especially young men struggled more [10]. Hence, females may have had higher happiness levels than males because our study population's age (M = 31.53) was young. However, further research needs to include middle-aged riders to clarify the effects of rider gender differences.

Our study showed that the predictors of riders' high happiness levels were those who got more than three vaccinations and had a low risk of COVID-19 on a self-assessment. A previous study revealed that especially young men were hesitant about the COVID-19 booster. In addition, subjective health and future anxiety were predictors of hesitancy [11]. Moreover, it was revealed that psychological factors and perceived risk of COVID-19 infection are related [12]. Therefore, those who got more than three vaccinations and had a low risk of COVID-19 on a self-assessment may feel less subjective health anxiety, future anxiety, and psychologically stressed and may let high happiness levels. Second, our study identified wearing a mask frequently was a predictor of high happiness levels. Wang et al. (2021) reported that the precautionary measures for COVID-19 have been associated with reduced psychological effects, indicating those who wear masks more often have lower anxiety and depression scores [13]. Therefore, the rider's preventive behavior may have reduced the psychological burden and brought happiness. However, it needs to consider the limitation of causal relationships by cross-sectional study.

Furthermore, regarding health, work, and economic conditions, the predictors of riders' high happiness levels were those who slept well within the last seven days, had less stress, had good control of the job, and were never concerned about providing for family or own life. A study on adults over 18 years before and during the lockdown revealed a decrease in well-being accompanied by delayed and poorer quality sleep [14]. In addition, it was reported that there is a relationship between the degree of job stress and well-being [15]. These studies agree with our results; hence our study emphasizes that sleeping well and reducing stress are important factors in maintaining a high happiness level for the rider. Regarding the association between control of the job, a previous study revealed that job control enhances job satisfaction and connects to the intention to stay [16]. For riders, feeling good control of food delivery to their customers may create a strong sense of responsibility for the work and increase job satisfaction. Finally, our study shows the importance of promoting vaccine boosters, motivating preventive measures, and social support to riders.

STUDY LIMITATION

Our research had some limitations. Since this study was a cross-sectional study and online data collection, it is impossible to clarify the causal relationship between happiness and factors. Second, our findings cannot be applied to generalize all riders working in the Bangkok metropolitan area. Our study was a limited group, and the data may be biased due to the convenient sampling method.

CONCLUSION

The findings highlight the importance of promoting booster vaccinations, motivating precautionary measures of COVID-19, and providing social support to riders, particularly among young male riders aged 18–29. Social support from food delivery companies and families can help reduce riders' stress, improve sleep quality, and lead to high happiness.

RECOMMENDATIONS

Our study recommends promoting vaccine boosters and infective prevention behaviors to riders by policymakers and food delivery companies in terms of psychological. For instance, the distribution of free masks is one effective prevention. In addition, food delivery companies should provide psychological support (e.g., regular stress checks), especially for young males aged 18 to 29 years.

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PREVALENCE AND ASSOCIATED FACTORS OF FOOD INSECURITY AMONG BANGKOK RESIDENTS DURING THE COVID-19 PANDEMIC

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ABSTRACT

Introduction The prevalence of food insecurity (FI) in Thailand has fluctuated over time. The Covid-19 pandemic has had a substantial impact on Thailand's food networks, resulting in severe FI during 2020-21. The factors that contribute to food insecurity differ greatly across developed and developing countries. Consequently, this study may contribute toward achieving some of the 2030 Sustainable Development Goals.

Objective The aim of this study was to estimate the prevalence and associated factors of FI among a sample Bangkok residents during the Covid-19 pandemic.

Methods This research used a cross-sectional study design, and data were collected in all 50 districts of Bangkok. Respondents consisted of 440 persons age 18-60 years who were selected by convenience sampling through an online social media platform. Participants filled out a self-administered questionnaire via Google Forms, and questions asked about the respondent's general and household characteristics. The questionnaire included the Food Insecurity Experience Scale (FIES). Data were cleaned and coded in Excel, and analyzed with SPSS Version 28 using univariate, bivariate (Chi-square), and multivariate (logistic regression) statistics.

Results The majority of the 440 participants were female, age between 46 and 55 years, single, living with family, childless, graduated with at least a bachelor's degree, employed, earning more than 20,000 baht per month, and not the head of the family. The study revealed that nearly two out of five (39.4%) participants experienced FI due to the impact of Covid-19 (mild 26%, moderate 8%, and severe 6%). FI was significantly associated with younger age, living with a disabled person, lack of ownership of one's domicile, and reliance on food aid. Those age 36-45 and 46-55 were 0.29 and 0.14 times less likely to experience FI than their younger counterparts. However, FI increased 3.4 times when households had at least one disabled member (OR=3.369; P=0.003), increased 2.7 times for those who rented their domicile (OR=2.738, P=0.005), and increased 2 times if the participant had received food aid (OR=2.055, P=0.001).

Conclusions The results indicate that almost half the sample had experienced some level of FI, meaning that the Thai Covid epidemic posed a threat to food security, particularly among young adults, those living with a disabled person, those who rented their domicile, or had received financial/food aid either from the government or the private sector. Therefore, additional research and the relevant stakeholders should focus on food assistance interventions and policy to protect young adults and households with disabled members from FI.

Keywords: *food insecurity, food security, food insecurity experience scale (FIES), Covid-19 impact, urban food* ***insecurity***

INTRODUCTION

Food security is a broad concept that spans environmental, agricultural, social, and economic dimensions [1]. Its opposite, or food insecurity (FI), occurs when a person does not have regular access to safe and nutritious food for a healthy diet, growth, and wellbeing. FI could be due to a food shortage, financial difficulty, or basic lack of food supplies. FI is considered a multilayered concept which can be classified at the following levels: (1) Availability — National; (2) Accessibility — Household; (3) Utilization — Individual; and (4) Stability — with time as a key factor [1]. The levels of these four pillars of food security vary by context and country. In the northern hemisphere, economic accessibility is a major food security issue. However, in high-income countries with robust and sustainable food systems, FI crises are usually quickly resolved [2-7]. By contrast, countries in the southern hemisphere are vulnerable to prolonged disruptions of the transportation infrastructure which can threaten food access. Despite being a net food exporter, Thailand is still vulnerable to FI given its large number of citizens who are already suffering from hunger and socioeconomic inequality [1, 5, 6, 8-12]. Thus, this study first reviewed the literature on the situation of FI and other related food and nutrition issues in Thailand in the recent past.

The authors of existing studies on the impact of Covid-19 all agreed that the pandemic has had a devastating impact on FI at both the individual and household levels and, collectively, this has created major public health challenges for many countries around the world [1-5, 8, 13, 14]. Nonetheless, the factors that contribute to FI vary significantly across developed and developing countries, and this study investigated the prevalence and associated factors of FI among a convenience sample of Bangkok residents during Thailand's Covid-19 epidemic.

METHODS

STUDY DESIGN

This research used a cross-sectional design, and data were collected during the month of June, 2022.

STUDY AREA AND POPULATION

Respondents were selected from all 50 districts in Bangkok, and the inclusion criteria were age 18 years or older and having resided in Bangkok for at least six months prior to the survey.

SAMPLING TECHNIQUE

Participants were selected by convenience sampling through an online social media platform.

MEASUREMENT TOOL

The survey used a web-based, self-administered questionnaire with 49 questions divided into five sections as follows: Part 1: Screening and general characteristics (15 items); Part 2: Household characteristics (8 items); Part 3: Covid-related characteristics (3 items); Part 4: Food/financial aid (4 items); and Part 5: Food Insecurity Experience Scale (FIES) (8 main items and 11 sub-items). According to the UN Food and Agriculture Organization (FAO), the revised FIES instrument is an appropriate tool to monitor the impact of FI during the Covid-19 pandemic since items have been added to reflect potential consequences of Covid [15]. Even before Covid, FIES had been successfully applied around the world, and it provides core data on progress toward attainment of the UN Sustainable Development Goals (SDG). FIES has been proven to efficiently produce timely and accurate data [15]. For the purpose of this research, the FIES scores were grouped as follows: Food secure (0 points), mild FI (1-3 points), moderate FI (4-6 points), and severe FI (7-8 points) [15].

DATA ANALYSIS

DESCRIPTIVE ANALYSIS

Independent variables include age, sex, marital status, living arrangement, educational attainment, employment status, occupation, and individual monthly income. Household characteristics include household composition, family role, house tenure, and place of residence. Covid-related factors include respondent history of Covid-19 infection and Covid vaccination status. Respondents were asked whether they received any food aid or financial assistance to help them cope during the Thai Covid epidemic. The dependent variable (food insecurity) was constructed as a binary Yes/No item.

INFERENTIAL ANALYSIS

The Chi-square test was performed to examine the association between all independent variables and the dependent variable (i.e., FI, or food insecurity). Variables with statistically-significant associations (at $p<0.05$) were included in the multiple logistic regression analysis. Adjusted odds ratio and 95% confidence intervals were calculated. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) Version 28 licensed by Chulalongkorn University.

RESULTS

DESCRIPTIVE STATISTICS OF THE SAMPLE

Table 1 shows that the majority of the 440 participants were female (67.3%), age 46-55 (31.1%), unmarried (58.2), living with family (84.3%), having no children (59.1%), having a bachelor's degree (72%), working for the government (55.9%), and earning more than 20,000 baht per month (51.8%). The most common living arrangement was as a nuclear family (39.5%). Most lived in a household with less than three members (59.8%). Most were childless (57.7%); most were age 60+ years (53.6%), and nearly all lived in a household without a disabled member (91.1%). Most participants had not been infected with Covid-19 (73.4%), and the majority had already received at least three doses of Covid-19 vaccination (86.6%). Two out of three respondents (67.7%) had received Covid-related financial or food assistance.

Table 1: Individual Characteristics, Household Characteristics, Covid-19 Situation, and Receipt of Food/Financial Aid (n=440)

General characteristics	Frequency (%)
Age (years)	
Under 26	120 (27.3)
26-35	62 (14.1)
36-45	121 (27.5)
46-55	137 (31.1)
Gender	
Female	296 (67.3)
Male	137 (31.1)
LGBTQ+	7 (1.6)
Marital status	
Single	256 (58.2)
Married	150 (34.1)
Divorced/widowed/separated	34 (7.7)
Number of children ever born	
None	260 (59.1)
One or more child	180 (40.9)
Educational Attainment	
Bachelor’s degree or lower	317 (72.0)
Higher than a Bachelor’s degree	123 (28.0)
Occupational Status	
Unemployed	10 (2.3)
Employed (full-time, part-time, or free-lance)	316 (71.9)
Student	80 (18.2)
Other	34 (7.7)

General characteristics	Frequency (%)
Occupation	
Government sector	246 (55.9)
Private sector	37 (8.4)
Own business/self-entrepreneur	83 (18.9)
Retired	60 (13.6)
Others	14 (3.2)
Monthly income during 2022 (baht)	
≤ 20,000	212 (48.2)
> 20,000	228 (51.8)
Housing arrangements	
Living alone	68 (15.5)
Living with friends or relatives	44 (10.0)
Married couple living alone	56 (12.7)
Married couple with child(ren)	174 (39.5)
Extended family	55 (12.5)
Skipped-generation	43 (9.8)
Number of household members	
< 3	263 (59.8)
3 or more	177 (40.2)
Number of children in the household	
Zero	254 (57.7)
One or more	186 (42.3)
Number of elderly (age 60+ years) in the household	
Zero	236 (53.6)
One or more	204 (46.4)
Number of persons with a disability in the household	
Zero	401 (91.1)
One or more	39 (8.9)
Family role of respondent	
Head of the family	160 (36.4)
Not the head of the family	259 (58.9)
Other	21 (4.7)
Domicile ownership status	
Owns the domicile themself	192 (43.6)
Rents	79 (18)
Family owns the domicile	169 (38.4)
Bangkok arrangement?	
BIC	188 (42.8)
BUF	170 (38.6)
BSA	82 (18.6)
Covid-19 infection	
Never infected (to their knowledge)	323 (73.4)
Infected	117 (26.6)
Covid-19 vaccination (doses)	
≤ two	59 (13.4)
Three or more	381 (86.6)
Financial support (Covid-related)	
Did not seek or receive additional support	142 (32.3)
Support from government, private sector, etc.	298 (67.7)
Food support (Covid-related)	
Did not seek or receive additional support	142 (32.3)
Support from government, private sector, etc.	298 (67.7)
Has Covid-19 insurance	
Yes	199 (45.2)
No	241 (54.8)

PREVALENCE OF FI AMONG BANGKOK RESIDENTS DURING THE COVID-19 PANDEMIC

Table 2 shows the prevalence of FI among this sample of Bangkok residents during the Thai Covid-19 epidemic. Nearly two out of five (39.4%) of all participants experienced FI due to the impact of Covid-19 and the government containment measures.

Table 2: Severity of FI Attributable to the Impact of Covid-19 and Containment Response (n=440)

FI by level of severity	Frequency (%)
None (0)	267 (60.7)
Mild (1-3)	112 (25.5)
Moderate (4-6)	35 (8.0)
Severe (7-8)	26 (5.8)

ASSOCIATION BETWEEN INDEPENDENT VARIABLES AND FI AMONG BANGKOK RESIDENTS

Table 3 shows significant associations between participant characteristics and FI due to the impact of the Thai Covid-19 epidemic and containment response. The significant factors include age, marital status, number of children, educational attainment, occupational status, occupation, monthly income prior and during the Covid-19 epidemic, number of household members with a disability, domicile ownership status, Covid-19 infection, and receipt of Covid-related financial/food aid (p-value <0.001).

Table 3: Association between Independent Variables and FI Attributable to the Impact of the Thai Covid-19 Epidemic and Containment Response among Bangkok Residents (n=440)

Variables	Total n (%)	FI		p-value
		No n (%)	Yes n (%)	
Age (years)				<0.001***
≤ 25	120 (27.3)	45 (16.9)	75 (43.4)	
26-35	62 (14.1)	32 (12)	30 (17.3)	
36-45	121 (27.5)	86 (32.2)	35 (20.2)	
46-55	137 (31.1)	104 (39)	33 (19.1)	
Marital status				<0.001***
Single	256 (58.2)	136 (50.9)	120 (69.4)	
Married	150 (34.1)	110 (41.2)	40 (23.1)	
Divorced/widowed/separated	34 (7.7)	21 (7.9)	13 (7.5)	
Number of children ever born				<0.001***
Zero	260 (59.1)	139 (52.1)	121 (69.9)	
One or more	180 (40.9)	128 (47.9)	52 (30.1)	
Educational attainment				<0.001***
Bachelor's degree or lower	317 (72.0)	176 (65.9)	141 (81.5)	
Higher than Bachelor's degree	123 (28.0)	91 (34.1)	32 (18.5)	
Occupational status				<0.001***
Unemployed	10 (2.3)	2 (0.7)	8 (4.6)	
Employed (full-time, part-time, free-lance)	316 (71.9)	210 (78.7)	106 (61.3)	
Student	80 (18.2)	33 (12.4)	47 (27.2)	
Other	34 (7.7)	22 (8.2)	12 (6.9)	
Occupation				<0.001***
Government sector	246 (55.9)	167 (62.5)	79 (45.7)	
Private sector	37 (8.4)	29 (10.9)	8 (4.6)	
Own business/self-entrepreneur	83 (18.9)	33 (12.4)	50 (28.9)	
Retired	60 (13.6)	25 (9.4)	35 (20.2)	
Other	14 (3.2)	13 (4.9)	1 (0.6)	
Bath monthly income prior to Covid-19 (2020)				<0.001***
≤ 20,000	231 (52.5)	110 (41.2)	121 (69.9)	
> 20,000	209 (47.5)	157 (58.8)	52 (30.1)	

Variables	Total n (%)	FI No n (%)	Yes n (%)	p-value
Baht monthly income during Covid-19 (2022)				<0.001***
≤ 20,000	212 (48.2)	96 (36.0)	116 (67.1)	
> 20,000	228 (51.8)	171 (64.0)	57 (32.9)	
Number of disabled household members				<0.001***
Zero	401 (91.1)	254 (95.1)	147 (85.0)	
- One or more	39 (8.9)	13 (4.9)	26 (15.0)	
Family role				<0.001***
Head of the family	160 (36.4)	111 (41.6)	49 (28.3)	
Not the head of the family	259 (58.9)	148 (55.4)	111 (64.2)	
Other	21 (4.7)	8 (3.0)	13 (7.5)	
Covid-19 infection				<0.001***
Never infected (to their knowledge)	323 (73.4)	218 (81.6)	105 (60.7)	
Infected	117 (26.6)	49 (18.4)	68 (39.3)	
Financial support (Covid-related)				<0.001***
Did not seek or receive aid	142 (32.3)	102 (38.2)	40 (23.1)	
Support from government, private sector, etc.	298 (67.7)	165 (61.8)	133 (76.9)	
Food support (Covid-related)				<0.001***
- Did not seek or receive aid	142 (32.3)	102 (38.2)	40 (23.1)	
- Support from government, private sector, etc.	298 (67.7)	165 (61.8)	133 (76.9)	

Note: statistical significance *p≤0.05, **p≤0.01, ***p≤0.001

RISK OF FI AMONG A SAMPLE OF BANGKOK RESIDENTS DURING THE THAI COVID-19 EPIDEMIC

Table 4 presents results of the analysis for those factors that were significantly associated with FI, i.e., age, occupation, number of disabled household members, domicile ownership status, Covid-19 infection, Covid-related financial/food aid. These variables had bivariate statistically-significant associations with the dependent variable at p-value < 0.05; with R^2 0.445.

Table 4: Risk of FI by Characteristics of a Sample of Bangkok Residents during the Thai Covid-19 epidemic (n=440)

Variable	Crude Odds Ratio (OR) (95% CI)	P-value	R^2 0.445
Age (years)			
<= 25	Ref.		
26-35	0.502 (0.201-1.255)	0.141	
36-45	0.287 (0.114-0.723)	0.008**	
46-55	0.136 (0.046-0.398)	<0.001**	
Number of disabled household members			
Zero	Ref.		
One or more	3.369 (1.513-7.505)	0.003**	
Domicile ownership status			
Owner	Ref.		
Renter	2.738 (1.366-5.490)	0.005**	
Family-owned	1.188 (0.647-2.179)	0.578	
Covid-19 infection			
Never infected (to their knowledge)	Ref.		
Infected	2.425 (1.467-4.007)	<0.001***	
Financial support (Covid-related)			
Did not seek or receive aid	Ref.	0.017*	
Government, private sector, community, etc.	1.853 (1.117-3.075)		
Food support (Covid-related)			
Did not seek or receive aid	Ref.	<0.001***	
Government, private sector, Community, etc.	2.055 (1.336-3.163)		
Nagelkerke R^2	0.445		

Note: statistical significance *p≤0.05, **p≤0.01, ***p≤0.001

DISCUSSION

This study found that nearly two in five (39.4%) of this sample of Bangkok residents experienced FI due to the impact of the Thai Covid-19 epidemic. The level of the impact ranged from mild (25.5%), to moderate (8.0%), to severe (5.9%) FI. A FIES report estimated that, during 2018-20 (i.e., pre-Covid), nearly 30% (or 21 million) residents of Thailand had suffered from moderate to severe FI at some point. This study also applied the FIES questionnaire, however the time period (2022) was after the Covid-19 epidemic had plateaued in Thailand, and the situation was beginning to return to a 'new normal.' The FIES instrument is an efficient tool to rapidly assess nutritional risk of a population. There are numerous research publications of the application of FIES [9], including in such countries as Jordan [3], Saudi Arabia [10], Chile [11], League of Arab States [12], Zanzibar [16], and the UK [2]. Globally, the Covid-19 pandemic certainly aggravated the FI situation, and this trend is likely to continue given the worsening of the effects of man-made climate change, war (e.g., Ukraine), and socio-political conflict [5, 17].

This study was conducted among an online convenience sample of residents of Bangkok. The analysis found that persons under age 25 were at elevated risk of FI, and that finding is consistent with a number of studies which found that this age group is vulnerable due to the demands and stress of school, the workplace, and/or unemployment [2-4, 6, 7, 18]. In addition, this study found that living in a household with at least one disabled member increased the odds of FI by 3.4 times. Other studies have noted that disability often leads to FI [3, 19]. This study also found that renters were three times as likely as homeowners to be food insecure. According to several previous studies [2, 3], the majority of young adults are renters, and are more likely to be lower-income since they are just starting out in their career or living independently for the first time [2, 3, 14]. Consistent with prior findings, people who tested positive for Covid-19 were more likely to experience FI. Covid-19 disproportionately affects the lower socioeconomic strata of societies since those individuals have less resources to self-quarantine for extended periods of time. They also are more likely to live in overcrowded dwellings with minimal social isolation, and work in front-line jobs that don't allow them to work from home. The initial outbreaks of Covid-19 in Bangkok occurred in places of poor sanitation and ventilation [20]. People who required financial or food aid were twice as likely to experience FI as those who did not. Past studies show that people who receive financial and food aid are more likely to be food insecure, and that financial support lowers FI [11, 21, 22].

LIMITATIONS

The participants in this study were 440 Bangkok residents who were selected by convenience sampling through an online social media platform. Even though the participants were distributed throughout the 50 districts of the city, it is highly unlikely that this sample is representative of the larger population of Bangkok residents. Therefore, this study may underreport the vulnerable population or marginalized groups, such as people who live in slum communities or lower-income households, homeless people, refugees, those who are unable to read and write Thai, or those who lack access to the social media platform.

STRENGTHS

Despite the limitations, this research is one of a small number of studies of the prevalence and associated factors of FI in Bangkok. In addition, this study was conducted during Thailand's Covid-19 epidemic and, thus, may provide some lessons in preparation for future calamities.This study highlights the importance of strengthening food systems, especially for disadvantaged communities, and addressing socioeconomic inequality. The findings can be used as a benchmark for future research on this topic.

CONCLUSIONS

This study analyzed FI among residents of Bangkok during the Covid-19 epidemic in Thailand. Owing to the lack of research on the topic, FI in Thailand may appear to be a minor issue at the present time. Nevertheless, this study documented a significant level of FI in Bangkok during the Covid-19 epidemic, as nearly two in five respondents experienced some level of FI. The associated risk factors for FI are being under 25 years of age, being elderly, living in a household with at least one disabled person, being a renter, having had Covid-19 infection, and having received either financial and food aid. The results of this study may be beneficial as a baseline for assessing the impact of FI on a broader scale.

RECOMMENDATIONS

During the pandemic, Covid-19 significantly impacted Thailand's food systems, including food production, trade, commerce, and the supply chain, resulting in severe threats to food security. Future research should focus on the impact of a pandemic on population health and other policy interventions associated with food and financial assistance to protect young adults and the disabled population from FI, as well as the likelihood of reaching the SDG by 2030. From a medical standpoint, having a disability is recognized as an individual burden that should be treated or cured. Nevertheless, from a public health and social perspective, disability is the interaction between persons with impairments and an environment replete with physical, attitudinal, communication, and social obstacles. Research suggests that the government should implement more sustainable policies instead of providing cash hand-outs to vulnerable members of society. For example, people with disabilities need access to universal design of inclusive infrastructure and steady employment. In addition, local interventions should promote healthcare monitoring of urban residents' health status and FI.

ETHICAL DECLARATION

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

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PERCEPTIONS ON THE PROPER DISPOSAL OF USED FACE MASKS IN THE COVID-19 ERA AMONG NAKHON PATHOM PROVINCE RESIDENTS OF THAILAND

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ABSTRACT

In the COVID-19 era, wearing face masks is one of the preventive measures applied worldwide. As a result, the consumption and production of face masks increased due to the mandatory wearing of face masks. As the use of face masks is growing, the potential risk of spreading infection and environmental pollution becomes higher with improper use. Furthermore, the impact of improper disposal of used face masks is the consequences of people's activities; hence, the perception of disposal of used face masks needs to be assessed. This study aims to assess the individual's perception of proper disposal of used face masks in the COVID-19 era among the residents of Nakhon Pathom province. A descriptive cross-sectional survey was conducted in three districts of Nakhon Pathom province in May 2022. Questionnaires were adapted from the constructs of Protection Motivation Theory, validated by three experts, and reliability tested with Cronbach's Alpha (more than 0.7). Preliminary data of 158 participants were used for the analysis. More than half of the participants (53.2%) have a low level of perception, and just under half (51.9%) have poor knowledge of properly used face mask disposal. Chi-square analysis reported a significant association between the level of knowledge, COVID-19 infection experience, occupation, and residents' area, and the level of perception with a *p* value < .05. Spearman's Correlation resulted in a strong positive correlation between knowledge and perception of used face masks disposal. The findings revealed that the people have low perception and poor knowledge of disposing of used masks properly. Enforcing health promotion and information on the proper disposal of used face masks by public health officials is essential for the community to ensure the safety of public health and the environment. Also, the government must consider timely oriented and user-friendly modes of disposal guidelines for used masks to prevent further public health problems and environmental pollution.

Keywords*: COVID-19 era, disposal, perception, protection motivation theory, using face masks*

INTRODUCTION

On January 31, 2020, COVID-19 was declared a global pandemic by the World Health Organization (WHO) [1]. COVID-19 is very contagious, so the cases drastically increased, and people suffered from mild to severe respiratory symptoms leading to death in many countries. In February 2022, the total number of confirmed cases was over 400 million, and total death cases were over 5.7 million globally [2]. In Thailand, there were nearly 2.4 million confirmed cases and approximately 22,000 deaths as of January 26, 2022 [3]. On November 26, a new Omicron variant was discovered in South Africa [4, 5]. The COVID-19 problem is still ongoing across Thailand. It has been over two years, and COVID-19 still cannot be fully controlled [4]. Many countries initially adopted lockdowns, travel restrictions, and quarantine measures to prevent transmission, but due to these measures, many sectors stopped their functions. As a result, these countries applied other measures of face mask wearing, hand washing with soap, social distancing, and vaccination [1].

In the pre-pandemic period, mask waste was not a concern because of its inexistence in public places. Still, masks became a critical consideration in the COVID-19 era because the issues arise from the waste generated by the general population due to mandatory face masks enforced by the respective governments [6, 7]. With daily face mask usage being over 7 billion, nearly 129 billion face masks were needed per month based on the world's total urban population [8]. Used face masks can make a large amount of waste, burdening existing waste management [9]. The more people consume, the more the face mask industries must produce to cover their needs. Then, more waste is created, which leads to an adverse effect on public health and the environment, especially in developing countries with weak waste management systems [10, 11].

The impact of used face masks on public health and the environment is very high. It can affect short-term and long-term consequences ranging from further spread of infection to pollution of land and water channels, which is harmful to aquatic organisms, and disruption of the ecosystem [6]. Among the global regions, 54% of the total daily utilization of face masks came from Asia [8]. For Thailand, the estimated number of daily face masks used was more than 57 million pieces; discarded face masks were 171 tons per day [8]. Also, the annual total estimated plastic waste generation, including face mask waste, was nearly 19,000 tons, the percentage of inadequately managed waste was 60%, and mismanaged waste was about 62% [10]. It is seen that the waste problem is challenging in Thailand, and COVID-19 induced face mask waste is an added burden on existing issues.

According to studies on face mask waste disposal during COVID-19, most people dispose of mask waste with general waste and throw it in public places [12, 13]. These are improper ways of disposal. The potential of the virus transmission in the public increases without proper disposal of soiled face masks and potentially infectious waste and will negatively impact COVID-19 prevention in public health [14, 15]. In addition, the negligent behavior of a human in using face masks disposal in public areas such as sidewalks, gutters, and waterways results in the blockage of water bodies, endangerment of aquatic organisms, and ending up with microplastic pollution in the seas and oceans as an environmental concern [16]. The protection motivation theory (PMT) explained the theoretical aspect of preventive behaviors and focused on the importance of risk perception to reduce the consequences of improper waste disposal. According to the PMT, the decisions of people to practice preventative behaviors are adjusted initially on perceived vulnerability, perceived severity, the perceived reward of maladaptive behaviors, the perceived self-efficacy and response efficacy, and perceived cost [17]. Hence, in this preliminary survey, the perception of individuals on proper disposal of used face masks was assessed based on the constructs from PMT.

METHODS

STUDY AREA AND DESIGN

Nakhon Pathom province was selected because it is situated adjacent to the highest COVID-19 cases areas in the Bangkok Metropolitan Regions, according to the Thailand situation report on January 26, 2022 [3]. The transmission will expand to the Nakhon Pathom anytime because of dynamic population movement across the regions. The risk of COVID-19 is high without proper disposal of face mask waste [11]. According to Hantoko et al., the appropriate disposal of used face masks is essential for every country [8]. Therefore, the descriptive cross-sectional study of individuals' perception of proper disposal of used face masks was implemented among the residents of Nakhon Pathom province in Thailand.

TARGET POPULATION

The sample population was Thai citizens over 18, of both genders, residents of Nakhon Pathom, and those who had online access, and could understand the Thai language. The three districts (Mueang Nakhon Pathom, Nakhon Chai Si, and Phutthamonthon) were selected by lottery. Participants who were mentally or physically disabled were considered exclusion criteria.

RESEARCH INSTRUMENT

The structured questionnaires were developed by the tools of PMT. The questionnaires were created in English and then translated into Thai with the help of advisors. For content validity, the three experts in the field of public health and environmental background in AIHD carefully reviewed the details of constructs and verified the contents. Part A was for the general characteristics of participants, and Part B was for the perception of people. The constructs of PMT assessed the perception of individuals on the severity of public health and the environment with improper disposal, on the vulnerability of getting an infection and environmental pollution without proper disposal, perceived reward as the ease of doing inappropriate behavior, self-efficacy of proper disposal, the perception of the effectiveness of recommended disposal, and perceived cost as the degree of the inconvenience of proper disposal. All used a 5-point Likert scale with four sub-questions ranging from strongly disagree to strongly agree.

PROCEDURE

The questionnaire was created using Google forms and was distributed by introducing a QR code in the public areas to reach the residents. Pre-testing was done with 30 participants, and the original questionnaires were edited after pre-testing. The constructs of PMT had Cronbach's alpha > 0.7. An estimated 150 participants were required for preliminary data depending on the district's population. Data were collected in May 2022.

DATA ANALYSIS

The total response rate was over 100%. The analysis was performed using Statistical Packages for the Social Sciences (SPSS, version 26). Descriptive statistics were used to represent respondents' general characteristics and perception levels. Before starting the analytical test, the data were checked for normal distribution by the Kolmogorov-Smirnov test. The significance was *p* value <.05, which showed the data were not normally distributed. Then, the Chi-square test and Spearman's correlation were applied to assess the association and correlation.

RESULTS

GENERAL CHARACTERISTICS AND LEVEL OF PERCEPTION OF THE PARTICIPANTS

Table 1 shows the socio-demographic characteristics, modifying variables, and participants' perceptions in the preliminary test. More than half of the participants (55.7%) were female, and the dominant age group was adults aged between 18 and 39, with a median age of 30 years and QD of 18.25 [18]. Among the participants, 44.3 % resided in Muang Nakhon Pathom district, and more than half of the sample lived in municipality areas. Roughly 61.4% of participants had a higher education level, and 46.2% were employed. Most of the participants (88.4%) had no experience of COVID-19 infection. Most participants (94.3%) could access information on disposing of used face masks from the local government, television, or social media. The median value resulting from the scoring was used as a cut-off point to classify the level of knowledge and perception. More than half of the participants had poor knowledge of properly used face mask disposal. Moreover, most participants (74.7%) did not know that the surgical masks were made from plastic-based materials, and 89.9% of participants answered that surgical face masks could be recycled. More than half (53.2%) of participants had a low perception of properly used face mask disposal.

Table 1 General Characteristics and Level of Perception of Participants (n = 158)

Items	Frequency(n)	Percentage (%)
Sex		
Male	70	44.3
Female	88	55.7
Age Group		
Adult (18–39)	110	69.6
Middle-Aged Adult (40–59)	38	24.1
Senior Adult (60 and above)	10	6.3
Median = 30; QD = 18.25; Max = 77, Min = 18		
District of Resident		
Muang Nakhon Pathom	70	44.3
Nakhon Chaisri	56	35.4
Phutthamonthon	32	20.3
Living in Municipality Area		
No	81	51.3
Yes	77	48.7
Education Level		
Undergraduate and Lower	61	38.6
Graduate and Higher	97	61.4
Occupation		
Self-employed	62	39.2
Unemployed	23	14.6
Employed	73	46.2
Experience of COVID-19 Infection		
No	108	88.4
Yes	50	31.8
Information Accessibility on How to Dispose of Used Masks		
No	9	5.7
Yes	149	94.3
Level of Knowledge about Used Face Mask Disposal		
Poor (0–5)	82	51.9
Good (6–8)	76	48.1
Median = 5; QD = 2; Max = 8, Min = 2		
Level of Perception on Proper Used Face Mask Disposal		
Low (24–81)	84	53.2
High (82–120)	74	46.8
Median = 81; QD = 14; Max = 113, Min = 60		

ASSOCIATION BETWEEN GENERAL CHARACTERISTICS AND LEVEL OF PERCEPTION

The association between general characteristics, modifying variables, and perception of individuals on proper disposal of used face masks is shown in Table 2. The chi-square results reported that the perception of proper disposal of used face masks was significantly associated with the district of residence, having experience of COVID-19 infection, level of knowledge, and occupation of participants (p values < .05 and < .001).

Table 2 Association of General Characteristics and Level of Perception

Characteristics	Level of Perception		Pearson Chi-Square	p value
	Low n (%)	High n (%)		
Sex			3.447	.63
Male	43(61.4)	27(38.6)		
Female	41(46.6)	47(53.4)		
Age Group			2.698	.259
Adult (18–39)	54(49.1)	56(50.9)		
Middle Age Adult (40–59)	23(60.5)	15(39.5)		
Senior Adult (60 and above)	7(70.0)	3(30.0)		

Characteristics	Level of Perception		Pearson Chi-Square	*p* value
	Low n (%)	High n (%)		
District of Residence			11.538	.003**
Muang Nakhon Pathom	45(64.3)	25(35.7)		
Nakhon Chaisri	30(53.6)	26(46.4)		
Phutthamonthon	9(28.1)	23(71.9)		
Living in Municipal Area			1.577	.209
No	47(58.0)	34(42.0)		
Yes	37(48.1)	40(51.9)		
Education Level			2.239	.135
Undergraduate and Lower	37(60.7)	24(39.3)		
Graduate and Higher	47(48.5)	50(51.5)		
Experience of COVID-19 Infection			15.764	< .001**
No	69(63.9)	39(36.1)		
Yes	15(30.0)	35(70.0)		
Information Accessibility			3.670	.084
No	2(22.2)	7(77.8)		
Yes	82(55.0)	67(45.0)		
Level of Knowledge			42.394	< .001**
Low	64(78.0)	18(22.0)		
high	20(26.3)	56(73.7))		
Occupation			13.067	.001**
Self-employed	44(71.0)	18(29.0)		
Unemployed	9(39.1)	14(60.9)		
Employed	31(42.5)	42(57.5)		
Note: * *p* value < .05, ** *p* value < .01.				

CORRELATION OF KNOWLEDGE, EACH CONSTRUCT OF PMT AND PERCEPTION

According to Spearman's *rho* correlation coefficient in Table 3, the knowledge of adequate disposal of used face masks had a strong positive correlation to perceived severity, perceived vulnerability with *rho* > .6, moderate positive correlation to self-efficacy, and response efficacy with *rho* value > .3, and moderate negative correlation to perceived cost with *rho* = -.324. Finally, overall knowledge had a strong positive correlation with the overall perception of properly used face mask disposal.

Table 3 Correlation of Knowledge, Each Construct of PMT and Perception

Spearman's Rho	Overall Knowledge	Perceived Severity	Perceived Vulnerability	Perceived Reward	Perceived Self-efficacy	Response Efficacy	Perceived Cost	Overall Perception
Overall Knowledge	1.000							
Perceived Severity	.673**	1.000						
Perceived Vulnerability	.686**	.781**	1.000					
Perceived Reward	-.056	-.070	.059	1.000				
Perceived Self-efficacy	.364**	.388**	.458**	.134	1.000			
Response Efficacy	.470**	.486**	.590**	.271**	.702**	1.000		
Perceived Cost	-.324**	-.394**	-.355**	.320**	-.220**	-.221**	1.000	
Overall Perception	.554**	.671**	.755**	.497**	.653**	.782**	-.023	1.000
Note: ** Correlation is significant at the .01 level (2-tailed)								

DISCUSSION

To the best of the author's knowledge, the present study is the first to apply PMT constructs to assess the perception of proper disposal of used face masks during the COVID-19 era. The preliminary survey showed that the level of perception and knowledge on proper disposal of used face masks was low among the residents. The finding of a poor level of knowledge on the refusal of used face masks was contrary to the result of Limon et al. [19]. The poor knowledge score depended mainly on the incorrect answers to two items: "surgical masks are made from plastic-based materials and used surgical masks can be recycled." Limon et al. showed that more than 90% of Filipino respondents had the proper knowledge of these items [19]. In our study, although most residents accessed information on how to dispose of used masks from local government, television, or social media, the information alone cannot make a good perception. Therefore, precise and correct information needs to be promoted, and the methods and facilities of disposal must be provided to reduce the risk of public health threats and environmental pollution.

Our study showed that the perception of proper disposal of used face masks was low. Similar, as shown in Didar-Ul Islam et al.'s study in Bangladesh, which pointed out that most participants perceived a low level of PPE-related waste disposal [16]. The findings of Didar-Ul Islam et al. also revealed an association between the perception of PPE related waste disposal and female gender, urban residents, and higher education level [16]. These findings were not similar to our study that showed significant association with COVID-19 infected experience, level of knowledge, and occupation, as some literature explained that individual perception differs with experience, circumstances, expectation, and efficacy [20]. Moreover, the level of knowledge and the level of perception had significantly associated in our study. This finding was incongruent with Awosan et al. in Sokoto, Nigeria, which stated no association between risk perception and respondents' knowledge. But their study was on the hazards of unsanitary solid waste disposal [21]. It can be asserted that the disposal of used face masks is more specific than other waste disposal and should not be considered in the same way. Therefore, formulating the proper used masks disposal needs to be specified by providing accessible places and facilities with acceptable methods of refusal.

There was no similar study on the assessment of the association between the perception of proper disposal of used face masks and the level of knowledge of our vital information. Most of the literature mentioned that they were modifying variables for protective behaviors. According to a previous study on household hazardous waste management in Nakhon Nayok, Thailand, the high level of knowledge resulted in excellent engagement in managing household hazardous waste [22]. The pro-environmental behavior applied by PMT showed a positive association between perceived self-efficacy but a negative association between perceived reward and perceived cost with the protective behaviors [23]. Our study revealed a positive correlation between perception and knowledge on proper disposal of used face masks, but not for behavior. Since the pre-existing plastic waste has already damaged the environment, the face mask waste generated by COVID-19 is an added issue in the global community. Due to the absence of strong public policies, lack of public awareness, and poor management, the risk of environmental and public health impacts are so high [9]. By identifying the people's perceptions and knowledge, the policymakers can consider sustainable policy and promote the awareness program with a clear message.

STUDY LIMITATIONS

There were some limitations in this study. Selection bias will be possible because data was collected in three districts only. As the participants had to answer a self-administered survey, there would be social desirability and recall bias. This study was only a preliminary survey; the sample size obtained was small, and the generalization was uncertain. Therefore, further analysis should be carried out with a large sample size.

CONCLUSION

The preliminary survey results revealed a low level of perception and knowledge of the proper disposal of used face masks among the residents. Hence, residents still need to be aware of disposal methods, and the government must indeed plan timely oriented and user-friendly modes of disposal of used face masks. Furthermore, Public Health officials must promote the risks to public health and the environment that are affected by improper disposal.

RECOMMENDATIONS

The author would like to suggest further study with a large sample size to identify behaviors' intentions, and practices of disposal of used face masks within the community. Secondly, the residents of Nakhon Pathom province must be aware of the public health and environmental issues related to used face masks; seek the correct information from reliable and official sources such as general newspapers, government channels, and official pages on Facebook and Instagram, etc.; and follow the government's guideline for proper used face masks disposal. Lastly, we recommend the local government consider our findings in developing the appropriate disposal guideline to prevent public health problems and environmental pollution and to facilitate the proper general disposal by providing adequate numbers of waste bins specially designed for disposal of used face masks.

ETHICAL DECLARATION

The research was approved by Mahidol University Social Science Independent Review Board (MUSSIRB) on May 3, 2022 (COA No.: 2022/058. 0305) . The research purpose and privacy policy were mentioned clearly on the introduction page of the survey form.

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ASSOCIATION BETWEEN COMPLETED SUICIDE AND GENDER IN CHAIYAPHUM PROVINCE, THAILAND

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ABSTRACT

Background: Although it is generally preventable, suicide is a cause of death which has damaging emotional and societal costs, and remains a critical global public health issue. In Thailand, the trend in suicide is upward, and Chaiyaphum Province is one of the provinces that is confronting this health problem. However, there are very few study about suicide cases in Chaiyaphum Province.

Objective: This study evaluated the association between completed suicide and gender in Chaiyaphum Province.

Method: This study used data of reports of attempted and completed suicide in the Self-harm Surveillance Database of Thailand's National Suicide Prevention Center, Department of Mental Health, Ministry of Public Health. The data include cases recorded for January 2018 to December 2021. Completed suicide was the outcome variable in the analysis. Binary logistic regression was performed to test for statistically-significant associations.

Result: From a total of 563 registered cases, 278 (49.4%) were completed suicides and 285 (50.6%) cases were attempted suicides. Males had 4.9 times greater odds of completed suicide than females ([OR= 4.90, 95% CI: 3.05, 7.85], P<0.001). Age group and employment status were also associated with completed suicide (p<0.05).

Conclusions: We found that the probability of completed suicide was associated with being male, having advanced age, and being an employee of someone else. Policymakers should consider the gender dimension in designing suicide prevention programs. The culture of patriarchy in Thailand may condition males from a young age to hide their emotions in order to appear strong. This may deter people with suicide risk from seeking clinical help. In addition, programs should focus more on employee-workplace suicide prevention.

***Keywords**: Completed suicide, Chaiyaphum, Gender, Suicide, Thailand*

INTRODUCTION

Although it is generally preventable, suicide is a cause of death with damaging emotional and societal costs, and remains a critical global public health issue [(1)]. Every year, around the world, more than 700,000 people die by suicide. The World Health Organization (WHO) estimates that every 40 seconds one person dies by suicide [(2)]. There are no specific socioeconomic predictors of cases of suicide, however, most everyone who is close to the victim is adversely affected. In 2019, the global, age-standardized suicide rate was 9.0 per 100,000 population. Prevalence varies between countries, from fewer than two suicide deaths per 100,000 population per year to over 80 [(3)]. Over three-fourths (77%) of suicide deaths occur in low- and middle-income countries [(4)]. Nearly three in five (58%) suicides are committed by people age under 50 years [(3)]. Accordingly, WHO considers suicide as a serious global public health problem [(2)]. The Sustainable Development Goals (SDG), the WHO GPW13, and the global Mental Health Action Plan include the reduction of suicide as a key indicator for UN member states [(3)].

There are many factors that might either increase or decrease the likelihood of committing suicide. For example, there is a correlation between suicide and other forms of self-harm and violence, and suicide has potentially-significant adverse consequences for the community and society at large. Additionally, suicide rates vary by gender and age [(5)]. A large majority of completed and attempted suicides occur in low- and middle-income countries, usually where treatment options are disproportionately lacking. What is more, most cases of attempted and completed suicide had no previous contact with a hospital or clinic concerning their mental health status [(6, 7)].

In Thailand, the prevalence of suicide is increasingly over time. According to the Thailand National Suicide Prevention Center, the suicide rate rose from 6.0 per 100,000 population in 2017 to 7.4 in 2020 [(8)]. Chaiyaphum is one of 76 provinces in Thailand, and the province is confronting a serious suicide problem. Chaiyaphum is situated between Thailand's north and northeast regions, and is predominately rural and lower-income. The suicide rate in Chaiyaphum rose from 6.4 per 100,000 population in 2018 to 9.3 in 2020, for an increase of nearly 50% [(9)]. Chaiyaphum also has the highest suicide rate among the four provinces in the 9th region-based health service area [(10)]. However, there are very few studies about attempted and completed suicide in this province. Thus, quantitative data analysis of suicidal behavior could provide valuable insights into the consistency of prevalence estimates, and suggest precursors for attempted suicide. That information could help inform suicide prevention programs and suggest avenues for more in-depth qualitative research on suicide in Thailand [(5)]. As an initial step, this study evaluated the association between demographic characteristics of cases of completed suicide over a three-year period in Chaiyaphum Province.

METHODS

STUDY AREA

Chaiyaphum Province is sandwiched between the north and northeastern regions of Thailand at 15°48′20″N 102°01′52″E. Neighboring provinces, starting from the north in a clockwise direction, are Khon Kaen, Nakhon Ratchasima, Lopburi, and Phetchabun. The total area of Chaiyaphum is 12,788 km^2 [(11)], containing a registered population of 1,122,265 as of 2020 [(12)].

DATA SOURCE

This study used the registry-based data of attempted and completed suicide in the Self-harm Surveillance Database of Thailand's National Suicide Prevention Center, Department of Mental Health, Ministry of Public Health (MOPH), during January 2018 to December 2021. The Self-Harm Surveillance Database includes data on the individual cases of attempted and completed suicide such as gender, occupation, age, religion, and marital status. A trained health care provider conducts an interview or psychological autopsy for all cases. For this secondary data analysis, all records were screened and checked for completeness of the data. Only those cases with complete data from the Surveillance Database were included in the analysis.
Statistical analysis

Chi-square was used to test for a statistical relationship among the factors, with completed suicide as the outcome variable. Binary logistic regression was performed to identify independent predictors of completed suicide. The results are presented as odds ratios (OR) with a 95% confidence interval. The data was analyzed by SPSS version 22.

RESULTS

A total of 563 registered cases with complete data were available in the Self-Harm Surveillance Database of the MOPH. Of these, 278 (49.4%) were completed suicide and 285 (50.6%) were attempted suicide. Table 1 shows the association between individual characteristics and suicide. By gender, 66.8% of males in the database were cases of completed suicide while only 21.7% of females were cases of completed suicide. Older age was associated with completed suicide. Among cases who were older than 58 years, approximately three-fours were completed suicide. Completed suicide accounted for 16.9% and 35.1% of cases age ≤ 20 years and 21 – 33 years, respectively. By marital status, completed suicide accounted for the majority of divorcees (80.0%), followed by widows/widowers (63.4%), and the separated (60.7%). By employment status, the majority of cases who were an employee or a farmer had completed suicide. In sum, there was a statistically-significant association between gender, age, marital status, and occupation, with completed suicide.

Table 2 presents the results of the crude and binary logistic regression of factors associated with completed suicide. After adjusting for variables, males had 4.9 greater odds of completed suicide compared to females ([OR= 4.90, 95% CI: 3.05, 7.85], P<0.001). Odds of attempting suicide and succeeding increased with age. Cases age over 72 years had 8.2 times greater odds of completed suicide compared to those age less than 20 years ([OR= 8.18; 95% CI: 2.15, 31.13], P=0.002). Moreover, cases who were an employee of someone else had 2.7 times greater odds of completed suicide compared to cases in other employment categories ([OR= 2.66; 95% CI: 1.26, 5.60], P=0.01).

Table 1: Attempted and Completed Suicide by Individual Characteristics

Variables	N	%	Attempted Suicide		Completed Suicide		P-value
Gender							
Male	346	61.5	115	33.2%	231	66.8%	< 0.001
Female	217	38.5	170	78.3%	47	21.7%	
Age group (years)							
≤ 20	89	15.8	74	83.1%	15	16.9%	< 0.001
21 - 33	131	23.3	85	64.9%	46	35.1%	
34 - 46	143	25.4	54	37.8%	89	62.2%	
47 - 58	125	22.2	53	42.4%	72	57.6%	
59 - 71	49	8.7	13	26.5%	36	73.5%	
≥ 72	26	4.6	6	23.1%	20	76.9%	
Marital status							
Unknown	7	1.2	5	71.4%	2	28.6%	< 0.001
Single	206	36.6	125	60.7%	81	39.3%	
Married	241	42.8	121	50.2%	120	49.8%	
Widow	41	7.3	15	36.6%	26	63.4%	
Divorce	40	7.1	8	20.0%	32	80.0%	
Separate	28	5.0	11	39.3%	17	60.7%	
Religion							
Unknown	4	0.7	4	100.0%	0	0.0%	0.084
Buddhist	558	99.1	281	50.4%	277	49.6%	
Christian	1	0.2	0	0.0%	1	100.0%	
Occupation							
Employee	219	38.9	82	37.4%	137	62.6%	< 0.001
No job	99	17.6	81	81.8%	18	18.2%	
Agriculture	131	23.3	50	38.2%	81	61.8%	
Unknown	47	8.3	25	53.2%	22	46.8%	
Student	20	3.6	19	95.0%	1	5.0%	
Other	47	8.3	28	59.6%	19	40.4%	

Table 2: Predictors of Completed Suicide

Variables	Crude OR	95% CI		P-value	Adjusted OR	95%CI		P-value
		Lower	Upper			Lower	Upper	
Gender								
Female	ref				ref			
Male	7.27	4.91	10.76	< .001	4.90	3.05	7.85	< .001
Age group (years)								
<=20	ref				ref			
21-33	2.67	1.38	5.17	0.004	0.70	0.30	1.63	0.411
34-46	8.13	4.25	15.57	< .001	2.79	1.17	6.63	0.02
47-58	6.70	3.47	12.95	< .001	2.28	0.91	5.70	0.079
59-71	13.66	5.88	31.73	< .001	5.99	1.98	18.10	0.002
>=72	16.44	5.65	47.84	< .001	8.18	2.15	31.13	0.002
Marital status								
Unknown	ref				ref			
Single	1.62	0.31	8.55	0.57	0.15	0.02	1.10	0.062
Married	2.48	0.47	13.03	0.283	0.78	0.28	2.20	0.644
Widowed	4.33	0.75	25.15	0.102	0.54	0.20	1.46	0.226
Divorced	10.00	1.63	61.33	0.013	1.11	0.32	3.79	0.871
Separated	3.86	0.63	23.53	0.143	2.04	0.57	7.29	0.272
Occupation								
Other	ref				ref			
Employee	2.46	1.29	4.69	0.006	2.66	1.26	5.60	0.01
No job	0.33	0.15	0.71	0.005	0.50	0.19	1.27	0.145
Agriculture	2.39	1.21	4.72	0.012	1.72	0.78	3.80	0.183
Unknown	1.30	0.57	2.94	0.533	1.47	0.56	3.85	0.438
Student	0.08	0.01	0.63	0.017	0.29	0.03	2.83	0.287

DISCUSSION

This study evaluated the association of demographic characteristics with completed suicide in Chaiyaphum Province during 2018-21. Based on the binary logistic regression, males had 4.9 times greater odds of completed suicide compared to their female counterparts. That finding is consistent with other research on suicide. In general, completed suicides are more prevalent among males, whereas unsuccessful suicide attempts are more prevalent among females [5]. Males are more likely to choose a violent means of suicide such as self-immolation or hanging, while females are more likely to choose a less-violent method such as intentional drug overdose or poisoning. The traditional male gender role in patriarchal societies can produce a culturally-conditioned restriction of perceived options and cognitive rigidity under stress, and that, in turn, raises male suicide risk [13].

Another finding from this research is that persons who were an employee of someone else had 2.7 times greater odds of completed suicide. That finding is similar to previous studies which found that employees are a vulnerable group for suicide risk, especially those working in the lowest-skilled jobs [14]. The dataset for this study did not allow a classification of cases by occupational skill level and, thus, it is not clear why "employee" as an employment category in Chaiyaphum Province would have a higher risk of completed suicide than other types or workers. Future studies should analyze this factor in greater depth.

The odds of completed suicide in persons over age 58 years were significantly higher than those age less than 21 years of age. Another study of suicide found that older victims were substantially more likely to use violent measures to kill themselves [15]. In this study, there was a general, positive correlation between age and completed suicide. The secrecy surrounding suicide attempts as well as retirement issues, social isolation, and an increased likelihood of debilitating

morbidity, are all potential contributors to elevated risk of suicide among the elderly.

Many studies have found an association between history of attempted suicide and completed suicide [16-19]. Indeed, the strongest statistical predictor of suicide is having made a previous attempt, and suicide attempts are commonly associated with periods of extreme emotional distress. However, unsuccessful suicide attempts may also be associated with the potential mediating effect of depressive symptomatology and perceived stress on suicidal ideation [20]. The most common predictors of attempted suicide include clinical depression, a sense of hopelessness, chronic/debilitating mental illness, and impulsivity [21]. As part of suicide prevention programs, early detection and treatment of depressive symptoms and suicidal ideation are key. In this study of one province in Thailand, the findings point to significant precursors to completed suicide among cases entered into a national database. That information may help policymakers and mental health program managers to tailor prevention interventions more precisely to achieve greater cost-effectiveness of positive health outcomes.

CONCLUSIONS

The analysis in this study found an increased odds of completed suicide for being male, having advanced age, and being an employee of someone else.

RECOMMENDATIONS

This study provides potentially-useful information on antecedents of completed suicide. The analysis is based on a quantitative study of cases in Chaiyaphum Province reported to the national Self-harm Surveillance Database during 2018-21. Further research should include a more in-depth exploration of occupational status and age to gain a better understanding of the underlying factors which lead certain individuals to attempt suicide and others not so inclined. Policymakers should consider cultural factors in the context of a patriarchal society which still frowns on emotional expression for males, and which encourages male stoicism about one's mental health as a sign of strength. Instead, boys should be taught from a young age that it is skillful health behavior to seek professional help when experiencing mental health problems, especially when that includes suicidal ideation. This will require collaboration between the education and health sectors, as well as provincial labor organizations and associations of employers, to implement cost-effective screening and prevention strategies to reverse the upward trend of suicide in Chaiyaphum Province specifically, and Thailand generally.

ETHICAL DECLARATION

All data were treated anonymously in accordance with the 2019 Personal Data Protection Act. The Ethics Committee of the Department of Mental Health of the Thai MOPH approved the protocol for this study.

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ASSOCIATION BETWEEN MEDICAL INSURANCE CHOICES AND HEALTHCARE UTILIZATION AMONG DIABETES PATIENTS IN THE PEOPLE'S REPUBLIC OF CHINA: A SECONDARY DATA ANALYSIS

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ABSTRACT

By the end of 2009, 220 million people had participated in the basic medical insurance for urban employees in China. The universal medical insurance coverage rate reached 95% in 2018. However, a problem followed the high universal medical insurance coverage rate. Due to the lack of medical and health resources and insufficient health service capacity of primary healthcare facilities in China, the unbalanced allocation of resources makes patients prefer to bypass the primary healthcare facilities and causes the secondary and tertiary healthcare facilities to be overwhelmed. This study aims to assess how sociodemographic factors and medical insurance schemes affect the decision to utilize outpatient services and condition the choice among primary and higher levels, which are secondary and tertiary healthcare facilities used by people with diabetes in China. The design of this study used secondary data from the 2018 China Health and Retirement Longitudinal Survey (CHARLS) database. The study population is patients with diabetes aged 45 years or older. The bivariate logistic regression was used to identify contributing factors. More than 62.7% of the individuals suffered from chronic disease, which indicated the grim reality that there are significant healthcare service demands. This study found that only patients with diabetes and with other chronic diseases among Chinese middle-aged and older adults increased the likelihood of using outpatient care compared to patients without diabetes and without other chronic diseases. In addition, this research shows that the patients who have chronic illnesses are in a high-risk group for utilization of outpatient services, but it may not be the risk factor for the patients of choice to use secondary and tertiary hospitals. This illustrates that improving the mechanism for chronic disease prevention and management is better, which allows the patients to better access healthcare services. Now, the biggest problem with the health system in China is overcrowding, especially in outpatient services in secondary and tertiary hospitals. Based on primary findings in the study, reducing outpatient services in secondary and tertiary hospitals in China will require improving the quality of services rendered by primary healthcare facilities and the utilization of primary healthcare facilities. To this end, suggestions are put forward to continue to promote the hierarchical diagnosis and treatment system, establish medical treatment partnerships to promote practical cooperation and coordination between different types of medical institutions, and improve medical insurances system by adjusting insurance compensation policies and increasing leverage, promoting the development of commercial medical insurance and social, medical insurance, and actively promoting the integration of the medical insurance system to adapt to the "universal medical insurance."

Keywords: Healthcare utilization, medical insurance, public health policy

INTRODUCTION

In 2019, there were 703 million persons aged 65 years or over in terms of the global population. Globally, the proportion of the population aged 65 years or over increased from 6% in 1990 to 9% of the total global population in 2019. That proportion is estimated to rise to 16% in 2050, implying that one in six people worldwide will be 65 years or over, increasing the medical services burden [(1)]. In the literature, Wang et al., Zhou et al., and Zhang et al. showed that the population older than 65 was female, married, and the rural areas were more likely to receive outpatient services [(2–7)].

In addition, chronic diseases have gradually become the leading cause of disease burden and death of Chinese residents [(8)]. From 1990 to 2017, among the ten major risk factors, overweight and obesity accounted for the most significant change in the proportion of the Chinese population, which increased by 185%. Moreover, Li et al. found that compared to healthy weight people, obese people increased the likelihood of using outpatient and inpatient care [(9)]. Not only the prevalence of diabetes in China is higher than the global average, with the number of patients reaching 113.9 million [(10–11)], but also diabetes ranked top 10 in terms of the cause of death in China [(12)]. Shen's team conducted a study that showed that patients with diabetes or hypertension might be more willing to utilize primary care [(13)]. But there is no change in healthcare utilization among patients with other chronic diseases using chronic disease coverage. This is expected since most primary care providers are not equipped to treat these patients.

In 2017, China implemented medical insurance reform, integrating urban and rural medical insurance systems and realizing the full coverage of medical insurance. The universal medical insurance coverage rate reached 95% in 2018. However, a problem followed with the high universal medical insurance coverage rate. Due to the lack of medical and health resources and insufficient health service capacity of primary healthcare facilities which citizens living in rural areas or smaller communities in China, the unbalanced allocation of resources makes patients prefer to bypass the primary healthcare facilities and causes secondary and tertiary healthcare facilities which could serve larger communities and cities and provide specialized care to a larger region overwhelmed. Most of the regressions found significant impacts on health insurance coverage. They showed that individuals covered by healthcare insurance programs were more likely to use medical care than their uninsured counterparts. Li and Zhang found that compared with people without health insurance, people with BMIUE and BMIUR are more likely to use outpatient services [(14–16)]. Although the health insurance programs have some positive impacts on healthcare utilization, these impacts are still limited. Interestingly, there was still a part of regressions that found a statistically significant and negative impact of health insurance coverage on healthcare utilization [(17–21)].

Xian et al. showed that any outpatient visits in the past year of BMIUE enrollees and BMIURR enrollees were statistically different. Insured enrollees in the BMIUE scheme increased the use of outpatient services in secondary and tertiary hospitals [(22)]. Therefore, this study wants to find that any association between medical insurance and healthcare utilization for people with diabetes in China, whether different medical insurance schemes affect the decision to use outpatient services for people with diabetes in China, and do various medical insurance schemes choose the primary and higher level (secondary and tertiary) healthcare facilities among people with diabetes in China.

METHODS

The China Health and Retirement Longitudinal Study (CHARLS), conducted by the National School of Development of Peking University, is the data set used for this analysis. This study involved a total of 19,305 samples. In the empirical research, logistic regression was used.

Based on Andersen's behavioral model and references, the dependent and independent variables that affect the choice of medical and health institutions for diabetic patients were summarized and proposed. In this study, the independent variables include:

- Predisposing factors: gender, age, education level, location, marital status, income, BMI
- Enabling factors: medical insurance status, health insurance type
- Need factors: smoking, drinking, health care utilization, suffering from other chronic diseases with diabetes

The dependent variables include:

Healthcare utilization (Used the outpatient service in the last two weeks or not) and which type of hospitals (Primary healthcare or tertiary hospitals and secondary hospitals). While based on Andersen's behavioral model and the references set the model formula:

$$\begin{aligned}\text{Logit}(P) &= P(\text{Local} = 1) \\ &= a_0 + \sum a_i \, \text{Enable}_i \\ &+ a_1 \text{Demand} + \sum a_j \, \text{Control}_j \\ &+ k\end{aligned}$$

Local refers to whether patients with chronic diseases seek medical treatment in primary medical and health institutions. When the value Local is 1, this indicates that patients were treated at general hospitals including general hospitals, specialized hospitals, and Chinese medicine hospitals; when the Local value is 0, this indicates that patients were treated at the community healthcare center, township hospital, health care post, village clinic /private clinic nursing home, other.

Enable indicates the Enable variable, including annual household income, medical insurance participation, medical insurance type, and medical assistance. Demand is the Demand variable, suffers from other chronic diseases with diabetes, taking (self-rated health, smoking, drinking, clinic situation) treatments for diabetes.

Control is the Control variable, including age, sex, marital status, education, residential area, and BMI index.

STUDY VARIABLES

According to previous literature, independent variables include:

- Predisposing factors: gender, age, education level, location, marital status, income, BMI
- Enabling factors: medical insurance status, health insurance type
- Need factors: smoking, drinking, health care utilization, suffering from other chronic diseases with diabetes

The main variables and their assignments are shown in Table 1.

Table 1: Definitions of Variables

Variable		Variable Assignment	Reference variable	Definition
Independent variable				
x_1	Gender	1 if the individual is male; 0 for female	Female is the reference variable	Gender refers to the characteristics of women, men, girls, and boys that are socially constructed (23).
x_2	Age	1 if the individual is 45–54 years old; 2 if the individual is 55–64 years old; 3 if the individual is > = 65 years old	45–54 years old is the reference variable	Age of population in years counted until the latest birth date at the time of the survey. Age was divided into the following three groups basic on CHARLS Database and Elder Age standard in WHO: 45–54 years old group, 55–64 years old group, and above 65 years old group.
x_3	Education level	1 if the individual is illiterate; 2 if the individual attends primary school; 3 if the individual graduates from middle school; 4 if the individual graduates from high school; 5 if the individual graduates from above high school	Illiterate is the reference variable	Highest education level attained is categorized into “illiteracy,” “primary school,” “middle school,” “high school,” and “above high school” (including "high vocational certificate," "bachelor's degree," and "higher than bachelor’s degree").
x_4	Location	1 if the individual is an urban resident; 0 for a rural resident	Rural resident is the reference variable	The residential area where the population of Hukou at the time of the survey was categorized into an urban area and a rural area.
x_5	Marital status	1 if the individual married; 0 for never married	Never married is the reference variable	Marital status of the population at the time of the survey, defined as married (including “divorced,” “widowed,” and “separated”) and never married
x_6	Income	1 if the individual’s income is between 0–18,000； 2 if the individual’s income = 0； 3 if	The individual’s income between 0–18,000 is the	Defined by the range of average income per month in the survey questionnaire.

Variable		Variable Assignment	Reference variable	Definition
		the individual's income > 18,000	reference variable	In this study, the median proportion method was used. The incidence of relative poverty is set by Eurostat as the proportion of people with per capita disposable income less than 50% of the national median. The individual's household income is 0 (people without an income of the sample size) The individual's household income is (0–18,000) in the second third (people with income between the 0%–50% of the sample size) The individual's household income is (> 18,000) in the highest third, the highest 50% of the sample size)
x_7	BMI	1 if the individual's BMI is between 18.5–22.9； 2 if the individual's BMI < 18.5； 3 if the individual's BMI is between 23.0–27.5； 4 if the individual's BMI > 27.5	The individual's BMI between 18.5–22.9 is the reference variable	Body Mass Index (BMI), formerly called the Quetelet index, is a measure for indicating nutritional status in adults. It is defined as a person's weight in kilograms divided by the square of the person's height in meters (kg/m2) (22). BMI was divided into the following four groups according to WHO standards: Underweight (< 18.5), Healthy weight (18.5–22.9) Overweight (23.0–27.5) Obesity (> = 27.5）
x_8	Medical insurance	1 if the individual does not have medical insurance; 2 if the individual enrolls BMIUE (Basic Medical Insurance for Urban Employees); 3 if the individual enrolls BMIURR (Basic Medical Insurance System for Urban and Rural Residents); 4 if the individual enrolls in other medical insurance	The individual does not have medical insurance is the reference variable	Medical insurance ownership status There are three types of medical insurance in this study **Type A:** Basic Medical insurance for Urban Employees (BMIUE) It refers to the social medical insurance system that guarantees the fundamental medical rights of urban workers according to law. **Type B:** Basic Medical Insurance for Urban and Rural Residents (BMIURR) As early as January 12, 2016, the State Council of China issued the Opinions of the State Council on the Integration of the Basic Medical Insurance System for Urban and Rural Residents, integrating the basic medical insurance system for urban residents (BMIUR) and the New Rural Cooperative Medical Insurance system (NRCM), and establishing a unified basic medical insurance system for urban and rural residents (BMIURR) (24). **Type C:** Other medical insurance In this study, other insurances include commercial and supplementary insurance, excluding BMIUE and BMIURR insurance systems.

Variable		Variable Assignment	Reference variable	Definition
x_9	Smoking	1 if the individual who had smoking; 0 for never smoking	Never smoking is the reference variable	This study refers to never smoking and smoking.
x_{10}	Drinking	1 if the individual who had been drinking; 0 for never drinking	Never drinking is the reference variable	This study refers to never drinking and drinking (including drinking more than once a month and drinking but less than once a month)
x_{11}	Diabetes	1 if the individual who had diabetes; 0 for the individual who does not have diabetes	The individual who does not have diabetes is the reference variable	Have been diagnosed with diabetes or high blood sugar by a doctor (not including physical examination)
x_{12}	Other chronic diseases	1 if the individual who had Other chronic diseases without diabetes; 0 for otherwise (No chronic diseases or diabetes)	The individual who does not have chronic diseases or diabetes is the reference variable	Have been diagnosed with other chronic diseases without diabetes or high blood sugar by a doctor.
x_{13}	Cross term	1 if the individual who only had diabetes; 2 if the individual who had Other chronic diseases without diabetes; 3 for the diabetes is associated with other chronic diseases	The individual who only had diabetes is the reference variable	the partial effect, elasticity, or semi-elasticity of the dependent variable with respect to an explanatory variable depends on the magnitude of yet another explanatory variable (25). In this study, the cross term include the three types **Type A:** Only had diabetes or have been diagnosed with diabetes or high blood sugar by a doctor (Not including physical examination) **Type B:** Other chronic diseases without diabetes or have been diagnosed with other chronic diseases without diabetes or high blood sugar by a doctor. **Type C:** Diabetes is associated with other chronic diseases or have been diagnosed with diabetes (high blood sugar) and other chronic diseases by a doctor.
Dependent variable				
y_1	Healthcare utilization	1 if the individual used outpatient in the last two weeks; 0 for the individual who did not use outpatient during the previous two weeks	The individual did not use outpatient in the last two weeks is the reference variable	In this study, this variable was defined as the use of outpatient services.
y_2	Types of Hospital	1 if the individual used outpatient in primary healthcare hospitals; 2 for the individual used outpatient in high-level hospitals, general tertiary hospitals, and secondary healthcare hospitals)	The individual used outpatient in primary healthcare is the reference variable	Primary healthcare hospitals serve citizens living in rural or smaller communities; they typically have fewer than 100 inpatient beds. Secondary healthcare hospitals serve individuals living in small- to medium-sized cities; they usually have from 100 to 500 inpatient beds. Tertiary healthcare hospitals serve larger communities and cities and provide specialized care to a larger region (26)

RESULTS

The binomial logistic regression model was used to analyze the factors influencing the use of outpatient services and the factors influencing the respondents' choice of healthcare facilities. Table 2 shows the association between independent variables and outpatient services utilization.

For gender, males (OR = 0.852, 95%CI [0.776, 0.936]) were 14.8% less likely to use outpatient services. In addition, older respondents were more likely to use outpatient services, especially those aged 65 and above (OR = 1.001, 95%CI [0.893, 1.121]), than those aged 45. Among different levels of educational status, illiteracy was used as a reference. The increase in education level is positively associated with the utilization of outpatient services. Moreover, respondents with a high school education or above (OR = 1.524, 95%CI [1.222, 1.901]) were more likely to use outpatient services, which is 1.524 times more than those who never went to school.

The martial status of respondents (OR = 0.924, 95%CI [0.826, 1.034]), their living environment (OR = 0.984, 95%CI [0.866, 1.118]), and whether they smoked (OR = 0.738, 95%CI [0.661, 0.825]) and consumed alcohol (OR = 0.904, 95%CI [0.67, 1.219]) were not risk factors affecting the use of outpatient services. In different income groups, respondents without income (OR = 1.126, 95%CI [1.017, 1.245]) were more likely to use outpatient services, 1.126 times more than those with regular income.

For BMI scores of respondents, underweight people using outpatient services were 1.27 times more likely to use outpatient services than those of normal weight (OR = 1.27, 95%CI [1.041, 1.548]).

In terms of medical insurance status, the respondents participating in urban and rural residents' medical insurance (OR = 1.389, 95%CI [1.069, 1.806]) and urban employees' medical insurance (OR = 1.444, 95%CI [1.069, 1.952]) were positively associated with outpatient service utilization, in other words, people with medical insurance were more likely to use outpatient services compared to those without medical insurance.

Patients with diabetes (OR = 1.407, 95%CI [1.063, 1.863]) were 1.407 times more likely to use outpatient services than those without diabetes. In contrast, for patients with other chronic diseases not including diabetes (OR = 1.88, 95%CI [1.736, 2.037]), the likelihood of using outpatient services was 1.88 times higher than that of non-chronic disease patients.

This shows that patients with chronic diseases have a higher preference for using outpatient services. However, regarding the cross-term, respondents with diabetes and other chronic diseases (OR = 0.114, 95%CI [0.082, 0.159]) were 88.6% less likely to use outpatient services than those with diabetes alone.

Table 2: Association between independent values and outpatient services utilization (N = 19,305)

Utilization of Outpatient Services	OR	St. Err.	*p* value	[95% Conf	Interval]	Sig
Gender						
Female	Ref.					
Male	0.852	0.041	.001	0.776	0.936	***
Age group						
~54	Ref.					
55–64	0.954	0.05	.365	0.861	1.056	
65+	1.001	0.058	.991	0.893	1.121	
Education group						
Illiterate	Ref.					
Primary School	1.157	0.063	.007	1.041	1.287	**
Middle School	1.119	0.075	.093	0.981	1.276	*
High School	1.174	0.106	.076	0.983	1.402	*
Above High School	1.524	0.172	< .001	1.222	1.901	***
Married						
Never married	Ref.					
Have a partner	0.924	0.053	.170	0.826	1.034	
Location						
Urban	Ref.					
Rural	0.984	0.064	.803	0.866	1.118	
Smoking						

Utilization of Outpatient Services	OR	St. Err.	*p* value	[95% Conf	Interval]	Sig
No	Ref.					
Yes	0.738	0.042	< .001	0.661	0.825	***
Drinking						
No	Ref.					
Yes	0.904	0.138	.507	0.67	1.219	
Income level						
0 < income < 18,000	Ref.					
income = 0	1.126	0.058	.022	1.017	1.245	**
18,000 < = income	0.912	0.058	.149	0.805	1.034	
BMI group						
18.50 < = BMI < 23.00	Ref.					
18.50 < = BMI	1.27	0.128	.018	1.041	1.548	**
23 < = BMI < 27.50	1.003	0.048	.956	0.914	1.1	
27.5 < = BMI	0.993	0.068	.921	0.868	1.136	
Insurance						
No insurance	Ref.					
BMIUE	1.444	0.222	.017	1.069	1.952	**
BMIURR	1.389	0.186	.014	1.069	1.806	**
Other insurance	1.544	0.299	.025	1.056	2.257	**
Diabetes						
No	Ref.					
Yes	1.407	0.201	.017	1.063	1.863	**
Other chronic diseases						
No	Ref.					
Yes	1.88	0.077	< .001	1.736	2.037	***
Cross term						
Only Diabetes	Ref.					
Only other chronic diseases	0.735	0.127	.075	0.524	1.032	*
Diabetes is associated with other chronic diseases	0.114	0.019	< .001	0.082	0.159	***

Table 3 describes the association between independent variables and the choice of using healthcare facilities. Among respondents willing to use outpatient services, for gender, males (OR = 1.113, 95%CI [0.931, 1.33]) were 11.3% more likely to use secondary and tertiary healthcare facilities. In addition, older respondents were more reluctant to use secondary and tertiary healthcare facilities, especially those aged 65 and above (OR = 0.699, 95%CI [0.564, 0.866]), yet they were 30% more likely to use secondary and tertiary healthcare facilities than those aged 45.

Among different levels of educational status, illiteracy is used as a reference. Only people with a primary educational level were not associated with choosing secondary and tertiary healthcare facilities. Respondents with middle school education (OR = 1.413, 95%CI [1.099, 1.816]) were more likely to use secondary and tertiary healthcare facilities, which was 1.413 times that of the reference items. The high school and above high school educational respondents were more likely to use secondary and tertiary healthcare facilities. Respondents with a partner (OR = 1.16, 95%CI [0.937, 1.436]) were 16% more likely to use secondary and tertiary healthcare facilities than respondents who did not have a partner.

Respondents' living environment (OR = 0.615, 95%CI [0.487, 0.778]), whether the respondents smoked (OR = 0.735, 95%CI [0.592, 0.912]), and drank alcohol (OR = 0.747, 95%CI [0.415, 1.345]) were not the risk factors affecting the use of secondary and tertiary healthcare facilities.

In terms of different income levels, respondents with higher income (OR = 1.378, 95%CI [1.082, 1.756]) were 37.8% more likely to use secondary and tertiary healthcare facilities than those with average income.

The medical insurance and diabetes respondents use secondary and tertiary healthcare facilities.

Table 3: Association between independent values and Tertiary general hospitals. (N=3,181)

Tertiary general hospitals	OR	St. Err.	*p* value	[95% Conf	Interval]	Sig
Gender						
Female	Ref.					
Male	1.113	0.101	.241	0.931	1.33	
Age group						
~54	Ref.					
55–64	0.736	0.072	.002	0.608	0.892	**
65+	0.699	0.076	.001	0.564	0.866	***
Education group						
Illiterate	Ref.					
Primary School	1.096	0.113	.378	0.894	1.342	
Middle School	1.413	0.181	.007	1.099	1.816	**
High School	1.549	0.269	.012	1.102	2.176	**
Above High School	1.843	0.42	.007	1.179	2.881	**
Married						
Never married	Ref.					
Have a partner	1.16	0.126	.174	0.937	1.436	
Location						
Urban	Ref.					
Rural	0.615	0.073	< .001	0.487	0.778	***
Smoking						
No	Ref.					
Yes	0.735	0.081	.005	0.592	0.912	**
Drinking						
No	Ref.					
Yes	0.747	0.224	.331	0.415	1.345	
Income level						
0 < income < 18,000	Ref.					
income = 0	1.084	0.104	.400	0.898	1.309	
18,000 < = income	1.378	0.17	.009	1.082	1.756	**
BMI group						
18.50 < = BMI < 23.00	Ref.					
18.50 < = BMI	1.009	0.193	.962	0.693	1.469	
23 < = BMI < 27.50	1.183	0.107	.062	0.992	1.412	*
27.5 < = BMI	0.913	0.119	.486	0.708	1.179	
Insurance						
No insurance	Ref.					
BMIUE	2.298	0.701	.006	1.264	4.178	**
BMIURR	1.323	0.353	.294	0.784	2.231	
Other insurance	2.952	1.148	.005	1.378	6.324	**
Diabetes						
No	Ref.					
Yes	1.354	0.371	.268	0.792	2.316	
Other chronic diseases						
No	Ref.					
Yes	1.152	0.09	.071	0.988	1.343	*
Cross term						
Only Diabetes	Ref.					
Only other chronic diseases	0.729	0.239	.335	0.383	1.386	
Diabetes is associated with other chronic diseases	0.636	0.212	.175	0.331	1.223	

DISCUSSION

In the study, more than 62.7% of the individuals suffered from chronic disease, which indicated the grim reality that there are significant healthcare service demands. But it may not be the risk factor for the patients of choice to use secondary and tertiary hospitals. This illustrates that improving the mechanism for chronic disease prevention and management is better, which allows the patients to better access healthcare services.

This study found that individuals covered by medical insurance schemes tend to utilize more healthcare services among Chinese middle-aged and older adults. Thus, the expanded medical insurance schemes in China may stimulate the insured and unleash healthcare demands of the disadvantaged population in general, which was broadly consistent with the existing literature [27–29]. In this study, the result shows that the population covered by BMIUE and BMIURR were more likely to use the outpatient services. Especially BMIUE will use outpatient services more than BMIURR. For instance, BMIUE and BMIURR both cover outpatient services. Still, with different Insurance reimbursement ratios, this could partly explain our finding that compared to BMIUE, BMIURR had a more generous benefit package and a higher reimbursement rate. This may motivate the insured to utilize healthcare services when they get sick with chronic or acute conditions.

Second, the current study found that among Chinese middle-aged and older adults, people who regularly drank alcohol are less likely to use outpatient care than non-regular drinkers. Three possible reasons explain the inverse relationship between regular drinking and healthcare utilization. Firstly, people who regularly drink alcohol may not care about their health status or maybe risk-tolerant individuals. Secondly, the adverse health consequence of drinking may appear several years later. Lastly, alcohol is frequently used when population with friends and family. Although the population applies a healthy lifestyle today, non-drinkers in such a situation may be related to alcohol allergy and intolerance. Hence, they may be more likely to use healthcare services. It is worth noting that people who regularly drink alcohol experience omitted or delayed healthcare, which leads to serious health problems and higher healthcare expenditure on society. It is better to screen and brief advice programs delivered by primary level care to reduce the burden of diseases due to regular drinking. This study also found that smokers among Chinese middle-aged and older adults were more likely to use outpatient care than those who never smoked. The explanation is straightforward; the smoking population may care more about their health status or maybe have lower risk-tolerant individuals. And smoking also has adverse health effects and causes acute and chronic diseases and, therefore, may require more healthcare utilization.

Third, the present study found that underweight people among Chinese middle-aged and older adults increased the likelihood of using outpatient care than more healthy weight people. In addition, the research shows that underweight individuals are in the high-risk group for outpatient services. The study adds to the findings of other studies observing adverse outcomes in underweight patients that higher surgical mortality in underweight adults compared with normal weight patients, and also found that patients with low BMI had increased odds of emergency room visits and mortality. Hence, higher healthcare utilization may be needed for these conditions.

In this study, the individuals with a lower economic status tended to receive more outpatient services. Still, individuals with a higher economic status tended to receive more use in secondary and tertiary healthcare facilities, which aligned with the study conducted by Zhang et al. Economic status was fundamental to healthcare utilization of individuals and was one of the essential inequity elements favoring the better-off. The significant regional disparities in healthcare resources and quality may impede individuals' healthcare accessibility and affordability [30].

In the study, age, education level, location of residents, and smoking, also are risk factors for the utilization of outpatient in secondary and tertiary healthcare hospitals. More older people are likely to use outpatient care in secondary and tertiary healthcare hospitals compared to the reference group. In addition, this research shows that the people who have the education level of middle school are in a high-risk group for utilization of outpatient services in secondary and tertiary healthcare hospitals. But it may not be the risk factor for the high education level of choice to use secondary and tertiary hospitals. It illustrates that improving the propaganda dynamics for primary facilities and the quality of the primary healthcare services is better, allowing the patients to better access the healthcare services.

CONCLUSION

The study investigated the predisposing factors, enabling factors, and perceived factors associated the medical insurance choices and healthcare utilization. This study aims to empirically examine the association between

medical insurance choices and healthcare utilization among patients with diabetes in the People's Republic of China.

The empirical findings suggest that females among Chinese middle-aged and older adults are more likely to use healthcare compared to males. At different education levels, individuals above high school educational level are the high inducement to use outpatient services, which means that the high education level populations have a higher health consciousness, are more likely actively prevent diseases, and use outpatient services to diagnose and treat diseases.

With the expansion of medical insurance coverage, the inequity of the population using outpatient services are reduced. Moreover, the chronic disease is included in medical insurance reimbursement, resulting in eyes and patients with diabetes with other chronic diseases being more likely to use outpatient services. These results may have important implications for supporting the government in healthcare resource allocation decisions.

About the middle-aged and older adults in China that bypassed primary healthcare facilities to obtain care from upper-level providers. Rural patients were 61.5% as likely as urban patients to utilize outpatient services in secondary and tertiary hospitals. And the aging population is higher in the outpatient services provided in secondary and tertiary hospitals. The present study found that a relative increase in smoking had a higher likelihood of bypassing primary care. The high-income level population likely facilitated the use of secondary and tertiary healthcare hospitals. On one hand, the educated level of middle school people had a significant likelihood of utilization of outpatient services in secondary and tertiary healthcare hospitals. On the other hand, diabetes and other chronic diseases had a slight probability of using outpatient services in secondary and tertiary healthcare hospitals. On the other hand, diabetes and other chronic diseases had a remote likelihood of utilizing outpatient services in secondary and tertiary healthcare facilities.

RECOMMENDATIONS

Now, the biggest problem with the health system in China is overcrowding, especially in outpatient services in secondary and tertiary hospitals. Based on findings in the study, reducing outpatient services in secondary and tertiary hospitals in China will require improving the quality of services rendered by primary healthcare facilities and the utilization of primary healthcare facilities. With the rising prevalence of chronic diseases, it is more important to improve the basic medical insurance system and guarantee the ability to effectively enhance the level of medical security for patients with chronic diseases, promote the timely treatment of patients, ensure the health quality, and effectively reduce the economic risk of disease. To this end, the following suggestions are put forward:

a) Continue to promote the hierarchical diagnosis and treatment system Implement the functional orientation of medical institutions and carry out reasonable regional health planning Improving the capacity of primary healthcare facilities and the health services

b) To establish medical treatment partnerships to promote practical cooperation and coordination between different types of medical institutions
Improving the dual referral system to ensure the construction of medical associations promotes the sinking of high-quality medical resources and realizes the rational allocation and vertical integration of high-quality medical resources.

In Germany, hospitals only provide inpatient treatment and do not carry out outpatient services. But, in a short time, complete separation of outpatient and inpatient services is impossible in China. However, the time and quality of patient treatment can be guaranteed by gradually reducing the number of outpatient services in large hospitals. Reduce the waste of resources caused by repeated examinations and encourage large hospitals to transfer recovered patients to primary hospitals.

c) Improve the medical insurances system
Adjust insurance compensation policies and increase leverage Adjusting the compensation policy of medical insurance and enhancing the leverage of medical insurance can effectively restrain the patient's behavior of seeking medical treatment. At present, it mainly guides the flow of patients to the grassroots by increasing the reimbursement ratio of patients in primary medical institutions for hospitals to actively refer patients and standardize the referral process.

Promote the development of commercial medical insurance and social medical insurance.
Actively promoting the integration of the medical insurance system to adapt to the "universal medical insurance."

The development of "universal health insurance" is not only the universal coverage of the system design but also the equity in the operation of the coverage. Essential way to solve the problem in the system reform, through the integration of system optimization, constructing a "whole unification" mode, requires that the national fund integration guarantee the equal

opportunity of urban and rural medical services. The aim at truly achieving adequate healthcare.

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BIOINFORMATICS ANALYSIS TO IDENTIFY KEY CELL CYCLE-REGULATED TARGET GENES OF QUERCETIN AND THEIR ASSOCIATIONS WITH A DISEASE-FREE SURVIVAL IN CHOLANGIOCARCINOMA

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ABSTRACT

Cholangiocarcinoma (CCA) is an aggressive form of cancer and the leading cause of mortality in Thailand due to late diagnosis and lack of effective therapy emphasizing the development of effective therapeutic strategies. To overcome chemoresistance and minimize the high toxicity of chemotherapy, natural compounds have been proposed as alternative options for anti-cancer agents. Quercetin is a natural compound that has been shown to inhibit cell proliferation and induce cell cycle arrest in various types of cancer, highlighting it as a potential candidate agent for CCA therapy. Bioinformatics-based analysis was used to identify the key cell cycle-regulated target genes of quercetin and their associations with survival rate in CCA. Cell cycle-regulated target genes of quercetin were retrieved and analyzed the interaction between target proteins and quercetin by molecular docking using the AutoDock4.2 tool and visualizing data by Discovery Studio Visualizer. Gene expression and clinical data of CCA patients were collected from The Cancer Genome Atlas (TCGA) and Gene Expression Omnibus (GEO) database. Differential expression of target genes and survival analysis was performed using GraphPad Prism. Disease-free survival (DFS) and overall survival (OS) were estimated by the Kaplan-Meier method. A p value < .05 was considered statistically significant. CDK1, CDK2, CDK6, PLK1, GSK3B, and CDC25B were identified as target genes. Molecular docking revealed that CDK2 had the highest binding affinity, and all target genes were significantly overexpressed in CCA tissues. High expression of CDK1, CDK2, and PLK1 was significantly correlated with low DFS in CCA patients. This study revealed key targets of quercetin in cell cycle regulation and their associations with the survival rate of CCA patients, which could be beneficial in developing an anti-cancer agent. In addition, *in vitro*, and *in vivo* experiments are necessary for further studies.

Keywords*: cholangiocarcinoma, quercetin, cell cycle regulation, molecular docking, disease-free survival*

INTRODUCTION

Cholangiocarcinoma (CCA) is one of the aggressive forms of cancer. The northeastern region of Thailand has the highest incidence worldwide. Since CCA patients are mostly diagnosed when cancer progress to the advanced stage, the outcome of the surgery, which is the major treatment for CCA, is not satisfying enough [1]. Gemcitabine or gemcitabine plus cisplatin chemotherapy is the standard treatment for CCA. However, the overall survival rate of CCA patients is less than 1-year, and patients develop chemoresistance [2]. Evading from DNA disruption regulated by chemotherapeutic drugs causes chemoresistance and low effectiveness of the treatment [3, 4]. Due to the lack of efficiency and high toxicity of chemotherapy, more effective therapeutic strategies must be developed.

Natural compounds have been widely reported about anti-cancer abilities, which might be an alternative option for cancer cytotoxic agents. Since chemotherapy disrupts cell growth, cell cycle-related molecular mechanisms directly respond to the effects of chemotherapy [5]. Likewise, natural compounds have abilities in cell cycle arrest and inhibition of cell proliferation by targeting cell cycle-regulated pathways. Quercetin is a natural compound with anti-cancer abilities in inhibiting cell proliferation and cell cycle arrest [6]. In T-cell leukemia and liver cancer, quercetin arrests the G0/G1 phase of the cell cycle [7, 8]. Quercetin inhibits cell proliferation and arrests the cell cycle at S and G2/M phases in T47D B-cell leukemia and HepG2 liver cancer cells, respectively [9, 10].

Cyclins and cyclin-dependent kinases (CDKs) and cell cycle checkpoint molecules are involved as major modulators of cell cycle progression [11]. Since the defects in cell cycle progression and evading growth inhibition are hallmarks of cancer [4], cancer cell growth becomes uncontrollable. The inhibition of key regulators of cell cycle progression and related enzymes is a promising strategy for the development of more efficient cancer therapy [5]. Identifying various molecular targets of the cell cycle is a therapeutic strategy that might overcome chemoresistance and the high toxicity of chemotherapy. However, key cell cycle-regulated target genes of quercetin and their associations with survival rate in CCA are poorly understood.

This study applied bioinformatics-based analysis to identify key cell cycle-regulated target genes of quercetin. We investigated CDC25B, CDK1, CDK2, CDK6, GSK3B, and PLK1 as quercetin target genes which have the potential for cell cycle regulation through data collection from different drug-target profiling databases. The interaction between quercetin and proteins of target genes was analyzed by using molecular docking. In addition, differential expression of target genes in CCA tissues compared with normal tissues from the Cancer Genome Atlas Program (TCGA) and GSE107943 dataset (from Gene Expression Omnibus (GEO) database) was performed. Moreover, the association between target gene expression and survival rate of CCA patients was analyzed to verify the potential candidate agents for CCA treatment. Quercetin has multiple key cell cycle-regulated targets that could be beneficial in developing an anti-cancer agent.

METHODS

TARGET GENES COLLECTION AND PREPARATION

A total of 116 cell cycle pathways and related genes were retrieved from the UALCAN database (http://ualcan.path.uab.edu). Target genes of quercetin were collected (on 31 January 2022) from 3 different databases including BindingDB (http://www.bindingdb.org/bind/index.jsp), SwissTargetPrediction (http://www.swisstargetprediction.ch/) and TargetNet (http://targetnet.scbdd.com/). Venn diagram of target genes was generated through Venny 2.1 (http://bioinfogp.cnb.csic.es/tools/venny/).

Target genes were selected from the intersection of cell cycle-regulated genes with quercetin target genes in at least one database.

Analysis of the interaction between quercetin and protein of target proteins

Protein and ligand preparation

Protein structures of the target gene were obtained from RCSB Protein Data Bank on 31 January 2022 (http://www.rcsb.org/). The crystal structures of selected protein were downloaded in .dsb file including CDC25B (PDB ID: 4WH9), CDK1 (PDB ID: 6GU4), CDK2 (PDB ID: 4KD1), CDK6 (PDB ID: 2EUF), GSK3B (PDB ID: 5HLN) and PLK1 (PDB ID: 2RKU). Proteins were reconstructed by hetero atom (HETATM) removal using Discovery Studio Visualizer. The ligand molecule was prepared by retrieving the 3D structure of quercetin in the SDF file from the PubChem database (http://pubchem.ncbi.nlm.nih.gov/).

Molecular docking

The interaction between quercetin and target proteins was analyzed by molecular docking using a simple

protocol of the AutoDock tool [12]. The binding affinities of quercetin and each target protein were estimated by binding energy (kcal/mol). Data visualization of the protein-quercetin complex was performed by Discovery Studio Visualizer.

Differential gene expression analysis

The RNA sequencing data of target genes were collected from The Cancer Genome Atlas (TCGA) and Gene Expression Omnibus (GEO) database. The normalized RNA-seq data from the TCGA database, including CCA tissue (n = 36) and normal cholangiocyte tissue (n = 9), was rearranged into log2 of each data. In the GEO database, the Log2 (RPKM+1) of intrahepatic cholangiocarcinoma tissue (n = 30) and adjacent liver tissue (n = 27) were collected from the GSE107943 dataset. Differential gene expression analysis is visualized through a box plot of mean ± SD of the data by GraphPad Prism 8 software. A p value < .05 was considered a statistically significant difference.

Patient clinical data acquisition

Clinical data of CCA patients from the TCGA database and GSE107943 dataset was divided into two groups (low and high expression) using the median of normalized RNA-seq data of each target gene. Patient survival analysis was performed using GraphPad Prism 8 software. Disease-Free Survival (DFS) and Overall Survival (OS) was defined as the time from the randomization until cancer recurrence or death of a patient from any causes, respectively. Kaplan-Meier method was used to estimate patient survival time. Statistical differences between the two groups were calculated by log-rank test, and a p value < .05 was considered statistically significant.

RESULTS

Investigation of quercetin target genes which are associated with cell cycle regulation

We mainly focused on quercetin target genes related to cell cycle regulation. Target genes were selected from cell cycle-regulated genes, which are intersected with quercetin target genes from at least one database. The result of the intersection between the cell cycle pathway and related genes from the UALCAN database and quercetin target genes from three databases (SwissTarget, bindingDB, and TargetNET) revealed six candidate target genes (Figure 1). The 3D crystal structures of protein from target genes that were forming a complex with the standard inhibitor were retrieved from RCSB Protein Data Bank, including CDC25B (PDB ID: 4WH9), CDK1 (PDB ID: 6GU4), CDK2 (PDB ID: 4KD1), CDK6 (PDB ID: 2EUF), GSK3B (PDB ID: 5HLN) and PLK1 (PDB ID: 2RKU). We prepared the protein structure for molecular docking by removing the inhibitor and heteroatom. The inhibitors of protein targets were re-docked to optimize the grid of the original binding site for performing molecular docking with quercetin. Protein targets and quercetin were prepared and docked by Autodock 4.2 tools [12] to verify the interaction between these molecules. The visualization of the 3D structure of quercetin and protein complex is shown in Figure 2. The binding energy of quercetin and all protein targets are summarized in Table1. The CDK2 and quercetin showed the lowest binding energy at -7.83 kcal/mol, which reflected the highest binding affinity. Notably, the interaction and inhibitory potentiality between all protein targets and quercetin were supported by success in molecular docking.

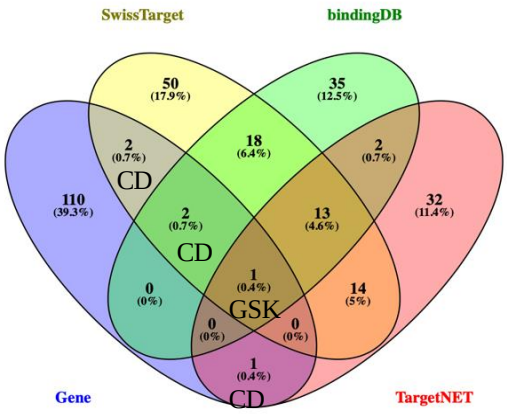


Figure 1 Venn Diagram of the intersection between cell cycle pathway and related genes from UALCAN database and target genes of quercetin from SwissTarget, bindingDB, and TargetNET database

Figure 2 The molecular docking of quercetin and protein targets. The binding of quercetin at the active site of CDC25B, CDK1, CDK2, CDK6, GSK3B, and PLK1 was analyzed by AutoDock 4.2 and Cygwin software and visualized by Discovery Studio Visualizer software.

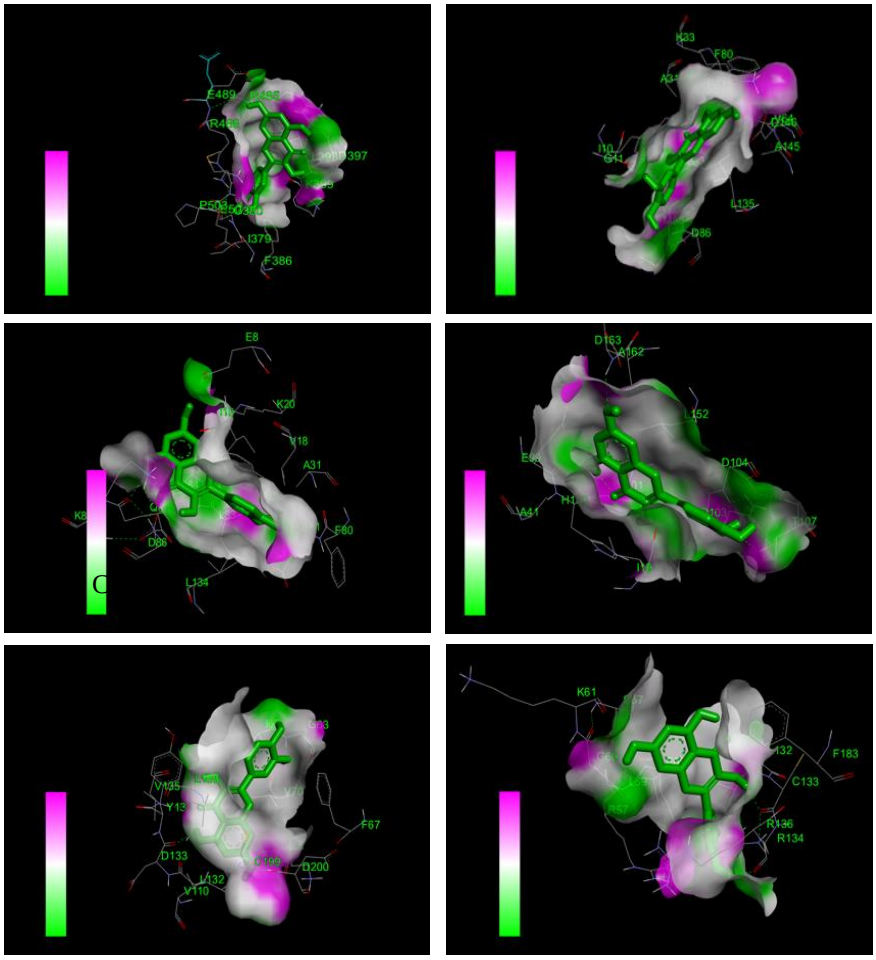


Figure 2 The molecular docking of quercetin and protein targets. The binding of quercetin at the active site of CDC25B, CDK1, CDK2, CDK6, GSK3B, and PLK1 was analyzed by AutoDock 4.2 and Cygwin software and visualized by Discovery Studio Visualizer software.

Table 1 Binding energy of molecular docking between quercetin and protein targets interaction

Protein target	Binding energy (kcal/mol)		Ligand Efficiency	Inhibition constant (Kpi)
	Original ligand	Quercetin		
CDC25B	-6.72	-6.96	-0.32	7.93 µM
CDK1	-7.62	-7.44	-0.34	3.50 µM
CDK2	-10.47	-7.83	-0.36	1.82 µM
CDK6	-11.64	-7.36	0.33	4.02 µM
GSK3B	-8.18	-6.71	-0.31	12.16 µM
PLK1	-9.33	-6.67	-0.30	12.97 µM

CELL-CYCLE REGULATED TARGET GENES OF QUERCETIN ARE SIGNIFICANTLY OVEREXPRESSED IN CCA TISSUE

Examining the different expressions of target proteins between CCA and normal tissues is crucial for developing a CCA therapeutic approach based on cell cycle-related molecular targets and mechanisms. We analyzed the expression of target genes in CCA tissue to evaluate the potential of these key molecules as therapeutic targets. Normalized expression data of all target genes from TCGA were collected and rearranged into logarithm values. CDC25B, CDK1, CDK2, GSK3B, and PLK1 were significantly overexpressed in CCA tissue, compared to normal bile duct (Figure 3A). In addition, the differential expression analysis of GSE107943 data presented that all target genes were significantly upregulated in intrahepatic CCA tissues. This result suggested that cell-cycle regulated target genes of quercetin were higher expressed in CCA than in adjacent normal tissues.

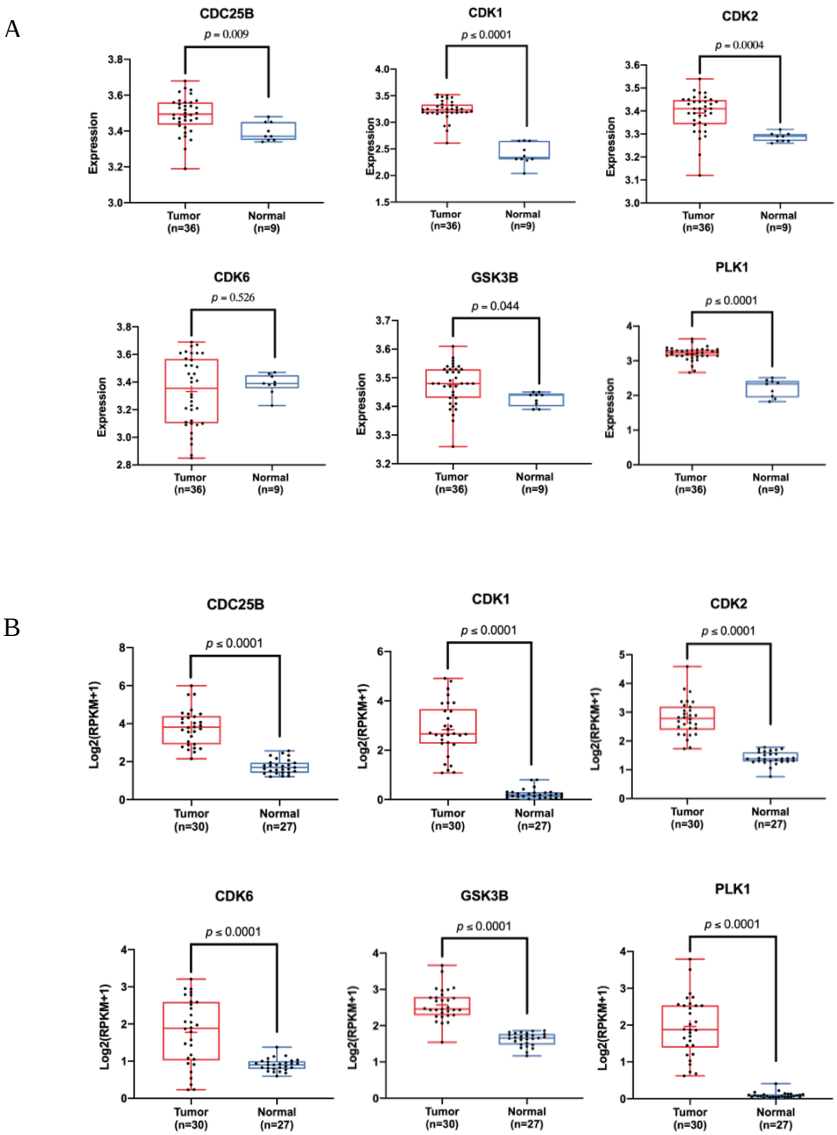


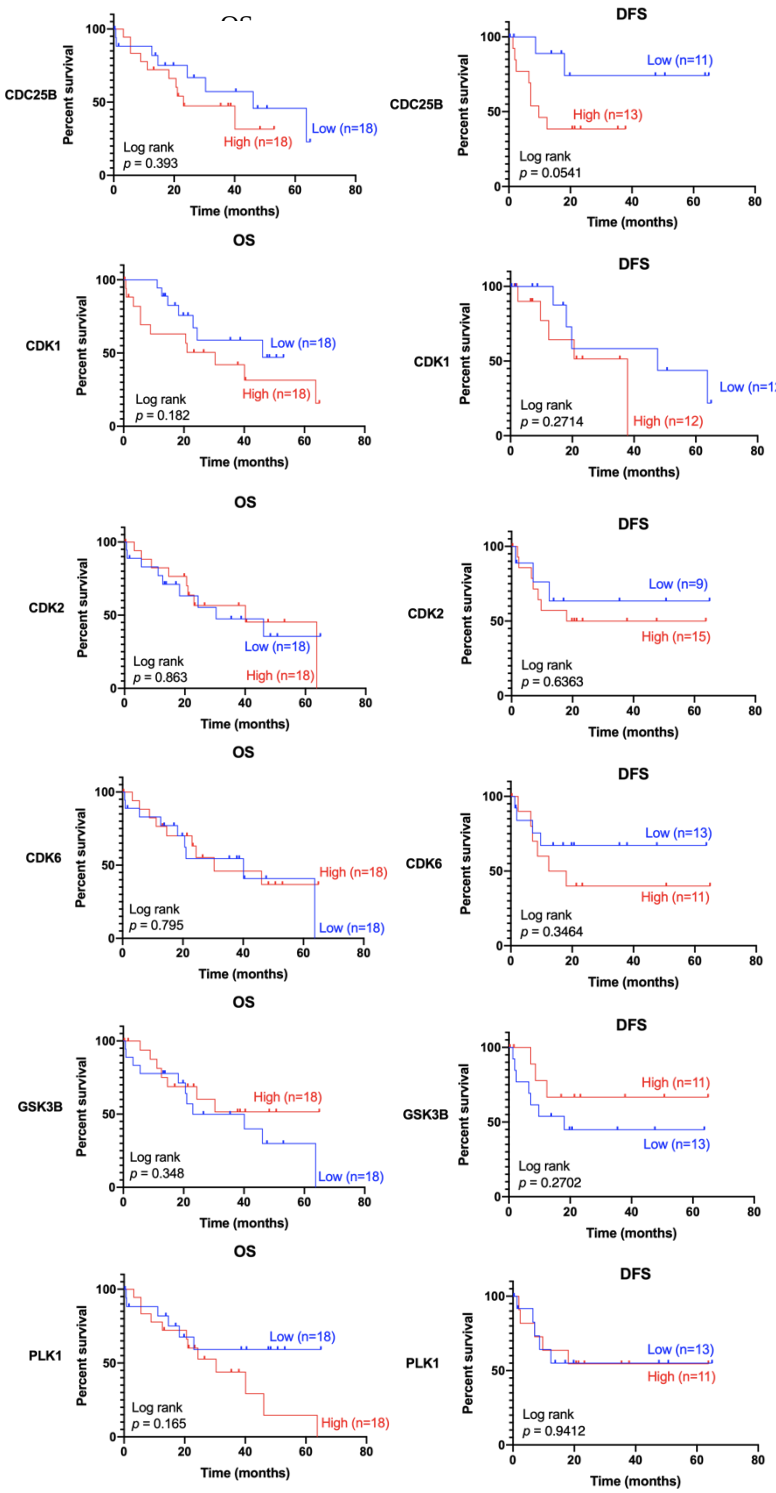
Figure 3 Differential gene expression of target genes including CDC25B, CDK1, CDK2, CDK6, GSK3B, and PLK1 in CCA tissue

Normalized data of RNA-seq was obtained from the TCGA database of CCA patients (n = 36) and normal cholangiocytes (n = 9) (Figure 3A). Gene expression analysis of the GSE107943 dataset from the GEO database was rearranged into Log2 (RPKM+1) value and visualized in a box plot by GraphPad Prism 8 software. Differences between the two groups were statistically compared by using a t-test, and all *p* values less than .05 were considered statistical significance.

High expression of CDK1, CDK2, and PLK1 are associated with poor disease-free survival (DFS) in CCA patients.

To verify the potential of target genes for CCA therapeutic development, the evaluation of relative gene expression in clinical data is crucial. In the TCGA database, the status of all target genes showed no significant differences between low and high groups through Kaplan-Meier survival analysis (Figure 4A). Interestingly, survival analysis of clinical data from the GSE107943 dataset revealed high CDK1, CDK2 and PLK1 were significantly associated with poor DFS in CCA patients. In addition, patients with high expression of CDK1, CDK2, and PLK1 had a lower median overall survival (OS) than patients with low expression of these genes (Figure 4B). These results indicated that CDK1, CDK2, and PLK1 were associated with poor DFS in CCA patients.

A


CDC25B
OS
Percent survival
Low (n=18)
High (n=18)
Log rank
p = 0.393
Time (months)
DFS
Low (n=11)
High (n=13)
Log rank
p = 0.0541
CDK1
Low (n=18)
High (n=18)
p = 0.182
Low (n=12)
High (n=12)
p = 0.2714
CDK2
Low (n=18)
High (n=18)
p = 0.863
Low (n=9)
High (n=15)
p = 0.6363
CDK6
High (n=18)
Low (n=18)
p = 0.795
Low (n=13)
High (n=11)
p = 0.3464
GSK3B
High (n=18)
Low (n=18)
p = 0.348
High (n=11)
Low (n=13)
p = 0.2702
PLK1
Low (n=18)
High (n=18)
p = 0.165
Low (n=13)
High (n=11)
p = 0.9412

B

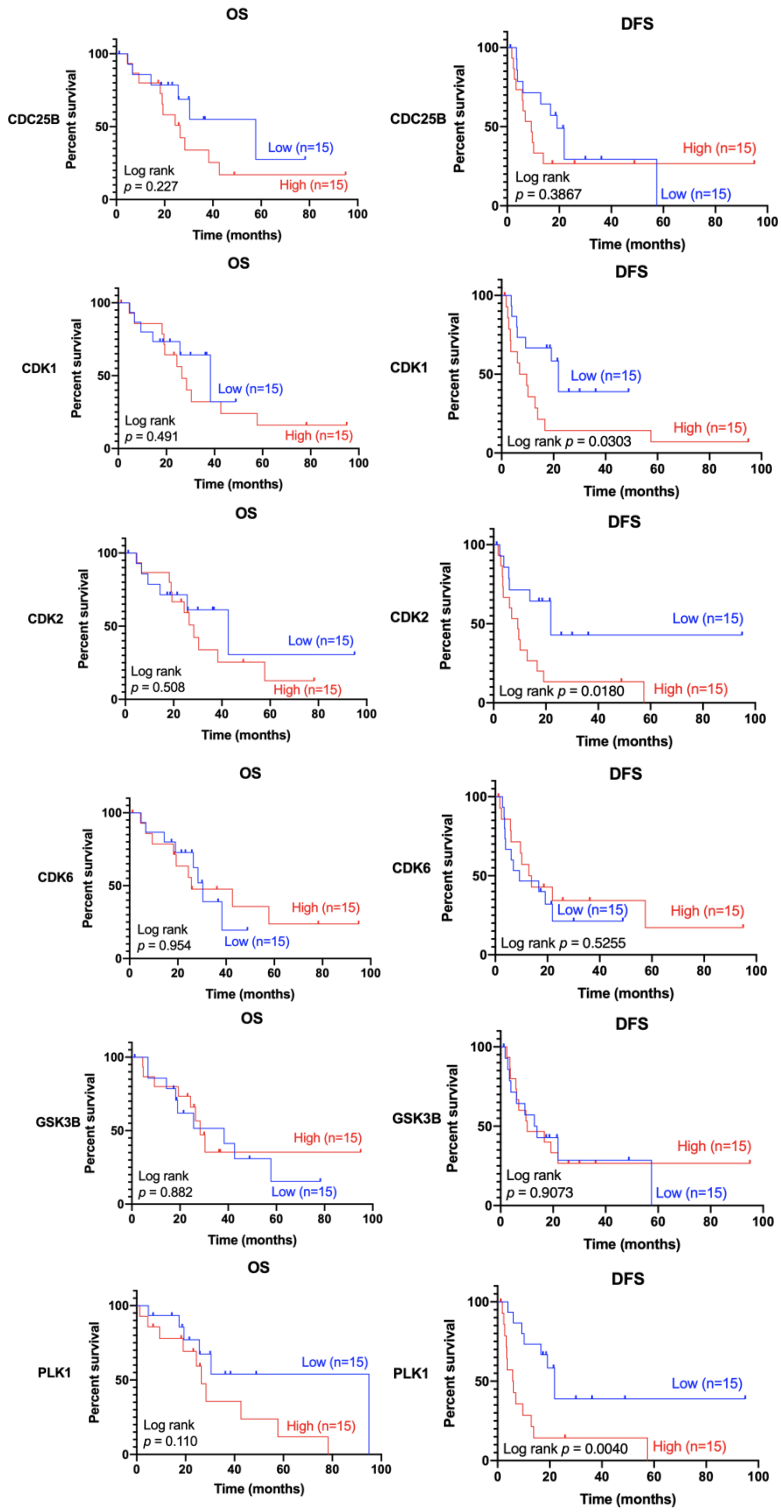


Figure 4 Correlation between target gene expression and survival of CCA patients.

Kaplan-Meier survival curves of CCA patients from TCGA database (Figure 4A) and GSE107943 dataset from GEO database (Figure 4B) based on the median expression of target genes including CDC25B, CDK1, CDK2, CDK6, GSK3B, and PLK1. A Log-rank *p* value < .05 was considered statistically significant.

DISCUSSION

Due to the limitations of chemotherapy, including chemoresistance and high toxicity, a better understanding of drug resistance mechanisms and alternative agents with less toxicity must be explored. We provided key cell cycle-regulated target genes of quercetin, including CDC25B, CDK1, CDK2, CDK6, GSKB3, and PLK1. Normally, cell cycle progression is regulated by cyclins, CDKs, and various checkpoint proteins. The interference of cell cycle regulators could cause uncontrollable cell division and cell growth disorder. The inhibition of these defects in cell cycle regulation might return equivalent progression of the cell cycle (3, 5, 13). *In vitro* and *in silico* studies in lung and breast cancer revealed that treatment with quercetin caused the downregulation of CDK6 and colony-forming reduction [(14)]. In addition, quercetin regulates the cell cycle through activation or inhibition of various proteins, including cyclin B, cyclin D, CDKs, p53, p21, and p27 [(15)]. Since the target genes of our study were also the regulators of the cell cycle, a therapeutic approach that targets these key molecules might directly affect cell cycle progression.

To verify the interaction between target proteins and quercetin, we performed molecular docking, which results in the binding energy (kcal/mol) to predict the binding affinity. Ranking by binding energy, the interaction between quercetin and CDK2 provided the lowest values, which reflected the highest binding affinity. Our results were consistent with the previous study demonstrating quercetin docked with CDK2 in a high affinity manner [(11)]. In addition, we further investigated the roles of CDK2 in CCA. Our results demonstrated that the expression of CDK2 was elevated in CCA tissue using data from TCGA and GEO databases, which was consistent with cohorts using CCA primary tissues (16, 17). In addition, our study is the first to reveal the association of CDK2 expression with the survival time of CCA patients. Consistent with our study, higher CDK2 expression was associated with lower survival rates in selected cancers [(18, 19)].

Moreover, previous studies demonstrated that the downregulation of CDK2 genes was found to be involved in cell cycle arrest by apoptosis-related protein-1 (Apr-1) induction [(16)]. The combination treatment between Dinaciclib, an inhibitor of CDKs protein, and gemcitabine induced CCA cell lines apoptosis, suppressed tumor growth *in vivo*, and reduced CDK2 protein expression [(17)]. Thus, we suggest that targeting CDK2 expression could be an alternative CCA treatment strategy. In contrast, the comparison of CDC25B interaction between standard inhibitor and quercetin showed the binding energy of -6.72 and -6.96 kcal/mol, respectively (Table 1). Quercetin might have a higher binding affinity with CDC25B protein than the standard inhibitor. However, the interaction of quercetin with other target proteins revealed low binding affinity than their inhibitors but approximate binding energy. Further studies of the effects on cell cycle regulation by these target proteins are required.

We first reported the differential expression of cell cycle-regulated target genes of quercetin in CCA tissues from the TCGA database and GSE107943 dataset. All target genes were significantly overexpressed in CCA tissues compared to adjacent normal liver tissues. In contrast, TCGA data showed that only 5 out of 6 target genes, including CDC25B, CDK1, CDK2, GSK3B, and PLK1, were significantly overregulated. Due to the GSE107943 dataset from the GEO database provided clinical from only intrahepatic cholangiocarcinoma (iCCA) patients (20), the distribution of normalized expression data might be impacted. In the TCGA database, clinical data are collected from iCCA, extrahepatic cholangiocarcinoma (eCCA), and Mixed hepatocellular and cholangiocarcinoma (Mixed ICC/HCC) (21). The increasing amount of data might improve the accuracy of the result of the bioinformatics-based analysis.

Due to the limitation of the amount of clinical data, increased clinical data of CCA patients might provide a more accurate and more precise correlation analysis between target genes expression and survival rate. Finally, these results suggested that key molecular targets of quercetin in cell cycle regulation and their associations with the survival rate of CCA patients could be beneficial in developing an anti-cancer agent.

CONCLUSION

In this study, CDC25B, CDK1, CDK2, CDK6, GSKB3, and PLK1 were identified as key cell cycle-regulated target genes of quercetin by using bioinformatics-based analysis. Molecular docking demonstrated that the interaction between CDK2 and quercetin had the lowest binding, which reflected the highest binding affinity. The analysis of differential gene expression from the TCGA database and GSE107943 dataset revealed that all target genes were significantly upregulated in CCA tissues compared to normal tissues. Moreover, high expression of CDK1, CDK2, and PLK1 was significantly associated with poor DFS. Therefore, our findings suggested that quercetin has multiple key cell cycle-regulated targets that could be beneficial in developing anti-cancer agents.

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THE PREVALENCE AND ASSOCIATED FACTORS OF PROBABLE POST-TRAUMATIC STRESS DISORDER AMONG FLOOD-PRONE PROVINCES IN THAILAND

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ABSTRACT

Flooding is one of the most frequent severe natural disasters facing Thailand, especially in the Central and Southern parts of the nation. Studies have shown that individuals may experience symptoms of post-traumatic stress disorder (PTSD) from exposure to floods. However, there are limited studies on the prevalence and associated factors of probable PTSD among flood-prone provinces in Thailand. To examine the prevalence and associated factors of probable PTSD among flood-prone provinces in Thailand, a secondary data analysis was performed using a dataset from a previous cross-sectional survey conducted from 2019 to 2020 in Nakhon Sawan and Nakhon Si Thammarat provinces selected from the expert reviews' discussion. The analyses were performed among 752 participants, with 376 participants from each province chosen. The questionnaire used the 5-item Primary Care PTSD Screen to detect probable PTSD. Chi-square and multiple logistic regression were used to examine the associated factors of probable PTSD. The level of statistical significance was set to a *p* value less than .05. The prevalence of probable PTSD was 12.6% in participants, 20.2% for Nakhon Sawan province, and 5.1% for Nakhon Si Thammarat province. The only associated factor found in this study was the province of residence (*p* value < .001). Participants who resided in Nakhon Sawan province had 4.836 times higher odds of having probable PTSD than those who lived in Nakhon Si Thammarat province (AOR = 4.836, 95% CI [2.762, 8.467]). Moreover, PTSD has been detected in flood-prone areas of Thailand. Therefore, public health authorities should also address mental health issues, such as conducting a rapid screening for psychological impacts after flood events. Periodic follow-up may be needed as it takes time to develop psychological symptoms.

Keywords: *flood, flood-prone, post-traumatic stress disorder, PTSD, Thailand*

INTRODUCTION

Floods are one of Thailand's most frequent severe natural disasters, especially in the central and southern parts of the country such as Nakhon Sawan and Nakhon Si Thammarat provinces. Nakhon Sawan province is considered an entryway between the central and northern parts of Thailand, while Nakhon Si Thammarat province is in the southern part of Thailand. Nonetheless, both of these two provinces frequently face floods. The topography of Nakhon Sawan province is one of the reasons that contributed to floods. The province is primarily flat, with two large rivers (Ping and Nan) flowing into the province. Therefore, a large amount of water usually flows into several areas of the province during heavy rain [(1)]. Moreover, continuous rainfall and inadequate water drainage are factors of repeated flooding in Nakhon Sawan province [(2)]. Nakhon Si Thammarat province is also facing recurrent flooding events. The causes of floods are heavy rainfalls, deforestation, expanded cultivated area, and mountain erosion. Moreover, the roads are paved throughout the community, perpendicular to the water line, making is difficult for water to drain [(3)].

The impacts of floods can be devastating, ranging from infrastructure damages, insufficient water and food supplies, diseases, and loss of lives. Post-traumatic stress disorder (PTSD) is one of the most common mental health issues diagnosed among flood survivals [(4)]. A previous study in the south of Thailand shows that the prevalence of PTSD is 44.8%, and depression is 31.29% [(5)]. Moreover, the prevalence of PTSD from floods is up to 33% in the United Kingdom [(6)], and 15.94% in China [(7)]. Therefore, the prevalence of PTSD varied from 14.94% to 44.48%, according to the study area and population. The factors associated with PTSD after floods are physical injury, lack of social support, underlying diseases before a flood event, financial difficulty, and displacement [(5, 8, 9)]. There are PTSD screening tools such as PCL, and CAPS-V. Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) is a tool for PTSD screening in the community that shows high sensitivity compared to CAPS-V and a higher likelihood ratio compared to GHQ – 12 [(10, 11)].

Since there was a limited study on the prevalence and associated factors of probable PTSD in Thailand, this study aimed to determine the prevalence and the related factors of probable PTSD among flood-prone provinces in Thailand**.**

METHODS

RESEARCH DESIGN

This study was a cross-sectional analysis using the primary data from the study titled "An action plan for health relief measures from water utilization during flood through a multidisciplinary approach" conducted in Nakhon Sawan province and Nakhon Si Thammarat province, Thailand, from 2019 to 2020. These two provinces were chosen as representative flood-prone provinces through multiple reviews by experts in the government and academic sectors. The Ethics Review Committee of Chulalongkorn University approved the original data collection (COA NO. 148/2563). All participants were provided with an information sheet about the study, agreed to participate, and provided informed consent. The Ethics Review Committee of Chulalongkorn University also approved the secondary data analysis.

STUDY POPULATION AND DATA SOURCES

Two flood-prone districts with a history of floods in the past 10 years from each province were purposively selected. All households in the chosen districts at the time of original data collection from 2019 to 2020 were eligible for this study. In the initial research, the head of the household was recruited as a representative for data collection, which was conducted through a face-to-face interview by trained primary healthcare officers and researchers. From a sample of 814 participants, a subsample for the present analysis was performed by excluding any incomplete or missing data. The final analyzed subsample was 376 participants for each province.

MEASUREMENTS

Six parts from the original survey were used for the analysis, including general characteristics, history of flooding experiences in the past 10 years, the impacts of flooding, level of flood concern, province of residence, and probable PTSD. Moreover, the impacts of flooding can be chosen from more than one item. The Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) is a 5-item screening for probable PTSD. If

the participants scored more than or equal to 3 points, this indicated a positive for probable PTSD [10]. The questionnaire from the original survey was validated by three experts with the Item Objective Congruence (IOC) Index of at least 0.7 for all items in the questionnaire. A pilot test for the Thai version of PC-PTSD-5 was conducted on 30 flood survivors before the original survey and was analyzed for reliability with a Cronbach's alpha value of 0.8.

STATISTICAL ANALYSIS

Data were cleaned and coded. Analyses were conducted using IBM SPSS, version 28 [12]. Frequency and percentage were presented for descriptive studies. A Chi-square test was performed to examine the association between general characteristics, history of flooding experiences in the past 10 years, the impact of flooding, level of flood concern, province of residence, and " probable PTSD." An alpha level < .20 was considered statistically significant in this step [13]. Multiple logistic regression was conducted to determine the associated risk factors with "having probable PTSD," with an alpha level < .05 regarded as statistical significance.

RESULTS

Most of the 752 participants, with ages ranging from 18 to 98, were women aged more than 50 years and had primary school education. The prevalence of probable PTSD among all participants was 12.6%. The prevalence of probable PTSD was 20.2% in Nakhon Sawan province and 5.1% in Nakhon Si Thammarat province. From Chi-square analysis, it was found that age group, educational level, salary, number of family members, no impact from flooding, and the province of residence were statistically significant associated with having probable PTSD (*p* value < .20) (Table 1).

Table 1: Associated factors and probable PTSD (*n* = 752)

Factors	Probable PTSD		*p* value
	Positive n (%)	Negative n (%)	
Gender			.615
Male	34 (35.8)	218 (33.2)	
Female	61 (64.2)	439 (66.8)	
Age (years)			.160*
≤ 30	3 (3.2)	26 (4.0)	
31 – 40	3 (3.2)	67 (10.2)	
41 – 50	10 (10.5)	129 (19.6)	
51 – 60	30 (31.6)	182 (27.7)	
≥ 61	49 (51.6)	253 (38.5)	
Educational level			.155*
Lower than primary school	5 (5.3)	60 (9.1)	
Primary school	67 (70.5)	419 (63.8)	
Secondary school	12 (12.6)	131 (19.9)	
Vocational education	4 (4.2)	20 (3.0)	
Bachelor's degree and above	7 (7.4)	27 (4.1)	
Occupation			.518
Agriculture	28 (29.5)	195 (29.7)	
Merchant	11 (11.6)	94 (14.3)	
Freelance	17 (17.9)	119 (18.1)	
Housewife	15 (15.8)	95 (14.5)	
NGO	0	4 (0.6)	
Government workers'	5 (5.3)	13 (2.0)	
Unemployed	11 (11.6)	60 (9.1)	
Others	8 (8.4)	77 (11.7)	
Salary (Thai Baht)			.134*
≤ 3000	23 (24.2)	164 (25.0)	
3001 – 6000	40 (42.1)	195 (29.7)	
6001 – 9000	13 (13.7)	131 (19.9)	
9001 – 12000	8 (8.4)	81 (12.3)	
≥ 12001	11 (11.6)	86 (13.1)	

Factors	Probable PTSD Positive n (%)	Negative n (%)	*p* value
Underlying disease			.407
Yes	49 (51.6)	309 (47.0)	
No	46 (48.4)	348 (53.0)	
Number of family members			.106*
1	10 (10.5)	67 (10.2)	
2	30 (31.6)	130 (19.8)	
3	21 (22.1)	155 (23.6)	
4	17 (17.9)	147 (22.4)	
≥ 5	17 (17.9)	158 (24.0)	
History of flooding experiences in the past 10 years			.227
1 – 2 time	16 (16.8)	103 (15.7)	
3 – 5 times	55 (57.9)	309 (47.0)	
5 – 10 times	22 (23.2)	217 (33.0)	
11 – 15 times	2 (2.1)	27 (4.1)	
> 15 times	0	1 (0.2)	
Impact of flooding			
No impact	12 (12.6)	50 (7.6)	.096*
Financial	75 (78.9)	514 (78.2)	.875
Migrate	25 (26.3)	160 (24.4)	.678
Destroy personal assets	52 (54.7)	393 (59.8)	.346
Sick (no treatment needed)	9 (9.5)	89 (13.5)	.270
Sick (treatment needed)	19 (20.0)	126 (19.2)	.849
Death of family members	0 (0.0)	7 (1.1)	.312
Others	2 (2.1)	6 (0.9)	.290
Level of flood concern			.690
Not at all concerned	9 (9.5)	48 (7.3)	
Slightly concerned	12 (12.6)	56 (8.5)	
Somewhat concerned	25 (26.3)	257 (39.1)	
Moderately concerned	32 (33.7)	161 (24.5)	
Extremely concerned	17 (17.9)	135 (20.5)	
Province of residence			< .001*
Nakhon Sawan	76 (80.0)	300 (45.7)	
Nakhon Si Thammarat	19 (20.0)	357 (54.3)	

Note: *Statistically significant difference (p value < .20)

Further analysis with multiple logistic regression in Table 2 shows that only the participants who resided in Nakhon Sawan province had 4.836 times higher odds of having probable PTSD than those who lived in Nakhon Si Thammarat province (AOR = 4.836, 95% CI [2.762, 8.467]).

Table 2: Associated risk factors and probable PTSD (*n* = 752)

Variables	AOR	95% CI	p value
Age			
- ≤ 30	0.457	0.105, 1.99	.297
- 31 – 40	0.211	0.053, 0.845	.028
- 41 – 50	0.379	0.167, 0.861	.020
- 51 – 60	0.886	0.512, 1.533	.666
- ≥ 61	1.00	Ref.	
Educational status			
- Lower than primary school	0.165	0.037, 0.74	.019
- Primary school	0.368	0.119, 1.138	.082
- High school	0.385	0.118, 1.256	.113
- Vocational education	1.065	0.219, 5.178	.938
- Bachelor's degree and above	1.00	Ref.	
Salary (Thai Baht)			
- ≤ 3000	1.484	0.571, 3.855	.418
- 3001 – 6000	2.445	0.99, 6.037	.053

Variables	AOR	95% CI	p value
- 6001 – 9000	0.797	0.299, 2.123	.649
- 9001 – 12000	1.004	0.337, 2.993	.994
≥ 12001	1.00	Ref.	
Number of family members			
- 1	0.651	0.263, 1.611	.353
- 2	1.244	0.614, 2.523	.544
- 3	0.934	0.452, 1.932	.854
- 4	0.805	0.379, 1.71	.572
- ≥ 5	1.00	Ref.	
Physical impact			
No impact	0.866	0.414, 1.814	.704
Had impact	1.00	Ref.	
Province of residence		Ref.	
- Nakhon Sawan	4.836	2.762, 8.467	< .001*
- Nakhon Si Thammarat	1.00	Ref.	

Notes: *Statistically significant difference (p value < .05); AOR: Adjusted Odds Ratio

DISCUSSION

In this study, probable PTSD was measured using PC-PTSD-5, designed to screen for PTSD and use in the community. The results found that the prevalence of probable PTSD was 12.6 % from a total of 752 participants. Interestingly, Nakhon Sawan province had significantly higher probable PTSD (20.2%) with participants than Nakhon Si Thammarat province (5.1%). Consistent with a previous meta-analysis study that the prevalence of PTSD 6 months after floods was 11.45% [14]. Moreover, the prevalence of PTSD varied between studies, from 0.63% to 46.64%, which may be caused by general characteristics and background such as education, culture, and area of residence of the participants [6, 14, 15].

However, the prevalence of probable PTSD was lower in this analysis compared with the previous study in Thailand, with a prevalence of 44.4% [5]. The difference could be from four main factors. Firstly, the difference in general characteristics and background of the participants in both studies. Secondly, the previous study examined the prevalence of PTSD right after floods which usually showed a higher prevalence of PTSD [14]. Thirdly, is a difference in screening tools for assessing PTSD. The previous study used GHQ-12 to screen PTSD, which is generally evaluated for mental health distress self-reports. In contrast, PC-PTSD-5 was used in this study to detect PTSD, as previously reported [10]. Lastly, the improvement of flood mitigation programs and psychological support by MCATT in Thailand. This study also found that provincial residence was the only associated risk factor, consistent with the meta-analysis study that the area of residence of the participants could affect the prevalence of PTSD [14].

CONCLUSION

Thailand has been facing many challenges from annual flooding events. However, there was a limited study on the prevalence of probable PTSD among flood-prone communities. This study found that the total prevalence of probable PTSD was 12.7% among participants from both Nakhon Sawan and Nakhon Si Thammarat provinces, consistent with the previous meta-analysis study. Further analysis found that participants from Nakhon Sawan province were presented with a higher prevalence of probable PTSD and had higher odds of having probable PTSD than those from Nakhon Sawan province. Therefore, timely screening for probable PTSD and other mental health issues among flood victims should be implemented. Therefore, appropriate relief measures such as support referral systems can be conducted in due course. In addition, further intervention should be conducted among people with probable PTSD, such as mental health support or crisis intervention.

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RELATIONSHIP OF SENSE OF OWNERSHIP AND TRUST TO COMMUNITY ENGAGEMENT IN THE COMMUNITY HEALTH WORKER PROGRAM, KARENNI STATE, MYANMAR: A CROSS-SECTIONAL STUDY

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ABSTRACT

Community health workers (CHWs) are considered the most promising health workforce in resource-constrained countries. However, the promise of CHW programs stems from their immersion in and support of the community. For this reason, the World Health Organization (WHO) has strongly encouraged the use of community engagement (CE) because it has a beneficial impact on CHW program outcomes such as community trust, awareness, support, and sense of ownership. In Demoso Township, Karenni State, Myanmar, the CHWs are the most common health professionals after the midwives, and yet the description of CE is mainly absent in the literature. The objective of this study was to explore the people's perceptions reflecting the ownership and trust towards CE. The findings would help generate recommendations for the CE strengthening to support the CHW programs. This quantitative descriptive cross-sectional study used a mobile application implemented in Demoso Township, Karenni State, Myanmar, in May 2022. The study tool combined the WHO guidelines on the CHW program, Dash et al.'s Decision-Making process, and Sripad et al.'s trust scale. It was then reviewed by the assigned expert committee for validity. The reliability test resulted in Cronbach alpha's values of 0.796, 0.766, 0.761, and 0.833, respectively, for participation in the intervention and decision making, health competence, and trust. The subjects were the service utilizers of CHWs and were randomly assigned. The Pearson chi-square test was run to analyze the associations between variables investigated and the level of engagement. Of the total of 425, 71.3% of participants have a high level of engagement which is transformational, a more proactive level allowing more leadership roles to the communities. There are statistically significant associations between CE and sociodemographic characteristics, including age, marital status, educational level, monthly household income, meeting venue, and collective funding with X^2 =15.102, 21.047, 22.100, 49.382, 21.854, 5.761, respectively ($p < .05$). The results showed no association between CE and ownership, $X^2 = 3.494$ with $p > .05$. However, a significant association was found between CE and trust, $X^2 = 6.826$ with $p < .05$. Our findings show a transformational level of engagement, whereas a statistically significant association between CE and trust was found. This study suggests health managers establish more trusting relationships between CHWs and the communities to increase their engagement in the CHW programs. This trust may create better ownership of the program in the future and towards the program's sustainability.

Keywords: Community Engagement, Community Health Workers, Myanmar, Sense of Ownership, Trust,

INTRODUCTION

To ensure acceptable and accessible community health services with the full participation of the community with affordability for self-reliance and self-determination, a new health cadre, the community health workers (CHWs), was introduced [1]. The CHWs are the lay persons who provide a wide range of services from health education, referrals, and preventative health to selected curative health [2]. In addition, they serve as a link between health, social, and community service providers and communities [2]. However, there remains a challenge to whether the CHW program designs are socially acceptable and whether the community is empowered to manage and determine the program [3].

The CE is applied to assess the participation of the community in the health intervention. The CE encompasses all the terms related to ways of integrating with the community [4]. Likewise, it is "a process of developing relationships that enable stakeholders to work together to address health-related issues and promote well-being to achieve positive health impact and outcomes" [5].

Bowen et al.'s three levels of engagement were applied to analyze the level of CE. They are transactional, transitional, and transformational engagement [6]. The transactional level engagement has a one-way communication from institution to community where the institutions decide, lead, implement, and demand the community to participate. The transitional level engagement has a somewhat two-way communication where a certain extent of collaboration occurs but more roles from the institution. The transformational or the empowerment level has two-way communication, and the skill transfer oriented purpose is present [4].

Further, the consequence of CE includes the sense of ownership [2], which is defined as the process that lies at the heart of empowerment of the communities in controlling their endeavors and destinies [7]. Moreover, the patients' trust in their healthcare providers is a substantial factor in successful healthcare [8]. Also, trust between the CHW and the community is one of the critical factors for an effective CHW program [3].

Myanmar has adopted the CHW program since the 1978 Alma Ata Declaration as part of the government "Health for All" program across the country [9]. Although there is no synchronizing data for the whole country, as far as the Ministry of Health Department can obtain, 118,767 total CHWs have been reported to have trained until 2020 [9]. A few studies have documented the significant contribution of the CHWs program on the improved outcomes in maternal health intervention, antenatal care, and contraception use. Nevertheless, the programs are not integrated into the government health system, budget, supply chain, and coordination mechanism [9].

All CHW programs in Myanmar are designed to contain community engagement strategies; however, the description of CE is mainly absent in the literature [9]. The objective of this study was to explore the people's perceptions reflecting the ownership and trust towards CE. The findings would help generate recommendations for the CE strengthening to support the CHW program.

METHODS

STUDY DESIGN, AREA, AND PERIOD

This study was a quantitative cross-sectional study conducted in Demoso Township of Karenni State, Myanmar. The township was purposively chosen due to the presence of the recently implemented or currently implemented CHWs program. Moreover, CHWs are the most common health professionals after midwives in the township. The four village tracts, under which 24 villages were included, were purposively selected due to their feasibility and accessibility for the data collection. The period of the study is from May 2022 to April 2023.

STUDY POPULATION

The total population covered was 79,201 in Demoso Township. The calculated sample size of 378 using Hulley, S.B. et al.'s statistical formula was combined with 12% compensation to 425. The subjects were randomly assigned from community members who had lived in the villages for more than 2 years. The additional inclusion criteria were age limit from 18 years old, either male or female, and had utilized service from CHWs.

STUDY MATERIALS

The study tool combined the WHO guidelines on the CHW program, Dash et al.'s Decision-Making process, and Sripad et al.'s trust scale. The developed questionnaire was then reviewed by the qualified specialist committee for validity. The reliability test was run for the questions on community participation in the intervention, community participation in decision-making, health care competence of CHWs, and respectful communication of CHWs, with the resulted scores of 0.796, 0.766, 0.761, and 0.833, respectively.

The questionnaire was constructed into four parts. The first part comprised multiple choice and short answer questions on sociodemographic factors such as gender, age, marital status, education level, household income, the presence of a designated venue for the community meeting, and the presence of collective funding. The second part of the questionnaire comprised nine items on the perception of the level of engagement. The respondents had to choose whether they strongly disagree, disagree, agree, or strongly agree with the statement. The CE level was classified into transactional, transitional, and transformational levels with a score of 1–5, 6–8, and 9–12, respectively. The third part asked the participants to rate the statement relating to the sense of ownership with 13 items. The fourth part included the statement relating to the community's trust with 13 items. All were 4-point Likert scale questions (strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4).

DATA COLLECTION

The supported data collection method was used. The KoBoToolbox mobile application allowed timely data collection and avoided internet accessibility limitations. The three assigned data assistants by Civil Health and Development Network (CHDN) were trained on the ethical issues and content and the KoBoToolbox. The data collection process was finished by the end of May 2022.

DATA ANALYSIS

Descriptive statistics were utilized to analyze the sociodemographic characteristics and the level of engagement. The chi-square test was run to identify the relationship between independent and outcome variables. A p value less than .05 was considered statistically significant.

ETHICAL APPROVAL

The ethnical review was approved by the Institutional Review Board of Faculty of Social Science and Humanities, Mahidol University, at the beginning of May 2022, with a certificate of approval number 2022/081.

RESULTS

The sociodemographic characteristics of the participants are described in Table 1. The participants were between 18 and 78, with a median age of 36 and a standard deviation of 13.28. The data showed that married participants accounted for 77.6% of the total participants. Also, 71.2% of participants had a lower than high school education level, and 90.8% of the total participants had a monthly household income of less than 100,000 MMK. Likewise, 68.2% of the participants mentioned that they had an existing meeting venue assigned for the community activity. However, only 32.7% had collective funding in the community.

Table 1 Sociodemographic Characteristics of Participants (n = 425)

Characteristics	Frequency n = 425	Percentage (%)
Age		
18–36	241	56.7
> = 37	184	43.3
Median = 36; *SD* = 13.28 [18, 78]		
Marital Status		

Characteristics	Frequency $n = 425$	Percentage (%)
Married	330	77.6
Single	75	17.6
Other	20	4.8
Education Level		
Lower than high school	302	71.1
High school and above	123	28.9
Household Monthly Income		
Less than 100,000 MMK	386	90.8
100,000–200,000 MMK	30	0.7
200,001– 300,000 MMK	6	7.1
300,001 MMK and above	3	1.4
Existing Meeting Venue		
Yes	290	68.2
No	135	31.8
Collective Funding for Health		
Yes	139	32.7
No	286	67.3

The individuals' perception of CE in the CHW program is described in Table 2, where 71.3% of the respondents perceived a transformational level of engagement.

Table 2 Community Engagement Level

	Frequency	Percent
Transitional	122	28.7
Transformational	303	71.3

The findings of the present study (Table 3) showed no association between CE and a Sense of Ownership, with $X^2 = 3.439$ and $p > 0.05$. However, a statistically significant association was found between the CE and community trust with $X^2 = 6.826$ with a p value < .05.

Table 3 Relationship of Ownership and Trust to Community Engagement

	Community Engagement			Pearson Chi-Square	*p* value
	Transactional (n, %)	Transitional (n, %)	Transformational (n, %)		
Sense of Ownership				3.494	.186
low	0(0)	15(31.9)	32(68.1)		
moderate	0(0)	25(37.7)	42(62.3)		
high	0(0)	82(26.4)	229(73.6)		
Trust				6.826	.035*
low	0(0)	19(31.1)	42(68.9)		
moderate	0(0)	36(38.7)	57(61.3)		
high	0(0)	67(24.7)	204(75.3)		

Note: *p < .05

The findings to identify associations showed in the Table 4 that the level of CE and age group were statistically significant with $X^2 = 14.869$, $p = .000$. The results showed that 75.2% of married participants had a transformational level of engagement, which had statistically significant associations with CE ($X^2 = 16.988$, $p = .001$). The level of education had a significant association with CE ($X^2 = 21.972$, $p = .000$). In addition, there was a statistically significant association between the level of CE and monthly household income, meeting venue, and collective funding with the chi-square value, $X^2 = 36.938$, 7.327, 6.435, respectively, with $p < .05$.

Table 4 Association of Community Engagement with Sociodemographic Characteristics

Characteristics	Community Engagement			Pearson Chi-Square	*p* value
	Transactional (n, %)	Transitional (n, %)	Transformational (n, %)		
Age Group				14.869	.000
Younger Adult	0(0)	87(36.1)	154(63.9)		
Older Adult	0(0)	35(19)	149(81)		
Marital Status				16.782	.000
Married	0(0)	82(24.8)	248(75.2)		
Single	0(0)	36(48)	39(52)		
Other	0(0)	4(21.1)	15(78.9)		
Education Level				15.576	.000
Lower than high school	0(0)	70(23.2)	232(76.8)		
High school and above	0(0)	52(42.3)	71(57.7)		
Household Monthly Income				36.938[a]	.000
Less than 100000 MMK	0(0)	95(24.6)	291(75.4)		
100000–200000 MMK	0(0)	21(70)	9(30)		
200001–300000 MMK	0(0)	3(50)	3(50)		
300001 MMK and above	0(0)	3(100)	0(0)		
Meeting Venue				7.327	.008
yes	0(0)	95(32.8)	195(67.2)		
no	0(0)	27(20)	108(80)		
Collective Funding				6.435	.008
Yes	0(0)	51(36.7)	88(63.3)		
No	0(0)	71(24.8)	215(75.2)		

Note: [a] Fisher's Exact Test

DISCUSSION

In this assessment of the CE in the CHW program, the results show that 71.3% of the samples perceived a transformational level of engagement characterized by the learning, decision-making, control over the engagement process, and benefits shared between the institution and the community [6]. In a study by Baltzell et al. to assess CE in Myanmar, a high level of CE was reported where CHWs are designated by local leadership through a community participatory approach [10]. However, Christens et al.'s assessment of the level of community participation found a difference between the self-reported and actual participation [11]. This discrepancy could be the reason for the high percentage in the transformational level of this study. Therefore, one crucial factor was raised to reconsider how to conceptualize and measure the CE.

This study finds no association between CE and ownership. In contrast, Mullenbach et al. showed a significant association [12]. In a study in Myanmar on the approach to control dengue vectors, the "community-controlled partner-driven," which reflects the definition of ownership, was found to have a superior effect on sustainability and community empowerment [13]. Different results may be due to the other study designs: experimental and cross-sectional studies.

This study revealed a statistically significant association between CE and trust. Also, Baltzell's study on CE in the Malaria program in Myanmar highlighted the association with the vital role of CHW in gaining trust and acceptance from the community [10]. In addition, a qualitative study of CE in Karen State, Myanmar, proved that the CE strategies had to build trust and establish a sense of authority [14]. Therefore, the continuous investment in the capacity building of CHWs for their health care competency and to support raising the trustworthiness of the CHWs are critical to capturing the community's trust.

The age group of the participants was divided into two groups: 18–36 and 37 and above. The findings showed that 81% of the older group but only 63.9% of the younger group engaged in the transformational level of engagement. There is a significant association with $p <$ .05. In a study on the influencing factors of market participation in the Dry Zone of Myanmar, the age of the household head was also found to have a negative

impact on the outcome [15]. So, the result suggests that it is worthwhile to consider age groups in the implementation to improve CE.

Participants' marital status showed that married people are more likely to engage in the program than single people, with 75.2% and 52%, respectively. The association is significant with $p < .05$. The results recommend that there is a need to encourage every category of status to participate in the community-level initiatives for meaningful CE. In contrast, a study in the Wattana-Nakorn District of Thailand found no statistically significant association between marital status and participation [16].

A statistically significant association was found between education level and CE. The least educated have the highest percentage in transformational engagement with 81.3%. Similarly, the study in the Dry Zone, Myanmar, also found the influence of educational level on the market participation of the farmers [15]. So, this study can be concluded that to stimulate CE in the CHW program, it is worthwhile to include educational level consideration.

In assessing the monthly household income, those with less than 100,000 MMK per month have 75.4%, and 0% of those with more than 300,000 MMK are in the transformational level of engagement. A significant association was found. Kyaw N.N et al.'s study on market participation of farmers similarly found a positive relationship [15]. In addition, Manesh et al.'s study in Thailand showed that those with lower than 5,000 THB income had good participation compared to those with high income. However, no significant association was found [16].

A statistically significant association was found in measuring the association between CE and defined meeting venue. This result is consistent with a study in Japan about the "Kayoinoba," community gathering places. The study indicated that after six years of promotion in these places, many high-risk older adults improved in social participation and networking and even helped reduce health inequalities in the community [17]. Therefore, mobilizing for a defined meeting place in the community should be considered for a smooth CE.

The presence of collective funding in the community has a statistically significant association with CE. A qualitative study in Indonesia assessing the CE in village funds management reported improved community participation around the fund. People participated in the direct implementation of the project. The evaluation of the implementation was practiced. The fund transparency was improved. And a sound communication channel was developed [18]. This suggests that the CE endeavors should include establishing or revitalizing village funds.

STUDY LIMITATIONS

The CE, sense of ownership, and trust are all abstract and intangible. When questioning individuals about their perspective of engagement in the program, they might rely on their skills, mood, and environmental conditions when conducting the interview. The quantitative measurement tool for those abstract concepts could also concern the study results. These might create some biases in the result. In addition, the study design is cross-sectional, that capture only the snapshot that a causality statement cannot be made.

CONCLUSION

The result of this study suggested that the CHW programs currently or recently implemented have a transformational CE level. The full participation of the community in the actions of their community has been acknowledged in the study area. This result can be generalized to all the CHW programs in Myanmar because this study had scoped to the area where 27 different organizations are operating. Those organizations have been funded by the same trend of donors to the whole country and therefore come from similar implementation designs. Moreover, with the statistically significant association with CE, program managers and implementors should design the programs to be more responsive to building trust between the CHWs and the community by providing regular refresher training on both technical and communication to CHWs, replenishing supplies, monitoring from the health system side, and so on. In addition, as this study uncovers some sociodemographic factors influencing the CE, the implementation should be sensitive to those factors to foster health equities and sustain achievements.

RECOMMENDATIONS

This study recommends that the current scale of CE in the CHW program should be continued with the ongoing support from both the donors and the government since the targeted outcome of the CE

should be planned with the long-term investment. And as this study only captures the perception of people on CE, the outcome from the CE should be further researched to endorse the genuine empowerment of the society.

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SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED WITH COMPREHENSIVE KNOWLEDGE OF HIV AMONG ADOLESCENTS AGED 15–19 IN ZIMBABWE

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ABSTRACT

With a prevalence rate of 3.8% among females and 2.1% among males, an increase in new human immunodeficiency virus (HIV) cases among adolescents in Zimbabwe is of great concern. The aim of this study is, therefore, to identify the factors associated with comprehensive knowledge of HIV among adolescents aged 15–19 in Zimbabwe. The paper is a secondary analysis of data collected from the Zimbabwe Demographic and Health Survey (ZDHS) of 2015/2016. The ZDHS used stratified two-stage cluster sampling. Quantitative methods, including descriptive statistics and simple and multiple logistic regression, were used to analyze a sample of 4,145 respondents. Findings reveal no significant difference in comprehensive knowledge of HIV among adolescents by sex (p = .770), but older adolescents at 19 had 1.85 higher odds compared to those aged 15 (AOR = 1.85; 95% CI [1.49, 2.28], p = .000). Those living in rural areas had 25% less odds of having comprehensive knowledge of HIV when compared to those residing in urban areas (AOR = 0.75; 95% CI [0.59, 0.97], p = .027). Higher wealth status was also associated with higher comprehensive knowledge of HIV. Adolescents from the wealthiest families were 1.34 times more likely to have comprehensive knowledge of HIV than the poorest. Those with secondary or higher education were twice as likely to have comprehensive knowledge than those without education. Results imply that the current policy on comprehensive sexuality education is not practical. Current policy revision is needed, and full implementation is required. There is a need for government to implement comprehensive sexuality education very early in high schools before adolescents are sexually active. Roadshows targeting poor communities are needed to impart knowledge to the poor with limited access to information.

Keywords: *Adolescents, comprehensive knowledge of HIV, factors, Zimbabwe.*

INTRODUCTION

The human immunodeficiency virus (HIV) has been a global health concern since the first case was discovered in the 1980s. Zimbabwe, a country in sub-Saharan Africa, is also battling HIV as the national HIV prevalence rate is 12.8% [1]. Of concern is the increase in new infections among adolescents in Zimbabwe. In 2018, young persons aged 15–24 accounted for one-third of all the new HIV infections [1]. Comprehensive knowledge of HIV is regarded as an essential component in reducing new HIV infections [1].

It is estimated that about 81,000 adolescents in Zimbabwe are currently living with HIV [2]. Of the new cases reported in 2018, cases among girls were twice as high compared to new cases among their male counterparts [2]. Some argue that new infections of HIV among adolescent girls are attributed in part to a lack of comprehensive knowledge of HIV and the increase in intergenerational relationships that make young girls vulnerable to older men [1].

Adolescent boys are misinformed as they are of the view that their risk of being infected with HIV is low because they date young girls [1]. The possible low-risk perception of HIV among adolescents in Zimbabwe is, to some extent, attributed to the cultural and religious systems rooted in patriarchy, making it difficult to implement policies on comprehensive sexuality education in schools [3].

The Zimbabwean culture regards the discussion of issues related to sexual education to young people as taboo, hence making it difficult to fully implement sexuality education in schools or community groups [3]. In addition, religions such as the Apostolic sect have doctrines that do not allow their congregants to access modern health care facilities or pursue education [4]. Such doctrines make it difficult for adolescents to gain information like comprehensive knowledge of HIV to protect themselves from the disease [4].

The advent of the digital era further increases the vulnerability of adolescents to HIV infection. The internet is widespread and a good source of relevant and helpful information as it is equally a source of wrong and misinformation [5]. As great consumers of internet services like social media, adolescents are highly vulnerable to toxic information, which leads to dangerous behaviors like multiple sex partners and drug use, which increase the vulnerability of young people to diseases like HIV [5]. This shows the importance of educating young people on comprehensive knowledge in this current era.

Studies on comprehensive knowledge of HIV have been conducted in various countries, mainly in middle-income and low-income countries such as Ghana, Indonesia, Nigeria, and Pakistan, to mention a few [6–9]. Results varied by context, but the significant factors associated with comprehensive knowledge of HIV include sex, age, wealth quintile, educational attainment, place of residence, and religion [6]. Moreover, studies on HIV knowledge in Zimbabwe have focused on general HIV knowledge among adolescents. The studies were based on small samples that cannot be generalized to the entire Zimbabwean adolescent population [10, 11].

This study sought to fill the gap in knowledge by using data from the Zimbabwe Demographic and Health Survey 2015/2016 that can be generalized to the entire Zimbabwe adolescent population. The study assessed if there are differences in comprehensive knowledge of HIV among adolescents by sex and factors associated with comprehensive knowledge of HIV among adolescents.

METHODS

STUDY DESIGN AND TARGET POPULATION

The researcher conducted a secondary analysis of data collected as part of the Zimbabwe Demographic and Health Survey (ZDHS) 2015/2016. The target population of this study was adolescents aged 15–19. The ZDHS 2015–2016 data sets were retrieved from Measure Evaluation's website. An additional variable, 'sex,' was created to differentiate the data sets for women (IR) and men (MR) with completed interviews (Male = 1, Female = 2). The two data sets were then appended, and only cases aged 15–19 were retained in the final SPSS data set for analyses. A sample of 4,145 adolescents was included in the analysis.

STATISTICAL ANALYSIS

Independent variables selected for this study included sex, age, marital status, level of education, religion, region, type of place of residence, and wealth quintile. Based on the ZDHS 2015/2016, wealth index was derived using principal component analysis based on household scores on different assets ranging from owning a television, bicycle, or a car, in addition to housing characteristics including a source of drinking water, ablution facilities, and type of floors. The distribution of scores was divided into five equal

categories (quintiles), with each quintile representing 20% of the population.

The dependent variable for this study was comprehensive knowledge of HIV. It was derived by adding the numeric responses to the individual HIV knowledge questions. Only those who answered all five questions correctly were considered to have comprehensive knowledge of HIV. Chi-square tests examined associations between each independent variable and comprehensive knowledge of HIV. Among the selected independent variables, linear regression was performed to check for potential multicollinearity by assessing correlation coefficients and computing the variance inflationary factor (VIF). Simple binary logistic regression was performed between each independent variable and the dependent variable using the Enter method. Finally, multiple binary logistic regression was performed, combining all selected independent variables into the model using the Enter method. The SPSS version 23.0 was utilized for all analyses, with a significance level of 5%.

RESULTS

Table 1 shows the descriptive statistics and characteristics of the adolescent sample included in the analysis. Only 43.8% of adolescents had comprehensive knowledge of HIV. Though knowledge of HIV is slightly higher among males (44%) than females (43.6%), results show that the difference by gender was not significant. Comprehensive knowledge of HIV increased with increasing age (p = .000). Residing in predominantly urban regions was significantly associated with having comprehensive knowledge of HIV compared to rural residents (p = .000). Comprehensive knowledge of HIV was associated with an increasing level of education. Religion was also associated with having comprehensive knowledge. Concerning the wealth index, coming from a more affluent background was associated with having comprehensive knowledge of HIV.

Table 1: Descriptive statistics and characteristics of the sample (n = 4,145)

Characteristics	Total	Comprehensive knowledge of HIV				p value
		Yes		No		
		Number	Percent	Number	Percent	
Total	4,145	1,815	43.8	2,330	56.2	
Sex						.770
Male	2,031	894	44.0	1,137	56.0	
Female	2,114	921	43.6	1,193	56.4	
Current age						.000
15	886	311	35.1	575	64.9	
16	852	338	39.7	514	60.3	
17	849	397	46.8	452	53.2	
18	788	361	45.8	427	54.2	
19	770	408	53.0	362	47.0	
Current marital status						.133
Never in union	3,696	1636	44.3	2,060	55.7	
Married	332	128	38.6	204	61.4	
Others	117	51	43.6	66	56.4	
Region						.009
Manicaland	472	213	45.1	259	54.9	
Mashonaland Central	422	175	41.5	247	58.5	
Mashonaland East	380	169	44.5	211	55.5	
Mashonaland West	450	204	45.3	246	54.7	
Matabeleland North	401	158	39.4	243	60.6	
Matabeleland South	369	136	36.9	233	63.1	
Midlands	466	215	46.1	251	53.9	
Masvingo	442	184	41.6	258	58.4	
Harare	386	181	46.9	205	53.1	
Bulawayo	357	180	50.4	177	49.6	
Type of place of residence						.000
Urban	1,463	788	53.9	675	46.1	
Rural	2,682	1027	38.3	1,655	61.7	
Educational level						.000

Characteristics	Total	Comprehensive knowledge of HIV				*p* value
		Yes		No		
		Number	Percent	Number	Percent	
No education	7	2	28.6	5	71.4	
Primary	922	232	25.2	690	74.8	
Secondary/Higher	3,216	1581	49.2	1,635	50.8	
Religion						.000
Roman Catholic	285	144	50.5	141	49.5	
Protestant	755	369	48.9	386	51.1	
Pentecostal	934	485	51.9	449	48.1	
Apostolic sect	1,470	560	38.1	910	61.9	
All others	701	257	36.7	444	63.3	
Wealth index						.000
Poorest	598	196	32.8	402	67.2	
Poorer	726	264	36.4	462	63.6	
Middle	896	358	40.0	538	60.0	
Richer	918	442	48.1	476	51.9	
Richest	1,007	555	55.1	452	44.9	

Results from simple binary logistic regression between selected socio-demographic variables and comprehensive knowledge of HIV. Variables including age, type of residence, religion, and wealth index had some independent and statistically significant associations with comprehensive knowledge of HIV among adolescents ($p < .05$). Adolescents aged 19 were two times more likely to have comprehensive knowledge of HIV compared to those aged 15 (COR = 2.08; 95% CI [1.71, 2.54], $p = .000$). Adolescents residing in rural areas were 47% less likely to have comprehensive knowledge of HIV compared to urban dwellers ($p = .000$). With Manicaland province as a reference, adolescents from Matabeleland South province were 46% less likely to have comprehensive knowledge of HIV. Adolescents belonging to the Apostolic sect were 56% less likely to have comprehensive knowledge of HIV compared to Roman Catholics (COR = 0.60; 95% CI [0.47, 0.78], $p = .000$). Richest adolescents had 2.5 higher odds of having comprehensive knowledge of HIV compared to the poorest (COR = 2.52; 95% CI [2.04, 3.11], $p = .000$).

Table 2 summarizes the multiple binary logistic regression results between the selected socio-demographic variables and comprehensive HIV knowledge among adolescents. After controlling for the effect of other predictor variables in the multiple logistic regression model, variables including age, region/province, and type of residence had significant associations with comprehensive knowledge of HIV. Adolescents aged 19 had 1.85 higher odds of having comprehensive knowledge of HIV compared to those aged 15 (AOR = 1.85; 95% CI [1.49, 2.28], $p = .000$). Adolescents from the capital, Harare, were 32% less likely to have comprehensive knowledge of HIV than those from Manicaland province. Rural residence had 25% less odds of having comprehensive knowledge of HIV compared to urban dwellers (AOR = 0.75; 95% CI [0.59, 0.97], $p = .027$). Though non-significant, the odds of having comprehensive knowledge increased with increasing income levels. Only 9.6% of the variation in comprehensive knowledge of HIV could be explained by the variables included in the model.

Table 2: Multiple binary logistic regression between socio-demographic variables and comprehensive knowledge of HIV

Characteristics	Comprehensive knowledge of HIV (n = 4,145)			
	AOR	95% CI for AOR		p value
		Lower	Upper	
Sex				
Male	Ref			
Female	.89	.77	1.02	.089
Age (in years)				.000*
15	Ref			
16	1.10	.90	1.35	.342
17	1.52	1.24	1.85	.000*
18	1.35	1.10	1.66	.004*
19	1.85	1.49	2.28	.000*
Marital status				.391
Never in union	Ref			
Married	.87	.67	1.14	.318
Others	1.17	.78	1.75	.442
Region				.135
Manicaland	Ref			
Mashonaland Central	1.03	.78	1.36	.828
Mashonaland East	.93	.70	1.24	.634
Mashonaland West	.93	.71	1.22	.598
Matabeleland North	.88	.66	1.18	.399
Matabeleland South	.79	.59	1.06	.118
Midlands	1.00	.76	1.31	.992
Masvingo	.85	.65	1.13	.264
Harare	.68	.51	.90	.008*
Bulawayo	.75	.55	1.02	.064
Type of residence				
Urban	Ref			
Rural	.75	.59	.97	.027*
Level of education				.000
No education	Ref			
Primary	.87	.16	4.65	.873
Secondary/Higher	2.04	.38	10.80	.404
Religion				.001
Roman Catholic	Ref			
Protestant	.97	.73	1.28	.815
Pentecostal	1.10	.84	1.45	.498
Apostolic sect	.80	.61	1.05	.109
All others	.74	.55	1.00	.047
Wealth index				.476
Poorest	Ref			
Poorer	1.02	.81	1.30	.842
Middle	1.10	.87	1.38	.417
Richer	1.21	.92	1.59	.167
Richest	1.34	.96	1.85	.083

Notes: * Statistically significant results; Nagelkerke R Squared = 9.6%; p = .000

DISCUSSION

In contrast to the expected results, given the patriarchal nature of the Zimbabwean society and culture, which supports male dominance, there were no significant differences in comprehensive knowledge of HIV between male and female adolescents. This might be explained by the fact that the government of Zimbabwe introduced education for all; hence more girls are also attending school, putting them at the same level as their male counterparts [12]. A study in Serbia among university students also found no differences in comprehensive knowledge of HIV by sex [13]. However, some studies found differences in comprehensive knowledge of HIV by sex, most likely because of different age groups included in the analyses [14, 15]. These results might indicate that if adolescents are exposed to the same educational system without gender segregation, gender inequality on matters to do with sexual and reproductive health may be reduced.

The results also reveal that marital status is not associated with comprehensive knowledge of HIV among adolescents in Zimbabwe. This result is likely caused by the low number of married adolescents in the ZDHS sample. The low numbers of married adolescents must be interpreted with caution as they do not imply that child marriage is low in Zimbabwe, but rather this might be a result of social desirability among adolescents interviewed during the ZDHS data collection. A study in India also supports the lack of association between comprehensive knowledge of HIV and marital status [16]. However, a study conducted in Ethiopia found an association between comprehensive knowledge of HIV and marital status [15].

Age is shown to be associated with comprehensive knowledge of HIV, as adolescents aged 19 were more likely to have comprehensive knowledge of HIV when compared to those aged 15. Bandura's social cognitive theory supports this finding, which argues that one learns through life experiences [17]. This explains why older adolescents seemed to have higher odds of having comprehensive knowledge of HIV. Similar findings are seen among studies in Serbia [13] and Indonesia [7].

Geographical location was also shown to be associated with comprehensive knowledge of HIV, as urban dwellers had higher odds of having comprehensive knowledge of HIV than rural dwellers. The possible explanation for this outcome is that rural areas seem underdeveloped in Zimbabwe and are home to a significant number of poor households compared to urban areas [18]. The results indicate the need to focus more on educating adolescents in rural areas as they do not have the privilege of reading HIV preventative measures on billboards like in urban areas, and some do not have access to internet services in rural areas. Likewise, a study in Iran found no association [19]. However, another study found similar results of higher odds of having comprehensive knowledge of HIV among those living in urban areas [6].

Both education and wealth index were shown to have associations with comprehensive knowledge of HIV. The higher the educational level and wealth status, the higher the odds of having comprehensive knowledge of HIV. Some studies have found similar results, including studies from Ethiopia and Ghana [6, 20]. Education is linked to higher odds of having comprehensive knowledge of HIV because the education system in Zimbabwe has included some aspects of sexual and reproductive health issues in schools even though full implementation of comprehensive sexuality education is yet to be achieved [3]. Wealth, on the other hand, increases one's odds of having comprehensive knowledge of HIV because of the privileges that come with wealth, such as access to education, access to health care facilities, and access to various sources of media, which then increase one's knowledge of sexual and reproductive health issues [21]. This finding suggests that all policy implements and sexual and reproductive health campaigns should aim at availing sexual and reproductive health information to the less privileged and less educated in Zimbabwean society.

CONCLUSION

The most noticeable finding was that there were no differences in comprehensive knowledge of HIV among adolescents by sex. Age, geographical location, education, and wealth quintile were associated with comprehensive knowledge of HIV.

RECOMMENDATIONS

Future qualitative research is needed to understand the reasons behind high new HIV infections among females. The government must implement comprehensive sexuality education in schools to educate adolescents about sexual and reproductive health issues like HIV. The government also needs to intensify roadshows and campaigns on sexual and

reproductive health issues like HIV among the poor and those in rural communities.

LIMITATIONS

The use of cross-sectional data means no causal relations could be established. The study focused on a few factors because of data limitations hence future studies that can include cultural and other factors are recommended. It is also important to point out that the purpose of the original Demographic and Health Survey differs from this current study's objective. As such, variables included in the DHS may not be sufficient to thoroughly investigate factors associated with comprehensive knowledge of HIV among adolescents.

ETHICAL DECLARATION

All data downloaded from the DHS website is kept on a personal hard drive and is not shared. Ethical approval of the research was granted by the Institutional Review Board, Institute for Population and Social Research Mahidol University.

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STRESS AMONG UNIVERSITY LECTURERS WITH ONLINE TEACHING DURING THE COVID-19 EPIDEMIC IN VIETNAM

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ABSTRACT

Background: Stress has different meanings for each person under concrete conditions. Stress is a part of the daily human experience, but it is associated with a variety of dissimilar problems, especially during the Covid-19 pandemic which has changed many aspects of daily life, including higher education.

Objective: The main purposes of this study were as follows: 1) To investigate the level of stress among lecturers in the universities in Vietnam during the Covid-19 pandemic; 2) To test for an association among socio-demographic characteristics, Covid-19 factors, teaching online, and stress among tertiary education lecturers in Vietnam.
Methods: Data were collected during April to May 2022 using an online questionnaire. A convenience sample of 247 lecturers in universities in Vietnam, age from 23 to over 50 years responded to the survey. The measurement tool was a Perceived Stress Scale (PSS-10). Chi-square was used to test for any association among factors and level of stress.

Results: Most of the respondents were female (77.7%), a plurality were age 31 to 40 years (45.7%), and the most common work load per week was under 48 hours (53%). Findings showed that 83.4% of participants reported a "*moderate*" level of stress, which was much higher than the percent reporting "*low*" and "*high*" stress (8.1% and 8.5%, respectively). The study found significant associations for education level (p=0.025), working hours per week (p=0.00), teaching method (p=0.036), and level of stress (low, moderate and high).

Conclusions: The prevalence of lecturers with "*moderate*" stress was substantial. The changes in the format of education have been accelerated by the Covid-19 pandemic. Covid containment measures have forced changes in teaching routines, and this has aggravated the stress of lecturers. A better understanding of the factors associated with stress can help inform interim solutions to minimize the level of stress and improve the efficiency of education until the situation returns to a "new normal."

***Keywords**: Stress, Lecturers, Teaching, Online Teaching, Covid-19.*

INTRODUCTION

In 2020, Covid-19 spread with dramatic speed throughout the world, and nearly every country was adversely affected in some way by the pandemic, which has continued through 2021 and 2022. Governments responded differently to containing and coping with the spread of Covid and, in some cases, the prevention measures seemed to do more harm than good, e.g., prolonged lockdowns, closure of worksites and public areas, travel limitations, and school closures. UNESCO has observed that Covid-19 has significantly affected the education sector across all regions, and an estimated 87% of the students from 165 countries were not able to maintain continuous on-site classroom learning as had been the case prior to the pandemic. The ministries of education in these countries had to provide alternative learning methods to maintain the progress of educating the younger generation. In particular, online teaching has become more prevalent than ever compared to the traditional methods of teaching or face-to-face learning [(1)]. However, ensuring that students have the equipment and resources for an uninterrupted Internet signal and access to the online platforms is a huge challenge in resource-constrained countries. Nevertheless, the transition to e-learning is moving very swiftly, and the success of online learning greatly depends on the knowledge of teachers and how they adapt the curriculum to the virtual classroom [(2)]. The demand for online teaching and learning has increased dramatically, and some of these changes may become permanent, even after the threat of Covid has abated [(3)].

During periods of Covid-19 lockdowns and quarantine, online instruction was almost the only means to keep students engaged with their formal education. However, e-learning is prone to self-isolation and, accordingly, reduction in academic achievement. Student mental health may also be adversely affected by the long periods of lonely confinement to a computer screen and loss of in-person interaction with classmates and peers. These factors can contribute to anxiety and depression of both students and instructors [(4)]. The Covid-19 pandemic has had an impact on the well-being and mental health of lecturers around the world [(5)]. Stress is directly associated with work-based psycho-social factors [(6)]. Thus, it is not surprising that studies have found that one in four lecturers reported that teaching was very or extremely stressful (5).
The Covid-19 pandemic has clearly posed a unique set of challenges for higher education and, particularly, compensating for the loss or truncation of face-to-face field activities [(7)]. Field activities are defined as educational activities that occur outside the classroom or educational institution, and involve interaction with the natural or built environment [(8)]. Therefore, lecturers have had to devise new approaches to teaching online in order to simulate field and in-person learning [(9)].

Teachers play a crucial role in delivering interactive online learning, and they cannot be replaced by video recording of lectures or self-learning digital tools. This adaptation has had to occur extremely rapidly as government mandates and school closures can be invoked suddenly whenever a Covid outbreak strikes, with little way to prepare or predict in advance.

The Vietnam government responded quickly and firmly in the face of the spreading pandemic of Covid-19. The response included travel restrictions and school closures, among other containment measures. To maintain alternative teaching methods, Vietnam has supported Internet access as an interim solution to keep students progressing through the core curriculum. A 2021 report on use of digital communication in Vietnam estimated that over 70% of the population had regular access and use of the Internet, and there was an increase in use between 2020 and 2021. Still, there are limitations of Internet access for instructors and students in different parts of Vietnam, and the multitude of teaching platforms can be overwhelming at times. The relationship between using smart devices and stress is a topic of concern for many researchers [(10)].

This study explored statistical associations between online teaching and stress of lecturers in Vietnam. The goal is to identify factors which can help reduce the level of stress among lecturers in higher education in Vietnam. The authors propose strategies to improve the quality of online instruction in ways that should reduce stress, and strategies for adapting learning methods to be appropriate for both students and lecturers alike.

METHODS

Research Design: This study used a cross-sectional survey design, and data were collected by online, self-administered questionnaire.

Participants: The study population is university lecturers who have been teaching online in Vietnam.

Measures: The self-administered questionnaire is divided into two parts.

PART 1: DEMOGRAPHIC CHARACTERISTICS: AGE, GENDER, MARITAL STATUS, AND DOMICILE.

Socio-environmental factors: Method of teaching, education background, workload, classroom size.
Covid-19 factors.

PART 2: PERCEIVED STRESS

The researchers applied the Perceived Stress Scale (PSS-10) [11]. The PSS includes ten questions, and response is organized using a 5-point Likert type rating scale from 0 (never) to 4 (very often) to measure the level of stress. Cronbach's Alpha for the questionnaire indicated that the reliability of the instrument was strong for stress (α= 0.8)

Data Collection: A special online link was used to distribute the questionnaire to lecturers in selected universities in Vietnam. All data collection in this study were carried out through the Google Forms application.

Data analysis: Descriptive statistics were used to analyze the distribution of response for the key variables. Chi-square was used to test for statistically significant associations between variables related to lecturer characteristics, online teaching, Covid-19, and stress.

RESULTS

A total of 247 lecturers took part in the research. Of these, 8.1% reported low stress, 83.4% moderate stress, and 8.5% high stress, with a mean stress score of 20.4 (SD= 5.0).

As can be seen from Table 1, most participants were in the age groups of under 30 years and 31-40 years old, accounting for 44.1% and 45.7% respectively. Over three-fourths (77.7%) were female, and nearly two-thirds (65.2%) were married. The majority (81.8%) of respondents lived in an urban area.

Labor law in Vietnam stipulates that the minimum working time for an employee is 48 hours per week. Table 2 shows that the mean working hours per week was 52.8 (SD= 12.5, Min = 40, Max= 84) and over half (53.0%) reported working 48 hours per week. As the Covid epidemic situation stabilized in Vietnam, most universities reopened to some extent, and offered a hybrid teaching method including both online and on-site sessions. There was no significant difference among lecturers for classroom size, which varied from 31-50 students, under 30 students, from 51 to 100 students, or 36.4%, 32.4% and 27.9%, respectively. The percent of classes with over 100 students was only 3.2%. Half the lecturers had a bachelor's degree (48.6%), followed closely by those with a master's degree, with few having a PhD. Most participants had less than five years of work experience, followed by 5 to 10 years (43.7% and 30.8%, respectively).

As shown in Table 3, 80.2% of the participants had three doses of the Covid vaccine. Fully 62.3% "*sometimes*" felt uncomfortable with the mandatory Covid containment regulations. In addition, 43.3% of the respondents "*sometimes*" felt worried about the variants of Covid-19, while 29.6% "*usually*" felt worried.

As shown in Table 4, there were significant associations among level of stress and number of work hours per week (p=0.000), teaching method (p=0.036), education background (p=0.025).

As shown in Table 5, lecturers with more than 48 work hours per week experienced a "*high*" level of stress, compared to the group of less than 48 hours. Lecturers experienced more stress with the hybrid format of instruction (i.e., both online and offline teaching). The lecturers who had a Ph.D. had a higher level of stress than those with less than a Ph.D.

Table 1: Socio-demographic Characteristics of the Sample)N=247(

Variable		Number	Percent
Age (years)	≤ 30	109	44.1%
	31-40	113	45.7%
	41-50	22	8.9%
	51-60	3	1.3%
	Mean (± SD)	32.3 ± 6.1 (Min= 24, Max= 54)	

Variable		Number	Percent
	Median:	32	
Gender	Male	55	22.3%
	Female	192	77.7%
Marital Status	Single	81	32.8%
	Married	161	65.2%
	Divorced	5	2.0%
Living Area	Urban	202	81.8%
	Rural	45	18.2%

Table 2: Teaching Conditions)N=247(

Variable		Number	Percent
Work Hours/week	≤ 48 hours	131	53%
	> 48 hours	161	47%
	Mean (± SD)	52.76 ± 12.5	
	Median	48	
Teaching Method	Online	86	34.8%
	Online and On site	161	65.2%
Working Experience	≤ 5 years	108	43.7%
	5-10 years	76	30.8%
	>10-15 years	40	16.2%
	>15-20 years	15	6.1%
	> 20 years	8	3.2%
Educational Level	Bachelor's degree	120	48.6%
	Master's degree	114	46.2%
	Ph.D.	13	5.3%
Classroom Size	<30 students	80	32.4%
	31-50 students	90	36.4%
	51-100 students	69	27.9%
	> 100 students	8	3.2%

Table 3: Covid-19 (N=247)

Variable		Number	Percent
Covid Vaccine Doses	2 doses	42	17%
	3 doses	198	80.2%
	4 doses	7	2.8%
Feeling sad with Covid regulations	Never (0%)	31	12.6%
	Sometimes (20%)	154	62.3%
	Usually (50%)	48	19.4%
	Often (80%)	10	4.0%
	Always (100%)	4	1.6%
Feeling worried about Covid variants	Never (0%)	13	5.3%
	Sometimes (20%)	107	43.3%
	Usually (50%)	73	29.6%
	Often (80%)	19	7.7%
	Always (100%)	35	14.2%

Table 4: Level of Stress by Independent Variables

Independent Variables	Level of stress	
	P-value	Cramer's V
Gender	0.216	0.106
Age	0.903	0.066
Marital status	0.795	0.052
Living Area	0.359	0.093
Working experience	0.847	0.087
Education Level	0.025*	0.142[L]
Working hour/week	0.00*	0.392[M]
Teaching Method	0.036*	0.163[L]
Classroom Size	0.328	0.151
Covid Vaccine	0.718	0.057
Feelings about containment regulations	0.211	0.143
Feeling about Covid-19 variants	0.775	0.108

Notes: * significant association at p-value<0.05
[L] : low association between independent variable and level of stress.
[M] : moderate association between independent variable and level of stress.

Table 5: Prevalence between the Associated Variables and Level of Stress

Variables		Level of stress			Total	p-value
		Low	Moderate	High		
Working hour per week	≤ 48 hours	19 14.5%	112 85.5%	0 0%	131 100%	0.000*
	> 48 hours	1 0.9%	94 81%	21 18.1%	116 100%	
Teaching Method	Online	8 9.3%	76 88.8%	2 2.3%	86 100%	0.036*
	Both online and offline	12 7.5%	130 80.7%	19 11.8%	161 100%	
Education Background	Bachelor	7 5.8%	99 82.5%	14 11.7%	120 100%	0.025*
	Master	12 10.5%	98 86%	4 3.5%	114 100%	
	PhD	1 7.7%	9 69.2%	3 23.1%	13 100%	

Note: *significant association at p-value<0.05

DISCUSSION

At present, stress is increasingly recognized as the debilitating condition it is, especially when stress is prolonged or chronic. The more highly-educated persons and even lecturers are not immune to stress. This study attempted to identify factors associated with stress by characteristics of a sample of lecturers, online instruction, and the containment of Covid-19.

The results show that the majority of lecturers suffered from a "*moderate*" level of stress, and that finding is similar to the results of a study of Arab and Jewish institutions of higher learning [(12)]. Some studies have found that the use of technology as part of a work-from-home policy can create feelings of tension [(13)]. During the Covid-19 pandemic, the shift to online teaching presents problems such as Internet access, adjusting to the learning software, and other complications. However, Vietnam has anticipated these challenges, and the government is providing considerable support to ensure that students have the communications hardware and software, and online

teaching platforms, and that has helped to limit the level of stress for both lecturers and students.

This study found no association between gender, age, marital status, living area, and stress level. There were significant associations among level of stress and number of work hours per week, teaching method, and education level.

Lecturers who worked more than 48 hours a week were more likely to have a "*high*" level of stress. A 2021 study in Ukraine found that educators reported an increased workload and stress from the shift to online classes [14]. The instructors faced myriad challenges with remote learning, for example, keeping track of student engagement, ensuring timely completion of assignments, and being mindful of the potential for cheating.

Although teaching online had some benefits, such as being able to spend more time with the immediate family, the lecturers admitted to being stressed due to deadlines and a higher workload than in the pre-Covid period, and that is consistent with a study at the University of Brunei Darussalam [15]. Working long hours was linked with psychological distress and physical ill-health [16]. This relationship is especially strong when average work-weeks regularly exceeded 48 hours [17].

Educational background was significantly associated with stress level of lecturers in universities. In this study, those with the highest education (i.e., PhD) reported experiencing more stress, perhaps because of the demands of students at the higher grade levels and the greater consequences of falling behind in the curriculum. In addition, the Vietnamese lecturers with a Ph.D. may also have administrative responsibilities in the university, such as serving as a head of an academic faculty or department. Furthermore, those lecturers with a Ph.D. may have had more responsibility to ensure that their host institution complied with government Covid containment measures. By contrast, an international study in Israel in 2022 [18] found that lecturers at a lower academic level had higher occupational insecurity during Covid and that, in turn, was associated with higher levels of stress in teaching. Those findings are similar to a study by Miller, Rutherford, and Kolodinsky [19].

During outbreaks of Covid-19 and school closure for in-person classes, lecturers felt pressure to identify lessons that were more suitable for online learning, often requiring learning a new teaching method. Furthermore, some lecturers were unfamiliar with technology and digital devices, and online teaching software as well. Some teachers faced communication barriers and challenges to keep students engaged with online classes. Lecturers felt the need to optimize use of online learning material and to evaluate teaching assignments in a new way in order to take into account the new dimensions of online learning [20]. The challenges of Covid for lecturers was certainly not unique to Vietnam; many countries around the world were also documenting stress and issues of work motivation across many sectors of the labor force [21]. After the Covid epidemic situation in Vietnam stabilized, universities started to re-open. However, this presented another challenge for the lecturers and students in adapting to the "new normal." Both groups experienced more stress from a hybrid curriculum of in-class and online instruction, compared to either approach by itself.

A 2021 study of personnel in from African universities found that lecturers with fewer years of seniority might feel insecure and, therefore, experience difficulty coping with a crisis [22], and that produced stress. People with under five years working experience tended to have a higher level of stress. These results were considered as evidence that the first working years are the most challenging, and the less-experienced lecturers were not able to skillfully face adversity. Further, that study found that changes in the teaching method were a predictor of stress, and that finding is consistent with this research.

Most of the participants reported having had three doses of the Covid-19 vaccine, and that helped the universities in Vietnam to reopen sooner for on-site classes. Participants with lower level stress were also people who never worried about Covid variants or did not feel uncomfortable the government containment measures. Accurate knowledge about Covid, having had the Covid vaccine, and the advent of effective treatments were all factors which made lecturers in this study to feel safe and experience less stress in the process of teaching.

CONCLUSIONS

At present, stress is increasingly recognized as a potentially serious debilitating conduction, especially for higher education instructors. The level of stress in the lecturers in universities in Vietnam in this study is moderate, but the number who did experience a high level of stress is worthy of concern.

This study found no statistical association between age, gender, marital status, living area, and stress level. The Covid-19 variables were also not associated with level of stress.

Instead, stress was associated with the abrupt transition to teaching online. What is more, the hybrid teaching format (combining both on-site and online instruction)

was even more stressful than either format alone. This study found that stress was higher among participants who had to work over the standard 48 working hours per week. Years of experience was inversely associated with the level of stress of the lecturers.

RECOMMENDATIONS

The findings from this study should be useful for the administrators of the universities and the policy makers in considering improvements in the quality of education, and minimizing the level of stress in a crisis situation such as a pandemic. Attention should be paid to the level of stress of educators in general and lecturers in particular. Based on the associated factors with level of stress, each academic department should consider making adjustments to some characteristics of the curriculum and teaching methods to decrease stress on lecturers.

Recently, the Vietnam government has put forth a new policy to decrease the standard number of weekly working hours and rise the base pay for all employees, including educators. This policy is intended to ameliorate the harm caused by two full years of the Covid-19 epidemic. In addition, the government is providing the latest technology to universities in rural areas which generally have less access to digital devices and communication software.

Furthermore, the workload should be distributed among all lecturers equally, and institutions should take care not to overwork their faculty members. There needs to be time allocated for leisure and unwinding after a long day of demanding work. The university needs to organize training courses so that the more experienced lecturers can advise their younger counterparts on time management and controlling the classroom, including social skills for interacting with students. The most important strategy is to increase awareness among lecturers about stress as a legitimate mental and physical health concern. They should be coached on coping mechanisms such as relaxation, time management, and interpersonal and social skills.

ETHICAL DECLARATION

The study protocol was reviewed and approved by the Ethics Committee of Nam Dinh University of Nursing, Nam Dinh, Vietnam (protocol number 965/GCN-HDDD).

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HEALTH RISK ASSESSMENT RELATED TO CADMIUM EXPOSURE FROM CIGARETTE SMOKING AMONG INDONESIAN SMOKERS IN SURAKARTA, INDONESIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Smoking tobacco cigarettes is a habit that negatively impacts the health of the world community, accounting for the deaths of more than 8 million people worldwide. Indonesia is no exception. As a developing country, Indonesia ranks third, following China and India for having the most significant number of smokers. Heavy metals in tobacco smoke accumulate in tissue and fluid that can cause carcinogenic and non-carcinogenic effects. Heavy metals such as cadmium, classified as a Group 1 carcinogen in tobacco smoke, pose significant health hazards. This study aimed to assess the human health risks of cadmium exposure from cigarette smoking among Indonesian smokers. Personal information and smoking behavior were obtained via an online questionnaire among Indonesian male smokers living in Surakarta. The survey was conducted on 100 subjects aged 20–35 who continually smoked for at least 6 months. The data analysis used four steps of Health Risk Assessments for inhalation from the United States EPA: Hazard identification, Dose-response assessment, Exposure Assessment, and Risk Characterization. The results of smoking behavior showed that as much as 19% of the male population smoked $M = 8.68$, $SD \pm 7.34$ cigarettes per day with an average of $M = 3.8$, $SD \pm 3.36$ years. Both cancer and non-cancer risks of heavy metals exposure through inhalation were assessed. The results showed the average cancer risk (CR), and non-cancer risk (HQ) were 4.75×10^{-6} and 132.0, which ranged from 3.74×10^{-7} to 2.06×10^{-5} and 10.3 to 571.4, respectively, 87% of subjects found the cancer risk > 1×10^{-6} and 100% found HQ > 1, which were exceeded the acceptable level. The results showed that non-cancer risks or suggested substantial non-cancer risks posed by heavy metals were found in 100 respondents. The Cancer Risk inhalation posed by personal cadmium exposure via inhalation averaged CR for Cd (4.75×10^{-6}), which exceeded the tolerable risk limit. These results indicate that ~ 5 out of one million adults living in the study area may develop cancer from inhaling cadmium. This study concluded that cadmium contained in cigarettes might pose adverse health risks to smokers with both cancer and non-cancer risks. These findings suggest that people should be more concerned about the heavy metals contamination from smoking that may lead to increased cases of non-carcinogenic and carcinogenic.

Keywords: *Cadmium, Smoking, Heavy Metals, Health Risk Assessment, Cancer risk.*

INTRODUCTION

Smoking tobacco is a public health threat that kills more than 8 million people worldwide. Tobacco users who live in low- and middle-income countries accounted for 80% of the global deaths, which causes significantly more health problems related to illness and death. Smoking tobacco causes more than 7 million active smokers to die, and around 1.2 million passive smokers account for much of the total death rate. The 2015 Global Burden of Disease (GBD) study showed a prevalence rate of smoking among 25% of men, half of which live in three Asian countries—China, India, and Indonesia.

A smoker inhales cigarette smoke either directly or indirectly. The active smoker is someone who smokes cigarettes regularly, while passive smokers are nonsmokers who participate in inhaling other people's cigarette smoke [(1)]. Riskesdas showed that 19.16% of daily smokers in Indonesia are in Surakarta city. The Global Burden of Disease stated that smoking tobacco carries a risk of premature death and morbidity in Indonesia. Each year as many as 225,700 people experience premature death from some diseases, such as heart disease, stroke, cancer, and lung disease [(2)]. Cancer and cardiovascular diseases can be attributed to the adverse effects of smoking. Smoking tobacco is an obstacle for Indonesia because smokers are more susceptible to illnesses. Likewise, the more people who are sick, the more state expenditures are needed for the treatment of noncommunicable diseases treatment. This demand represents 6% of total health care spending or around 15 trillion Indonesian Rupiah (≈ 1 billion USD) [(3)].

Smoking tobacco has a lot of toxic content and is very dangerous for the human body, one of which is heavy metals such as cadmium which can enter the human body through the air [(4)]. Cigarette smoke contains a high concentration of heavy metals, typically absorbed into the body by inhalation. One pack of cigarettes contains 24 g/kg of heavy metals, which are mostly absorbed by the lungs of smokers while those around them inhale the rest. The blood cadmium (Cd) content for smokers is 1.9 times higher than that of nonsmokers (2.67 ± 1.21 mg/l and 1.37 ± 0.45 mg/l, respectively (*M* ± *SD*, mean age 30 years) [(5)]. Smokers had a 1.7-fold higher serum cadmium level than nonsmokers (0.92 ± 0.83 mg/l and 0.55 ± 0.48 mg/l, mean age 36 years) [(6)]. A recent study showed cadmium concentration in Indonesian cigarettes is 0.93 µg/g [(7)].

Smoking contributes to health concerns owing to the presence of heavy metals. Cadmium contributes significantly to the risk of cancer [(4)]. Cadmium is classified as a Group 1 carcinogen [(8)]. The toxicity of these agents is evidenced by cadmium being identified in the top 10 environmental hazards by the Agency for Toxic Substances and Disease Registry [(9)]. Several studies have examined the health risk assessment of cigarette consumption, but few studies have analyzed heavy metals in Indonesian cigarettes. The research evaluated the concentrations of cadmium (Cd), lead (Pb), and zinc (Zn) in 10 branded cigarettes showing the human cancer risks posed by cadmium and lead and non-carcinogenic risk estimates for cadmium and lead were more significant than 1.0 (Hazard Index > 1) [(10)]. In addition, smoking tobacco is an essential contributor to cadmium exposure. Cadmium is the metal that has been examined most concerning cigarette smoke. So, we can conclude that cigarette smoking is the primary way humans consume cadmium [(11)].

Seeing as smoking habits are often found in Indonesian society and have an essential role in triggering deaths due to heart disease, we studied research on the health risk assessment related to cadmium and lead exposure from cigarette smoking among Indonesian smokers in Surakarta.

MATERIALS AND METHODS

STUDY AREA AND SUBJECTS

The city of Surakarta is in Central Java, Indonesia. Surakarta is the third-largest city in the southern part of Java Island. Surakarta is 44.03 km² with an altitude of ± 92 m above sea level and consists of five sub-districts. More than 60% of the land in Surakarta is used as residential land, and 20% of the existing area is used for economic activities. The city of Surakarta has a total population of 562,269 people, with a population density of 12,767 people per km^2, and a smoking rate of 19.16% [(12)].

This study was a preliminary analysis conducted from May to June 2022 using an online questionnaire constructed with Google Forms and distributed to 100 male smokers in Surakarta, Indonesia. The survey was based on a random sample of people aged 20–35 who smoked local Indonesian cigarettes for more than 6 months—the data regarding their socio-demographic and smoking behavior. A sample collection questionnaire (online questionnaire) was used for collecting data. The researcher distributed two questionnaires (screening and main questionnaires) to respondents who met the inclusion and exclusion

criteria. The questionnaire link was distributed to respondents in Surakarta, Indonesia, using official Surakarta city's social media platforms and social media influencers. After the respondents successfully entered the link, they filled out a screening questionnaire. The screening questionnaire consisted of fundamental questions such as living location, age, gender, and diseases. This questionnaire aimed to screen respondents before proceeding to the following questionnaire, which was the main questionnaire. If the respondent answered "No" to the inclusion criteria, they could not proceed to the main questionnaire.

HEALTH RISK ASSESSMENT

Health risk assessment is a data analysis technique used to estimate people's increased risk of health problems due to exposure to a toxic pollutant. There are four steps of health risk assessment.

Hazard Identification: The risk assessor examines whether a stressor has the potential to cause harm to humans. In this study, cadmium is considered a high concentration in tobacco smoking. Cadmium contributes to non-cancer effects such as respiratory effects (bronchitis, emphysema, and kidney). Cadmium also contributes to cancer risk, which has been classified as a Group 1 carcinogen.

Dose-response assessment: In this step, the risk assessor(s) examine what is known about the frequency, timing, and levels of contact with the stressor. The dose-response relationship for non-cancer effects was calculated differently than for cancer effects. Threshold values were developed for non-cancer-causing chemicals. Doses below the threshold are considered "safe," and doses above the threshold are considered dangerous.

Exposure assessment: The risk assessor collects information to determine a numerical relationship between exposure and effect. Smoking cessation mainly uses the inhalation exposure route to humans when the human body is exposed to cigarette smoke. In this way, cigarette smoke can be inhaled or exhaled from the mouth, which means that the most common route of tobacco use is via inhalation (13). The average daily dose (ADDinh, mg/kg. day) of heavy metals in tobacco cigarettes was defined as follows:

$$ADD = \frac{Cair \times InhR \times ET \times EF \times ED}{BW \times AT}$$

Where Cair represents the concentration of metals in tobacco cigarettes (mg/m3); InhR represents the volume of air inhaled over a specified timeframe (m3/hour) based on the health ministry of Indonesia for Indonesians (0.83); ET is the exposure time (24 h/day); EF refers to exposure frequency (365 days/year for metals in this study); ED is the exposure duration in years; AT is the averaging time (ED × 365 days/year). Furthermore, personal information (e.g., body weight (BW), kg) was extracted from the questionnaire-based survey and self-reported activity diaries of study participants (14).

Risk Characterization: In characterizing cancer and non-cancer risk, a human risk assessment was performed to estimate the non-cancer risk and cancer risk of heavy metal exposures via the inhalation route. The non-cancer risk of HMs via inhalation was estimated using a hazard quotient (HQ), with the following equation applied by U.S. Environmental Protection Agency:

HQ= ADD/ RfC (Reference Concentration)

Where RfC is the chronic inhalation reference concentration (mg/m3) of the targeted metal component (as reported in Table 1), a Hazard Quotient (HQ) value of > 1 suggests a potential non-cancer risk exposure to a particular metal component. An HQ value of < 1 indicates that adverse health outcomes are not expected from exposure to the metal component. In this research, excess lifetime cancer risk posed by heavy metals via inhalation (CRinh) was thus calculated using the updated equation:

Cancer risk = LADD x IUR (Inhalation Unit Risk)

Where IUR refers to inhalation unit risk of carcinogenic heavy metals (μg/m3), a CRinh of 1×10^{-6} is considered a negligible risk. However, CRinh values between 1×10^{-6} and 1×10^{-4} are considered acceptable or tolerable for regulatory purposes, while a CRinh above 1×10^{-4} is likely to be harmful to human beings, remediation may be desirable.

RESULTS

THE CHARACTERISTICS OF SUBJECTS

The personal information from 100 male smokers was collected, and the results of their characteristics were $M = 23.07$, $SD \pm 2.91$ years. The average daily smoking rate of tobacco cigarettes was 8.68 cigarettes/day. The average smoking duration was 3.8 years. The characteristics of the subjects are presented in Table 1.

Table 1: Characteristics of Respondents

Characteristics (N = 100)		
Age (years)	Mean ± SD	23.07 ± 2.91
	Median	22.00
	Min–Max	20–34
Smoking (Cigarettes/day)	Mean ± SD	8.68 ± 7.34
	Median	7.00
	Min–Max	1–50
Smoking duration (years)	Mean ± SD	3.8 ± 3.36
	Median	3.0
	Min–Max	0.5–20
Weight (kg)	Mean ± SD	60.8 ± 11.8
	Median	60
	Min–Max	34–128

HEALTH RISK ASSESSMENT

Cadmium is a heavy metal that can cause both cancer and non-cancer risks via inhalation and non-cancer risks of HMs via inhalation. For exposure assessment, the average tobacco cigarette consumption of the 100 surveyed was high at M = 8.68, SD ± 7.34. For risk assessment calculation, the inhalation rate was taken as 0.83 m^3/hour set by the Indonesian Ministry of Health. For non-cancer risk assessments, the hazard quotient (HQ) was calculated for the inhalation route due to the smoking behavior of the subjects. The HQ results showed M = 132 (See Table 2). For cancer risk, the results showed 4.75×10^{-6}. The CR*inh* posed by personal Cd exposure via inhalation was the highest for these adult participants. The average and 95th percentile values of CR*inh* for Cd (4.75×10^{-6}) exceeded the tolerable risk limit. These results indicate that 5 out of 1 million adults living in the study area may develop cancer from inhaling cadmium during their lifetime.

Table 2: Cadmium Risk Assessment

Cd Risk Assessment		
Non-cancer risk	Mean ± SD	132.0 ± 127.5
	Median	88.4
	Min–Max	10.40-571.0
Cancer risk	Mean ± SD	$4.75 \times 10^{-6} \pm 4.59 \times 10^{-6}$
	Median	3.18×10^{-6}
	Min–Max	$4.00 \times 10^{-7} – 2.06 \times 10^{-5}$

DISCUSSION

Limited studies have reported the effects of heavy metal exposures from Indonesian cigarette consumption. Our results were generated by previous studies examining the concentration of heavy metals in Indonesian cigarettes. The cadmium concentration found in this study agrees with the results previously reported that Indonesian cigarettes have a cadmium concentration ranging from 0.48–0.93 µg/g [7]. The results in Table 1 show that most respondents smoked 8.68 cigarettes per day, averaging 23 years. This indicates that a lot of smoking tobacco is consumed in the adult age range. This is also in line with the research conducted by Permana that an individual at about 30 years of age can smoke as many as 10 cigarettes in a day [15]. Another study showed higher yields in daily cigarette consumption; almost half of the respondents smoked more than 31 average daily cigarette consumption [16]. Research from Bali, Indonesia, showed similar results to cigarette consumption of 11–20 (32.1%) cigarettes per day. Various studies were also carried out to determine the smoking behavior of the Indonesian people, namely from basic health research, which states that adults can smoke one pack of cigarettes per day [12].

The smoking duration varied among respondents. The average is 3.8 years, with an average of smoking 3.7 times a day. It can be said that most of the respondents are active smokers [1]. Research from Gupta entirely differed in the duration of smoking, which is more than 10 years on average (44.6%). Smoking is a significant source of cadmium in the human body, linked to various health effects. If a cigarette is consumed in ten puffs of cigarette smoke, then within a year, smokers of 20 cigarettes (one pack) per day will experience roughly 70,000 puffs of cigarette smoke.

Some of the chemicals in cigarettes that are harmful to health are cumulative. One day, the poison dose will reach the toxic point, so symptoms will begin to appear.

Smoking is the leading risk factor and various cancer diseases, most notably lung, head, and neck cancer. Not only cancer but cadmium can also cause non-cancer diseases. The kidney appears to be the main target organ in humans following chronic inhalation exposure to cadmium. Respiratory effects, such as bronchitis and emphysema, have also been noted in humans chronically exposed to cadmium through inhalation [9]. The International Agency for Research on Cancer (IARC) categorized cadmium as a human carcinogen (Group 1) based on sufficient evidence in humans and experimental animals.

This study found the Hazard Quotient (HQ) result was 132 and the cancer risk $4.75 \times 10^{-6,}$ with 87% of subjects found the cancer risk > $1x10^{-6}$ and 100% found HQ > 1. This finding exceeded the acceptable level from US EPA that stated the HQ value > 1 suggests a potential non-cancer risk exposure to a particular metal component. In contrast, cancer risk above 1×10^{-4} is likely to harm human beings. This result is in line with the research by Dinh that showed the average Hazard Index value of Cd was 40.7, and the Cancer Risk result was (7.32×10^{-4}), which exceeded the normal value for cancer risk [7]. The result of the Hazard Index (HI) is the same as the research of Benson, which showed HI for Cd was more significant than 1.0 (HI > 1), and the human cancer risks posed by Cd ranged between 1.87 x 10^{-2} and 2.52 x 10^{-2} [10].

The high exposure to cadmium in cigarettes is also supported by research conducted by Mayaserli, which shows levels of cadmium in the urine of smokers, which means that smokers are more at risk for exposure to non-cancer risks [17]. The lung tissue of smokers had a higher content of the heavy metals that were analyzed elements compared to the lung tissue of nonsmokers. The study found significantly higher levels of cadmium and lead in smokers' lung tissue. The lead means level was three times higher in smokers than nonsmokers (0.32 vs. 0.11 g/g). However, the cadmium level was almost ten times higher in the lung tissue of smokers compared to nonsmokers (0.68 vs. 0.074 g/g) [18]. Thus, it is evident that smoking influences the content of cadmium and lead in the lung tissue.

A significant strength of this study is that this is a critical study examining the possible effects of heavy metals in cigarettes that have not been widely carried out, especially on the heavy metals content in Indonesian cigarettes. A significant weakness of this study was not measuring the ambient air of heavy metals concentration directly from the respondent's site.

CONCLUSION AND RECOMMENDATIONS

This study evaluated the human health risk from heavy metals in cigarette smoking from Indonesian tobacco in Surakarta, Central Java, Indonesia. The concentration of Cd in Indonesian cigarettes is 0.93 µg/g, which is then used to analyze the health risk assessment. The HQ result is 132, and the cancer risk is $4.75 \times 10^{-6,}$ which exceeded the acceptable level from US EPA guidance. Moreover, 87% of subjects found the cancer risk > 1 x $10^{-6,}$ and 100% found HQ > 1, which means the result is unacceptable for non-cancer and cancer risk.

The results can be used beneficially and applied to manage and control the risk in the community who generally smoke tobacco cigarettes and prevent adverse health risks from heavy metals contamination in cigarettes. This study provides vital information for international and local health authorities, standard enforcement organizations, and the general population on the inherent dangers of smoking cigarettes. Relevant agencies must ensure strict regulation of locally produced cigarette and tobacco products. A comprehensive assessment of the contents and the full disclosure of all ingredients in cigarettes and other tobacco products consumed in Indonesia with the potential risks correlated with exposure to heavy metals should be communicated to the general population, especially the cigarette consumers who can give them knowledge about the adverse effects to the human body.

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ASSOCIATION BETWEEN LONELINESS AND RELATED FACTORS AMONG UNIVERSITY STUDENTS DURING COVID-19 PANDEMIC IN BANGLADESH: A CASE STUDY OF A PRIVATE UNIVERSITY

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ABSTRACT

Loneliness is the state of wanting human contact but ending up feeling alone. The factors associated with loneliness are rarely studied and researched, especially during the COVID-19 pandemic period. University students are one of the vulnerable groups to be affected by loneliness. Many factors within and around them change when a child becomes an adolescent. This study aimed to analyze the association between loneliness and related factors among Bangladeshi university students. A cross-sectional survey was conducted in May 2022 among university students in Bangladesh. A total of 245 responses were received through convenience sampling. The questionnaire included demographic factors, i.e., age, gender, and BMI; relationships; health behaviors; UCLA loneliness scale. The prevalence of loneliness among university students was 67.8%. Logistic regression analysis was used to measure the association between loneliness and the related factors. It was found that loneliness was significantly associated with students $\geq$ 22 years old (Unadjusted OR = 2.57, 95%CI [1.09, 6.03]). A bad relationship with family was also found to be a significant risk factor for loneliness (Unadjusted OR = 2.82, 95%CI [1.37, 5.79]). This study suggests that age and relationship with family are the only factors that affect loneliness among university students in Bangladesh. Our study indicated that the prevalence of loneliness was significantly high among university students. The educators concerned should reach out and provide counseling consultations to high-risk groups, especially students $\geq$ 22 years old and those with bad family relationships.

Keywords: *family relationships, gender, loneliness, student, COVID-19*

INTRODUCTION

Loneliness is commonly defined as a distressing feeling due to the perception that an individual's social needs are not being met, consequently ending up feeling alone [(1)]. Humans are social beings, constantly feeling the need for social relationships as an integral part of our survival. An article published by the World Health Organization explained that loneliness is a subjective term, and due to a lack of quality of people with whom one can share feelings rather than quantity of people, a person can still feel lonely even if they seem to be socially active from a third person point of view [(2)]. Loneliness is most common in adolescents and the older generation [(3)]. However, loneliness has now become prevalent throughout all age groups globally. Research has shown that loneliness peaks in adolescence and early adulthood as well as in old age [(4)]. A previous study reviewed data from 113 countries from 2000 to 2019. The analysis reported that the pooled prevalence of loneliness for adolescents ranged from 9.2% in Southeast Asia to 14.4% in the Eastern Mediterranean region. For adults, loneliness was up to 21.3% in the European region. No data was available for the Asian region [(5)].

Much research has analyzed the importance of social relationships and the negative consequences of loneliness, which can be physical and/or mental health related, ranging from cognition, emotion, and behavior. Several studies have discovered health impacts of loneliness, including increased morbidity and mortality by increasing cardiovascular health risk, systolic blood pressure, physiological aging, depressive symptoms, etc. [(6–10)]. Several studies have found that loneliness has been associated with suicide, psychosis, increased risk of Alzheimer's disease, and impaired cognitive functioning over time [(11–14)]. There are several risk factors for loneliness that have previously been reported. These include living alone, lower educational attainment, the inadequacy of financial resources, having a disability, and risk of anxiety and depression for all age groups. Risk factors for young adults included being male, having a higher age, and having little contact with family [(4)].

Since December 2019, the COVID-19 pandemic has hit the world. It forced people to go into isolation and become distant from each other. One of the groups primarily affected by the pandemic is university students. Research suggests that loneliness levels increased in students and the general population during the pandemic. The increases were more prevalent among students [(15)]. Although no data has been found on the prevalence of loneliness among Bangladeshi university students, a study reported that 71% of individuals aged 18–65 across Bangladesh suffered from loneliness during the pandemic [(16)].

The previous research on other countries reported that COVID-19 had a considerable impact on the student population and their loneliness status. However, in Bangladesh, most research on loneliness during and before the pandemic is based on older adults. Therefore, in this study, we aimed to analyze the association between loneliness and related factors among Bangladeshi university students during the COVID-19 pandemic, as the impact of loneliness can be tremendous on physical and mental health. The study will also determine the prevalence of loneliness among this group. This study will help to understand the status of loneliness among university students and the risk factors. This will help the educators take appropriate action to improve the situation and take necessary actions to support the risk groups in the student community.

METHODS

STUDY DESIGN AND PARTICIPANTS

This cross-sectional online survey was conducted between 23 and 30 May 2022 in a reputed private university in Dhaka, Bangladesh. The reason behind choosing this university is that it has six faculties and more than 10,000 undergraduate students from all over the country.

A total of 245 participants were selected through convenience sampling. All these participants were included in the final analysis as none of the surveys had any missing data. Based on the rule of thumb for the sample size required for logistic regression published by Green (1991), the required subject number (N) is $N > 50 + 8p$, where p is the number of predictors. Since we have eight predicting variables, p equals 8. Therefore, the required sample size is $N > 50 + 8(8) = 114$ (95%CI = 5%) [(17)]. Inclusion criteria were that participants must be able to read and write in English, be a student (of any department) of undergraduate studies at the selected university, be part of social media, should have the ability to use Google Forms, be a Bangladeshi resident and nationality, be 18–25 years old and have already completed at least one semester at the university. Exclusion criteria were having physical chronic diseases such as cancer, CVD, diabetes, CKD, and diagnosed mental diseases such as MDD, schizophrenia, and bipolar disorder.

ETHICAL CONSIDERATIONS

The study was approved by the ethics committee at Public Health Foundation, Bangladesh (COA No.: PHF-SG-4001). Informed consent was taken electronically due to social distancing measures during COVID-19. The questionnaire was distributed using social media, where the URL and QR code to the Google Forms was shared. The QR code was directed to the screening questions to filter out participants based on inclusion and exclusion criteria. The participants meeting these criteria were moved to the next section, where a link to the participant information sheet explaining all aspects of this research was provided. Participants who agreed to the electronic informed consent were only able to participate.

MEASUREMENTS

The questionnaire comprised data related to sociodemographic factors like age (≤ 19 years old, 20 years old, 21 years old, ≥ 22 years old), gender (male, female), BMI (underweight, normal, overweight, obese), self-dependence (yes, no), and living condition (living alone, living with immediate family, living with relatives, living with friends); health behavior about caffeine intake (yes, no), and alcohol consumption yes, no); and relationship with family (good, bad, neutral).

These variables were analyzed to see if they were associated with loneliness. Loneliness was measured using the UCLA-3 items loneliness scale. The questions asked for assessing loneliness on this scale are 1) First, how often do you feel you lack companionship? 2). How often do you feel left out? and 3). How often do you feel isolated from others? The responses were recorded in a three-point Likert scale where "hardly ever" scored as 1, "some of the time" was scored as 2, and "often" scored as 3. Scores for all three loneliness items were totaled and categorized into lonely or not lonely. Participants who scored 3 to 5 were categorized as "not lonely," whereas participants who scored 6 to 9 were categorized as "lonely." Previous research showed that the scale was highly reliable, both in terms of internal consistency with a coefficient $\alpha = 0.89$ to 0.94 and test-retest reliability over a 1-year period with $r = 0.73$ [18].

DATA ANALYSIS

Descriptive statistics were used to determine the percentage of each research variable and summarize the obtained data. Each variable is characterized by loneliness status (lonely or not lonely) through crosstabulation. Prevalence of loneliness and no loneliness within each category is reported. Bivariate logistic regression was used to analyze the association between the predictor's variables and loneliness. Statistical significance was defined as $p < .05$ and analyzed using SPSS version 24.

RESULTS

This study aimed to analyze the association between loneliness and related factors among Bangladeshi university students during the COVID-19 pandemic and the prevalence of loneliness.

SOCIODEMOGRAPHIC CHARACTERISTICS

Table 1 shows the sociodemographic characteristics of the study participants categorized by "lonely" or "not lonely" attained by crosstabulation. The prevalence of loneliness among the sample was 67.8%. It is seen that most participants were 20 years old (32.2%), followed by at least 22 years old (30.2%). Prevalence of loneliness was also highest within the age group of at least 22 years old (33.1%), followed by 20 years old (30.7%), 21 years old (25.3%), and lowest among participants who were 19 years old or younger (10.8%). More males answered the survey than females (68.6%,) with a higher prevalence of loneliness among the male group (68.1%). Most participants reported their BMI to be normal (53.1%), with the prevalence of loneliness highest within this group (54.2%). The prevalence of loneliness among participants who were overweight was higher (28.3%) compared to those who reported being underweight (8.4%) or obese (9.0%). Most participants were not self-dependent (80.4%), and the prevalence of loneliness was also higher within this group than among participants who reported being self-dependent (81.9%). Regarding living conditions, 69% of participants reported living with immediate family. This group also had a higher prevalence of loneliness (67.6%) compared to participants who reported living alone (7.8%), with other relatives (7.8%), or with friends (16.9%).

Table 1: Participants' Sociodemographic characteristics classified by loneliness status

Sociodemographic characteristic	Loneliness Status Not Lonely (%)	Lonely (%)	Total *n* = 245 (%)
Age in Years			
≤ 19	16 (20.3)	18 (10.8)	34 (13.9)
20	28 (35.4)	51 (30.7)	79 (32.2)
21	16 (20.3)	42 (25.3)	58 (23.7)
≥ 22	19 (24.1)	55 (33.1)	74 (30.2)
Gender			
Male	55 (69.6)	113 (68.1)	168 (68.6)
Female	24 (30.4)	53 (31.9)	77 (31.4)
BMI			
Underweight	4 (5.1)	14 (8.4)	18 (7.3)
Normal	40 (50.6)	90 (54.2)	130 (53.1)
Overweight	25 (31.6)	47 (28.3)	72 (7.3)
Obese	10 (12.7)	15 (9.0)	24 (10.2)
Self-Dependence			
Yes	18 (22.8)	30 (18.1)	24 (19.6)
No	61 (77.2)	136 (81.9)	197 (80.4)
Living Condition			
Living with immediate family	57 (72.2)	112 (67.5)	169 (69.0)
Living alone	3 (3.8)	13 (7.8)	16 (6.5)
Living with other relatives	6 (7.6)	13 (7.8)	19 (7.8)
Living with friends	13 (16.5)	28 (16.9)	41 (16.7)

HEALTH BEHAVIOR AND FAMILY RELATIONSHIP

According to the data, 73.5% of the participants reported drinking coffee. Prevalence of loneliness was higher among people who drank coffee (75.3%) than people who did not drink coffee (24.7%). When a relationship with family was analyzed, most participants reported having a good relationship with family (70.6%), followed by neutral (24.5%), and bad relationship (4.9%). The prevalence of loneliness also followed a similar trend. Among the participants who reported being lonely, 63.9% had a good relationship with their family, 29.5% had a neutral relationship, and 6.6% had a bad relationship with their family. As for alcohol consumption, most participants said they have never consumed alcohol (93.1%). 96.6% of people who reported being lonely also belonged to this group. Table 2 shows the frequency of health behavior and family relationship among the participants categorized by loneliness status.

Table 2: Participants' health behavior and family relationship classified by loneliness status

Health behavior and family relationship	Loneliness Status Not Lonely (%)	Lonely (%)	Total *n* = 245 (%)
Caffeine Consumption			
Yes	55 (69.6)	125 (75.3)	180 (73.5)
No	24 (30.4)	41 (24.7)	65 (26.5)
Alcohol Consumption			
Yes	3 (3.8)	14 (8.4)	17 (6.9)
Never	76 (96.2)	152 (96.6)	228 (93.1)
Relationship with family			
Good	67 (84.8)	106 (63.9)	173 (70.6)
Bad	1 (1.3)	11 (6.6)	12 (4.9)
Neutral	11 (13.9)	49 (29.5)	60 (24.5)

BIVARIATE ANALYSIS TO FIND OUT THE ASSOCIATION BETWEEN LONELINESS AND RELATED FACTORS.

Table 3 shows the association between sociodemographic characteristics and loneliness. Age was found to be significantly associated with loneliness. Participants who were at least 22 years old were 2.57 times more likely to be lonely (95%CI [1.09, 6.03], p < .05) compared to participants l9 or younger. None of the other sociodemographic factors were found to be significant.

Table 3: Association between sociodemographic characteristics and loneliness analyzed through bivariate logistic

Sociodemographic characteristic		Unadjusted OR [95%CI]	*p*-value
Age (Years)			
	≤ 19	Ref.	
	20	1.62 [0.71, 3.66]	.247
	21	2.33 [0.96, 5.66]	.061
	≥ 22	2.57 [1.09, 6.03]	.030*
Gender			
	Male	Ref.	
	Female	1.07 [0.60, 1.92]	.807
BMI			
	Underweight	1.55 [0.48, 5.02]	.460
	Normal	Ref	
	Overweight	0.84 [0.45, 1.54]	.565
	Obese	0.66 [0.27, 1.61]	.368
Self-dependence			
	Yes	Ref.	
	No	1.34 [0.69, 2.53]	.386
Living Condition			
	Living with immediate family	Ref	
	Living alone	2.21 [0.60, 8.05]	.231
	Living with other relatives	1.10 [0.39, 3.05]	.851
	Living with friends	1.09 [0.53, 2.28]	.806

Notes: *Age ≥ 22 years is significantly associated with loneliness when not adjusted with any other significant factors (Unadjusted OR = 2.57, 95%CI [1.09, 6.03], p < .05)

Table 4 shows the association between health behavior & family relationships, and loneliness. It was found that relationship with family was a significant risk factor for loneliness. The results showed that people who had a bad relationship with family were 2.82 times (95%CI [1.37, 5.79], *p* < .05) more likely to be lonely compared to people who had a good relationship with their family.

Table 4: Association between health behavior & family relationships and loneliness analyzed through bivariate logistic regression

Health behavior and family relationship		Unadjusted OR [95%CI]	*p*-value
Caffeine Intake			
	Yes	1.33 [0.73, 2.41]	.347
	No	Ref	
Alcohol Consumption			
	Yes	2.33 [0.65, 8.37]	.193
	No	Ref	
Relationship with family			
	Good	Ref	
	Bad	2.82 [1.37, 5.79]	*.005
	Neutral	6.95 [0.87, 55.0]	.066

Notes: *Having a bad relationship with family is significantly associated with loneliness when not adjusted with any other significant factors (Unadjusted OR = 2.82, 95%CI [1.37, 5.79], p < .05)

DISCUSSION

A cross-sectional study was carried out in Dhaka, Bangladesh, to find the association between loneliness and related factors among 245 university students during the COVID-19 pandemic. The study found a significant positive association between loneliness with age and relationships with family. Contrary to the hypothesis, loneliness was not significantly associated with gender, BMI, self-dependence, living conditions, or alcohol and caffeine consumption. This study indicates that the prevalence of loneliness among university students during COVID-19 was as high as 67.8%.

During the COVID-19 pandemic, a study conducted in Bangladesh among the general population aged 18–65 reported a high prevalence (71%) of loneliness [16]. This is consistent with our research, where the prevalence was 67.8%. However, the prevalence rate in our study was slightly higher than reported earlier in a survey conducted on intern doctors in Bangladesh during the pandemic (43.5 %) [19]. This may be due to differences in the study population.

This study was conducted on a student group at a private university in Bangladesh, which had been closed for over a year due to the pandemic, driving them away from their friends and left with nothing much to do at home as most of the study participants reported to be dependent on their family financially and not to work a job. This may be one reason why loneliness is so high among this group. Medical doctors are front liners during the pandemic and constantly working during this difficult time. Although they are more prone to suffering from mental health problems during this time, they might have little to no time to feel alone or isolated with constantly working. A cross-cohort analysis conducted in the United Kingdom reported that loneliness increased significantly among students during the pandemic than before [15]. This is consistent with the high prevalence of loneliness reported in this study.

This study also indicated that participants at least 22 years old were 2.57 times (95%CI [1.09, 6.03], $p < .05$) more likely to be lonely compared to those 19 years or younger. This can be explained by the fact that people 22 years or older are likely to be in their third or fourth academic year compared to those who are 19 or younger, who would most likely be in their first year. Compared to the younger undergraduates, the third- and fourth-year students are likely to have more friends around the university. First-year students did not have on-site classes since they enrolled in a university, so the pandemic would not affect their loneliness. The university's closure during the pandemic might cause the friendships of the older students to drift apart, attributing to increasing loneliness.

There is little data on the association between this age group and loneliness. However, a study conducted on university students in Germany contradicts our findings. The study reported that the level of loneliness decreased from the youngest to the oldest group of students using the Mann-Whitney U test ($p = < .05$) [20]. However, this study was conducted before the pandemic, which can explain the difference in the result. Before the pandemic, when students had to attend classes on-site, it was more likely for the younger students to be lonelier due to a change in environment and not having friends around the campus. As they take more classes and move to higher academic years, chances of making more friends are likely to increase, and loneliness is expected to decrease.

Another significant predictor of loneliness reported in this study was the relationship with the family. This study showed that participants who had a bad relationship with family were 2.82 times (95%CI [1.37, 5.79], $p < .05$) more likely to be lonely than people who had good relationships with family. In Bangladesh, it is common for adults to stay with their families as a part of the culture.

Although younger adults moved away from family in search of better education, during the pandemic, when all universities were closed, most students stayed with their immediate family. This can be reflected in the findings of this study, where 69% of the participants reported staying with immediate family. Although authorities decided to reopen the institutions when the survey was conducted, this university was closed due to the semester break. Due to this, the students also spent much time in their dwelling and with their family members. Having a bad relationship with the family means they would be unable to share their feelings with their family or simply feel stuck with them, leading to a sense of isolation and loneliness. Although many studies have analyzed the association between living conditions and loneliness, little is only known about the association between the relationship between family and loneliness. A multisite longitudinal study conducted on adolescents indicated that, compared with adolescents in families with one or more poor-quality ties, adolescents with all high-quality relational ties experienced lower levels of loneliness, which is consistent with our finding [21].

This study had a few limitations. First, this was a self-administered questionnaire, meaning the responses can be subjectively biased. This study was only conducted in one university, so the results are not generalizable to a larger population.

CONCLUSION AND RECOMMENDATIONS

This cross-sectional study aimed to determine the prevalence of loneliness and analyze the association between loneliness and related factors among university students during the COVID-19 pandemic. The results showed that the prevalence of loneliness was as high as 67.8% among university students during this period. The significant predictors associated with loneliness were age (≥ 22 years old) and having a bad relationship with the family. The university authority can use these data to reach out and provide counseling consultations to high-risk groups, especially students under 22 years old and those with bad relationships with family. The university can arrange psychosocial sessions to reduce the prevalence of loneliness in the community. This study can be used as a pilot study to research several universities across the country to make the data more generalizable.

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PROPORTION OF MUSCULOSKELETAL SYMPTOMS AMONG FEMALE GARMENT WORKERS IN KHAN MEAN CHEY, PHNOM PENH, CAMBODIA: A PRELIMINARY RESULT FROM CROSS-SECTIONAL STUDY

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ABSTRACT

Musculoskeletal disorders (MSDs) are a serious public health concern stemming from inappropriate workstation designs and poor postures in developed and developing countries. This preliminary study aimed to investigate the proportion of musculoskeletal symptoms among garment workers in Khan Mean Chey, Phnom Penh, Cambodia. A cross-sectional study was carried out among 87 female garment workers from April to May 2022. The data were collected through face-to-face interviews using the standardized Nordic questionnaire (SNQ). The questionnaire related to demographic and subject characteristics was validated by three key experts. Descriptive statistics were used to present the proportion of MSDs. In total, 87 garment workers were between 18 and 52 years old (M = 33, SD ± 7.79). The results revealed that 62.0% had at least one musculoskeletal symptom. The prevalence of MSDs in the previous seven days before data collection was in the shoulder (13.8%), lower back (11.5%), upper back (5.7%), and feet (5.7%). Moreover, the prevalence of MSDs in the previous 12 months was in the shoulder (23.0%), followed by the lower back (13%) and neck (11.5%). According to the preliminary results, the proportion of MSDs in the 12 months before data collection was higher than in the previous seven days among female garment workers, except for the elbow and hip. Further study should investigate the risk factors and working conditions of a larger population to design appropriate preventive measures to help minimize musculoskeletal problems.

Keywords: *Musculoskeletal disorders; Garment workers; Cambodia*

INTRODUCTION

The musculoskeletal system permits the human body to move freely. Musculoskeletal disorders (MSDs) harm body systems such as muscles, tendons, ligaments, cartilage, bones, join, and/or nerves, affecting employee quality of life and performance losses [(1)]. Moreover, MSDs account for 40% of all injuries in the United States, with an annual residual cost of USD 45–54 billion. Such diseases are more severe and acute in underdeveloped nations [(2)]. Previous studies have attempted to comprehend the impact of various risks of MSDs. These MSDs can be divided into two types, i.e., those based on physical aspects of the work (carrying heavy loads, bad posture, repetitive movements, physical exertion, mechanical pressure on bodily tissues, cold working conditions, body vibrations) and those based on the work environment and work organization (pace of work, repetition of tasks, work timetable, remuneration systems, job monotony, fatigue, worker perception of job organization, and psychosocial factors) [(3)]. Workplace activities such as carrying large loads, repetitive tasks, uncomfortable postures, highly repetitive motions, physical job duties, and poorly built ergonomic workstations were also physical risk factors associated with MSD issues [(4–5)].

The prevalence of MSDs among garment workers in Kandal province in Cambodia in 2016 was studied. The response rate was 98.3% (702 workers) among 714 workers. The majority (89.3%) were female. In the 12 months before data collection, 92% of workers complained about at least one body area, and 89% reported similar symptoms during the previous seven days. The most affected parts were the neck, shoulder, and lower back [(6)]. Since the late 1990s, Cambodia's garment industry has played a significant role in the country's economy. This industry accounted for around 15% of the gross domestic product and 50% of manufacturing jobs. Cambodia earned over US$4 million from exported garment products, comprising 58.9% of Cambodia's total export value for 2011 [(7)]. Currently, women make up the majority of garment workers. They come from the countryside to work in Phnom Penh, Kampong Speu, and Kandal provinces. Phnom Penh and Kandal account for about 90% of all garment manufacturing in Cambodia.

Garment workers typically labor in shifts and for lengthy periods; thus, the consideration of MSDs among workers who make money for the country is needed. However, only one study related the prevalence of musculoskeletal symptoms among garment workers in Kandal province, Cambodia [(6)]. Therefore, the study aimed to investigate the proportion of musculoskeletal symptoms among garment workers in Khan Mean Chey, Phnom Penh city, Cambodia.

METHODS

A preliminary cross-sectional research design studied the prevalence of musculoskeletal symptoms among female garment workers from April to May 2022. This study was carried out with 87 participants and was selected by a simple random sampling technique. The data were collected through face-to-face interviews using the standardized Nordic questionnaire (SNQ) [(8)]. According to the MSDs, participants were requested to report whether "yes" and "no" if they had any trouble in various parts of their body, including the neck, shoulder, upper back, elbow, lower back, hand, hip, knee, and ankle during the last seven days and the last 12 months.

The questionnaire related to demographic and subject characteristics (i.e., age, marital status, education level, exercise, alcohol drinking, cigarette smoking, and monthly income) was validated by three key experts. The IBM statistical package for the social sciences (SPSS) version 28 was used for data analysis. Statistical investigations of the individual demographic characteristics and MSDs among the participants of the present study were disclosed as a frequency, percentage, mean, and ± standard deviation (± SD). The participants who reported musculoskeletal symptoms in at least one part of their body during the previous seven days and the previous 12 months were classified as MSDs. Cross-tabulation analysis was used to present cross-data results between demographic characteristics and MSDs.

RESULTS

As shown in Table 1, the 87 female garment workers were between 18 and 52 years (M = 33, SD ± 7.79 years). Most were married (79.3%) and graduated from primary school (56.3%). Approximately 65.5% of female garment workers never exercised. All of them never smoked cigarettes, while some drank alcohol in the past (8.0%) and are currently drinking (6.9%). Over half (52.9%) had a monthly income between US$200–300, 40.2% with an income lower than US$200, and 6.9% over US$300.

Table 1 Demographic characteristics ($n = 87$)

Demographic characteristics	n(%)
Age	
18–35 years	55(63.2)
36–52 years	32(36.8)
($M = 33$; $SD \pm 7.79$; min, max = 18, 52 years)	
Marital status	
Single	16(18.4)
Married	69(79.3)
Widowed	2(2.3)
Education level	
Primary school	49(56.3)
Secondary school	33(37.9)
High school	5(5.7)
Exercise	
Never	57(65.5)
≤ 3 times/week	23(26.4)
> 3 times/week	7(8.0)
Alcohol drinking	
Never drink	74(85.1)
Drank in the past	7(8.0)
Currently drinking	6(6.9)
Cigarette smoking	
Never smoke	87(100.0)
Monthly income	
< US$200	35(40.2)
US$200–300	46(52.9)
> US$300	6(6.9)

Table 2 shows the musculoskeletal symptoms among female garment workers during the last seven days and the previous 12 months. About 62% of them had at least one MSD symptom. Over the previous seven days, female garment workers reported the prevalence of MSDs in their shoulder (13.8%), lower back (11.5%), upper neck (6.9%), back (5.7%), and feet (5.7%). In the previous 12 months, the workers reported the most musculoskeletal problems with their shoulder, lower back, and neck, 23.0%, 13.8%, and 11.5%, respectively.

Table 2 Musculoskeletal symptoms during the last seven days and last 12 months ($n = 87$)

Parts of body	Response			
	Last seven days		Last 12 months	
	Yes n(%)	No n(%)	Yes n(%)	No n(%)
Neck	6(6.9)	81(93.1)	10(11.5)	77(88.5)
Shoulder	12(13.8)	75(86.2)	20(23.0)	67(77.0)
Upper back	5(5.7)	82(94.3)	6(6.9)	81(93.1)
Elbow	2(2.3)	85(97.7)	1(1.1)	86(98.9)
Lower back	10(11.5)	77(88.5)	12(13.8)	75(86.2)
Hand	2(2.3)	85(97.7)	3(3.4)	84(96.6)
Hip	3(3.4)	84(96.6)	2(2.3)	85(97.7)
Knee	2(2.3)	85(97.7)	5(5.7)	82(94.3)
Angle	5(5.7)	82(94.3)	6(6.9)	81(93.1)

In Table 3, most garment workers reported MSDs in the group aged between 18–35 years (39.1%), married (47.1%), graduated primary school (35.6%), never exercised (40.2%), and had monthly income between US$200–300 (34.5%). Over half of the participants who never drank alcohol also reported MSDs (55.2%).

Table 3 Cross-tabulation between demographic characteristics and MSDs (n = 87)

Demographic characteristics	MSDs Yes n(%)	No n(%)
Age		
18–35 years	34 (39.1)	21 (24.1)
36–52 years	21 (24.1)	11 (12.6)
Marital status		
Single	12 (13.8)	4 (4.6)
Married	41 (47.1)	28 (32.2)
Widowed	2 (2.3)	0 (0)
Education level		
Primary school	31 (35.6)	18 (20.7)
Secondary school	19 (21.8)	14 (16.1)
High school	5 (5.7)	0 (0)
Exercise		
Never	35 (40.2)	22 (25.3)
≤ 3 times/week	14 (16.1)	9 (10.3)
> 3 times/week	6 (6.9)	1 (1.1)
Alcohol drinking		
Never drink	48 (55.2)	26 (29.9)
Drank in the past	3 (3.4)	4 (4.6)
Currently drinking	4 (4.6)	2 (2.3)
Monthly income		
< US$200	22 (25.3)	13 (14.9)
US$200–300	30 (34.5)	16 (18.4)
> US$300	3 (3.4)	3 (3.4)

DISCUSSION

This preliminary study showed that the average age of female garment workers was 33 years. Most graduated from primary school and never drank alcohol. Participants who reported at least one musculoskeletal symptom were classified into MSDs. The MSDs prevalence was 62%. Previous studies in Bangladesh indicated the prevalence of MSDs among female readymade garment workers was 57% [9]. Regarding joint and bone pain, 13.8% of the participants mainly reported shoulder pain, 11.5% with lower back pain, and 5.7% with upper back pain and feet pain during the seven days. Another study among garment workers in Kandal province, Cambodia, found that the seven-day musculoskeletal prevalence was more prevalent in the neck, shoulder, and lower back [6].

Nevertheless, the most prevalent MSDs in the previous 12-month period demonstrated that shoulder pain was 23.0%, lower back pain was 13.0%, and neck pain was 11.5%. Due to the finding, the neck, back, and shoulder were general anatomical areas to be affected. The most significant ergonomic factors related to musculoskeletal disorders in the garment factories were poor working spaces, inappropriate workstation design, mental stress, low-quality working environments, bending or lifting the neck, twisting the body, repetitive work, prolonged sitting or standing, and bending forward, and hand position while working [12–13].

Except for elbow and hip, the proportion of musculoskeletal symptoms consisting of neck, shoulder, upper and lower back, hand, knee, and ankle in the past 12 months was higher than in the past seven days among female garment workers. Many combined factors may cause musculoskeletal symptoms. In cross-tabulation analysis, over haft of the participants aged 18–35 complained about MSDs. A prior study revealed a significant association between age groups and the prevalence of any MSD being highly reported in younger ages 25–30 (9). However, aging is one of the risk factors for MSDs because it causes degeneration of muscle cells and a decrease in their strength [10]. Two-fifths (40.2%) of female garment workers who never exercise reported MSDs. A previous study mentioned that muscle pain tends to occur in workers who lack exercise habits [14]. As recommended, physical activities are needed because it has a beneficial effect on energy metabolism and may further improve bone mass and muscle function [11]. The MSDs causes are complex and multi-factorial. The MSD symptoms may be influenced by working techniques, work organization, individual characteristics, psycho-social factors, and other factors.

Several limitations should be concerned in this study. First, the preliminary cross-sectional design of the survey study cannot clarify the causes of MSDs in female garment workers. Second, the participants'

answers probably do not reflect their symptoms, especially in the last 12 months, possibly increasing recall bias. Third, this study conducted a small number of only female participants. Thus, future studies should increase the sample size and consider MSDs for both males and females. However, the present study did have some important strengths. First, it is one of the few studies evaluating MSDs among garment workers in Khan Mean Chey, Phnom Penh, Cambodia. Second, this finding might be helpful as scientific evidence for establishing MSDs prevention guidelines and standards.

CONCLUSION

According to the preliminary results, MSDs are high among female garment workers aged 18–35 who never exercise. Most reported higher MSDs in the last 12 months compared to the previous seven-day period. This problem may result in significant absenteeism and loss of productivity in the garment industry. Further understanding of risk factors for work-related MSDs among female garment workers should be evaluated.

RECOMMENDATION

The study shows that most female garment workers suffer from musculoskeletal symptoms. To reduce the musculoskeletal disorders among garment workers, the ergonomic risk factors should be undertaken, which can lead us to the proper preventive measure to protect the workers' health.

ETHICAL DECLARATION

Research ethics was approved by National Ethic Committee for Health Research in Cambodia (No 149 NECHR). All participants in the original survey had informed consent before participating in the study.

ACKNOWLEDGEMENT

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DECLARATION OF CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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OUTPATIENT SATISFACTION WITH COMMUNITY A HEALTH SERVICE CENTER USING SERVQUAL-IPA IN SHANGHAI, PEOPLE'S REPUBLIC OF CHINA

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ABSTRACT

Patient satisfaction surveys have been highly valued since satisfying the needs and expectations of patients has become an essential strategy for survival in the healthcare market. The objectives of this study were to assesses outpatient satisfaction with a community health service center in Shanghai, and to identify the most essential service items in terms of their need for managerial action to improve outpatient satisfaction. In December 2021, a cross-sectional study was conducted in a community health service center in Shanghai. The subjects were obtained by stratified convenience sampling from eight outpatient departments. Outpatients aged ≥ 18， willing to take part, were included. Unwillingness to participate and unavailability for an interview were considered the exclusion criteria. Researchers randomly solicited 424 participants in outpatient clinics of the health service center to fill out questionnaires face-to-face. The SERVQUAL scale was used to design the questionnaire in this study to obtain patients' expectations and perceived satisfaction scores for 22 service items from five service dimensions: tangibles, reliability, responsiveness, assurance, and empathy. The GAP analysis revealed the gap between expectations and perceived satisfaction. In addition, the original importance-performance analysis (IPA) and the revised IPA were applied to identify the necessary service items in terms of their need for managerial action to improve outpatient satisfaction. A total of 414 out of 424 completed questionnaires were returned, resulting in a response rate of 97.6%. The mean values of outpatients' expectations and perceived satisfaction were 4.561 ± 0.502 and 4.577 ± 0.472, respectively. According to the GAP analysis, 78.02% (323/414) subjects were satisfied, with a perceived satisfaction value ≥ expectation value. There was a significant correlation between expectations and perceived satisfaction, which did not meet the assumptions of the original IPA analysis. So, the revised IPA analysis was more applicable than the initial IPA analysis. The revised IPA showed that Item 1 – "the up-to-date equipment" and Item 18 – "giving individualized patient services" were in Quadrant IV "concentrate here," which patients consider very important and highly expected. At the same time, the actual perceived satisfaction score is low. Over 78% of the subjects were satisfied with the community health service center. The two essential items, but with low satisfaction perceived by outpatients, were Item 1 – "the up-to-date equipment" and Item 18 – "giving individualized patient services." The managers of this hospital should take steps toward improving the quality of services in Items 1 and 18 to increase outpatient satisfaction.

Keywords： *Outpatient satisfaction, SERVQUAL, Importance–performance analysis (IPA)*

INTRODUCTION

The increasing marketization of healthcare services and the growing momentum of consumerism have influenced health managers to focus on service quality to compete in the healthcare marketplace [1]. Satisfaction is a concept that is particularly important in health care and is critical in assessing the quality of services provided by organizations [2], since health managers need patient input and feedback to improve the quality of services. It has been found that satisfied patients are more likely to benefit from health care [3]. Therefore, patient satisfaction has been highly valued. Careful attention to the issue of patient satisfaction can profoundly improve the quality of health care services [2].

Satisfaction is generally defined as "the clients' perceived fulfillment of their demands and expectations." Thus, the level of patient satisfaction is a difference between a patient's perceived and expected performance [2]. The SERVQUAL scale was developed by PZB in 1988 to measure customer expectations and perceived satisfaction with the evaluation items [4]. There are different methods for determining the expectations of patients. The SERVQUAL is one of the best and most used models [3]. Our study used it to measure the outpatients' expectations and perceptions of the service qualities in Dapuqiao Community Health Service Center to know the level of outpatient satisfaction.

In addition, customer satisfaction directly impacts customer retention and the institution's market share. There is a positive correlation between customer satisfaction and profitability [5]. Therefore, improving customer satisfaction is critical for managers in today's competitive healthcare market [5].To help the health service center to stay abreast of competitors, we want to identify the necessary service items in terms of their need for managerial action to improve outpatient satisfaction.

The IPA was initially designed as a tool for targeted improvement and efficient resource allocation. The IPA has proven helpful in identifying the critical service performance in customer satisfaction survey data for services (3). In the IPA matrix, the importance and performance of the attribute are described along the x-axis and y-axis, respectively (5). This matrix is divided into four quadrants using the mean value of importance and performance as the intersection point (Figure 1). In Quadrant I, "Keep up the good work" both performance and importance are high) (6), attributes are the organization's primary strength and denote opportunities to achieve or maintain a competitive advantage. In Quadrant II, "possible overkill" (performance is high and importance is low), attributes represent business resources dedicated to these and would be overkill and should be deployed elsewhere (5). In Quadrant III, "low priority" (performance and importance are low), attributes are weaknesses, and extra effort is not required (5). Finally, in Quadrant IV, "concentrate here," attributes are of high importance but low performance (5). Focusing constructive action on this area will have the most significant effect. It should be a top priority and targeted for immediate improvement efforts (6). So, to improve outpatient satisfaction, we applied IPA in our data analysis; the performance is outpatients' perceived satisfaction. The service items in Quadrant IV are necessary in terms of their need for managerial action.

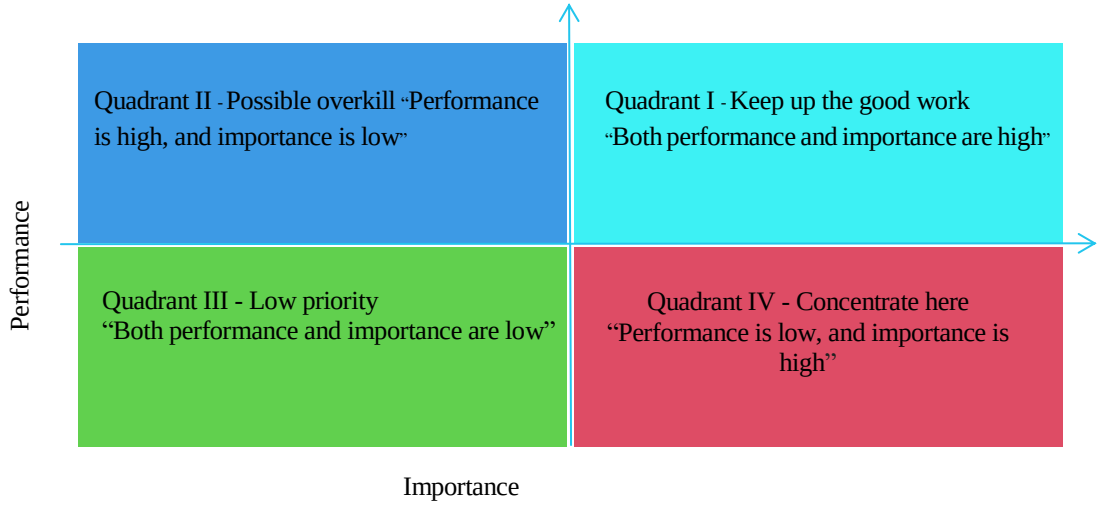

Figure 1 Importance–performance analysis

METHODS

RESEARCH STUDY DESIGN AND SUBJECTS

A cross-sectional study was conducted in the Dapuqiao Community Health Service Center in Shanghai, the People's Republic of China. The protocol was approved by the ethics committee of the Dapuqiao Community Health Service Center. Patients entered the study after their consent for participation was received. The sample size was calculated using the formula:

$$N = \frac{Z^2 pq}{e^2} \quad (7).$$

With a maximum error of .05, a confidence level of 95%, assuming p = 0.5 (maximum variability), and considering 10% invalid questionnaires, the sample size was 424. The subjects were obtained by stratified convenience sampling from eight outpatient departments of the center (Figure 2). We calculated the sample proportion of each department according to the number of consulting rooms, as follows: Sample size in each department =

$$\frac{\text{Number of clinics} * \text{Number of sample size}}{\text{Total Number of clinics}}$$

Outpatients aged ≥ 18 years, who agreed to participate were included. Outpatients unwilling to participate or unavailability to answer survey questions due to physical or mental conditions were excluded. A survey team of uniformly trained medical staff intercepted outpatients on-site during various working shifts and days until the intended sample size was fulfilled. Surveyors interviewed outpatients, and the questionnaires were filled out independently or with the help of the surveyor. Finally, 414 valid questionnaires were obtained, with a recovery rate of 97.6%.

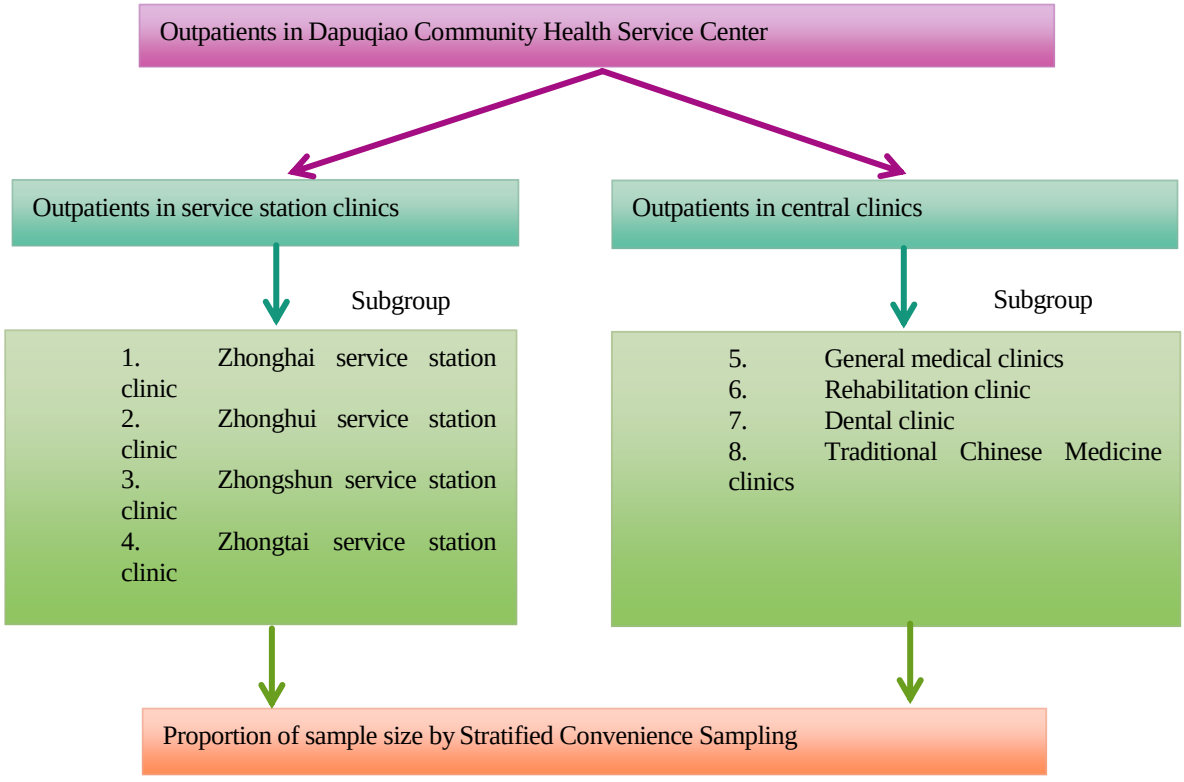

Figure 2 Diagram of sampling technique

RESEARCH INSTRUMENTS

The questionnaire in this study consisted of three parts. The first part was collecting basic outpatient information, including age, gender, education, marital status, occupation, and monthly household income. The second part was the SERVQUAL scale. The third part was the overall outpatient satisfaction rating.

The SERVQUAL scale was developed by PZB in 1988 to measure customer expectations and perceived satisfaction with the evaluation items [4]. The corresponding Likert 5 points scale method was assigned 1, 2, 3, 4, and 5 points according to strongly disagree, disagree, uncertain, agree, and strongly agree, respectively. The SERVQUAL scale is composed of 22 items to evaluate satisfaction with the service quality from the five dimensions: tangibles, reliability, responsiveness, assurance, and empathy [4]. Tangibility refers to external, tangible factors such as physical facilities, environment, equipment, and employees' appearance [4]. Reliability means fulfilling service commitments reliably and accurately [4]. Responsiveness means that service personnel is willing and able to provide services to customers quickly, reflecting the timeliness of services offered by the organization [4]. Assurance refers to employees' knowledge, courtesy, and ability to create a sense of trust among customers [4]. Empathy relates to care, concern, and the provision of personalized services [4]. Our study used the SERVQUAL scale to measure the outpatients' expectations and perceptions of the service qualities in Dapuqiao Community Health Service Center (Table 1). We can obtain outpatient satisfaction levels by measuring the gap between patients' expectations and perceptions (Gap = Perception score - Expectation score) (4) and get outpatient satisfaction levels. If the gap is greater than or equal to 0, we considered that the outpatient was satisfied since outpatients perceived their demands and expectations were fulfilled.

Table1 Items of the SERVQUAL scale questionnaire used in this study

Expectation section	Perception section
Tangibles	Tangibles
E1. They should have up-to-date equipment.	P1. They should have up-to-date equipment.
E2. Their physical facilities should be visually appealing.	P2. Their physical facilities should be visually appealing.
E3. Medical staff should dress well and appear neat, conforming to the medical environment and norms.	P3. Medical staff should dress well and appear neat, conforming to the medical environment and norms.
E4. The appearance of the physical facilities of this hospital should be in keeping with the type of services provided.	P4. The appearance of the physical facilities of this hospital should be in keeping with the type of services provided.
Reliability	Reliability
E5. When this hospital promises to do something by a particular time, they should do so.	P5. When this hospital promises to do something by a particular time, they should do so.
E6. When patients have problems, this hospital should be sympathetic and reassuring.	P6. When patients have problems, this hospital should be sympathetic and reassuring.
E7. They should provide their services at the time they promise to do so.	P7. They should provide their services at the time they promise to do so.
E8. The price of medical services is disclosure, reasonable and transparent.	P8. The price of medical services is disclosure, reasonable and transparent.
E9. The hospital should keep patients records accurately.	P9. The hospital should keep patients records accurately.
Responsiveness	**Responsiveness**
E10. The hospital could tell customers exactly when services will be performed	P10. The hospital could tell customers exactly when services will be performed
E11. The medical service expected by the patient is provided timely	P11. The medical service expected by the patient is provided timely
E12. The medical staff are willing to help the patient autonomously and spontaneously	P12. The medical staff are willing to help the patient autonomously and spontaneously
E13. The medical staff can respond to patients' requests promptly during rush hours.	P13. The medical staff can respond to patients' requests promptly during rush hours.
Assurance	**Assurance**
E14. The qualified professional skills could make patients trust them	P14. The qualified professional skills could make patients trust them
E15 The rich professional knowledge of medical staff could make patients trust them	P15 The rich professional knowledge of medical staff could make patients trust them
E16. Their staff should be polite	P16. Their staff should be polite
E17. Their medical staff should get adequate support from this hospital to do their jobs well	P17. Their medical staff should get adequate support from this hospital to do their jobs well

Expectation section	Perception section
Empathy	**Empathy**
E18. This hospital should give individualized patient services	P18. This hospital should give individualized patient services
E19. Medical staff of this hospital should provide patients with personal attention	P19. Medical staff of this hospital should provide patients with personal attention
E20. Medical staff of this hospital should know what the needs of their patients are	P20. Medical staff of this hospital should know what the needs of their patients are
E21. The hospital should have their patient's best interests at heart	P21. The hospital should have their patient's best interests at heart
E22. The hospital should have operating hours convenient to all their patient	P22. The hospital should have operating hours convenient to all their patient

DATA ANALYSIS AND STATISTICAL METHODS

Collected data were entered in SPSS 25.0. The overall distribution of samples was analyzed by descriptive statistical method, and the measurement data was presented as $\bar{x} \pm S$. Paired t-test was used to verify the difference between expectation and perceived satisfaction. Pearson correlation was performed to examine the correlation between each item's expectation and perceived satisfaction. The gap analysis was used to reveal outpatient satisfaction levels. The original IPA and revied IPA were used to identify the critical factor affecting outpatient satisfaction.

When the original IPA was used for satisfaction analysis in our study, performance was the outpatients' perceived satisfaction, and importance was the outpatients' expectations. The IPA model was constructed by plotting the average scores of expected and perceived values of each attribute in a two-dimensional matrix. If found, any service item located in Quadrant IV was considered to be the essential service items in terms of their need for managerial action to improve outpatient satisfaction. Since outpatients thought the service item was necessary and had high expectations, the perceived satisfaction was low.

However, the original IPA has two assumptions [5]. First, the importance and performance variables are independent, and second, there is a linear and symmetrical relationship between attribute performance and overall performance. Some researchers questioned the effectiveness of the IPA because the assumptions related to the original method are not easy to meet in the real world, suggesting that additional attention should be paid to improving the IPA [6].

To solve the problem, the revised IPA was developed by Weijaw Deng, which was applied in his study on Taiwanese hot springs tourism [5]. Weijaw Deng replaced self-reported importance with implicitly derived importance. The implicitly derived importance is obtained by the statistical method. It comprised two steps. First, take the natural logarithm of the perceived satisfaction (Pi) of each item and count it as ln (Pi) and the overall satisfaction as OS, and after, set ln (Pi) as the independent variable and OS as the dependent variable for multiple regression analysis and derive the partial correlation coefficient between the natural logarithm of each evaluation satisfaction and the overall satisfaction. The partial correlation coefficient is implicitly derived of importance [5, 8].

RESULTS

GENERAL CHARACTERISTICS OF SUBJECTS

A total of 414 outpatients completed this questionnaire survey. The average age of the subjects was 58.01 ± 17.03， and the percentage of those aged 60 years and above was 56.5%. The subjects in the 60–69 age group accounted for the highest percentage (27.8%). Most of the subjects were married. The percentage of those with an education level of college and above was 51.7%.

Table 2 Distribution of demographic attribute characteristics of the subjects.

Item	Classification	Number	Percentage (%)
Gender			
	Male	168	40.6
	Female	246	59.4

Item	Classification	Number	Percentage (%)
Age (years)			
	≥ 20, ≤ 29	33	8.0
	≥ 30, ≤ 39	52	12.8
	≥ 40, ≤ 49	36	8.7
	≥ 50, ≤ 59	58	14.0
	≥ 60, ≤ 69	115	27.8
	≥ 70, ≤ 79	92	22.2
	≥ 80	27	6.5
Marital Status			
	Unmarried	52	12.6
	Married	336	81.2
	Widowed	20	4.8
	Divorced	6	1.4
Education level			
	Graduate and above	24	5.8
	Undergraduate and junior college	190	45.9
	Technical secondary school and senior high school	134	32.4
	Junior high school and primary school	64	15.5
	Illiterate	2	0.5
Occupation status			
	Retired	257	62.1
	Unemployed	9	2.2
	Employed	148	35.7
Household monthly income			
	< 3,000 RMB	16	3.9
	≥ 3,000 RMB, < 5,000 RMB	105	25.4
	≥ 5,000 RMB, < 7,000 RMB	138	33.3
	≥ 7,000 RMB, < 10,000 RMB	87	21
	≥ 10,000 RMB	68	16.4

RELIABILITY AND VALIDITY

In this study, the internal consistency of the SERVQUAL scale was excellent, with Cronbach's value of 0.981. In factor analysis, the Kaiser-Meyer-Olkin test value was 0.946, and Bartlett's Test of Sphericity showed a chi-square of 21732.076 (p < .001), suggesting good sampling adequacy. Confirmatory factor analysis using the Varimax method showed that the extracted factors contributed to 74.95% of the variance.

THE GAP ANALYSIS

The mean values of outpatients' expectations and perceived satisfaction were 4.561 ± 0.502 and 4.577 ± 0.472, respectively. Knowingly, 78.02% (323 subjects) of the 414 outpatients had a perceived satisfaction value higher than the expected value, indicating they were satisfied. Table 3 shows the gap between the perception and expectation scores on the service of the health service center. For the 'tangibles' dimension, the perception score was significantly higher than that of expectation (p < .001), and a statistically significant negative difference was found in the empathy dimension (p = .01). For the reliability, responsiveness, and assurance dimension, the scores of perceptions and expectation were similar. Those results indicated that outpatients were satisfied with the reliability, responsiveness, and assurance dimension since their

expectations were met. Outpatients were highly satisfied with the tangibility dimension with the expectation being exceeded. However, outpatients were dissatisfied with the empathy dimension.

Among the 22 service items, the gap between Items 18, 19, 20, and 21 was less than -0.05, and between Items 12, 13, 17, and 22 was between -0.05 and 0 (Table 3, Figure 3). Combining the results of the paired t-test, only the difference between the four items with Gap < -0.05 was statistically significant at the $p < .05$ level. So, we consider the outpatients were dissatisfied with Items 18 - "This hospital should give individualized patient services," 19 - "Medical staff of this hospital should give patients personal attention," 20- "Medical staff of this hospital should know what the needs of their patients are," 21- "The hospital should have their patient's best interests at heart," which all belonged to empathy dimension. This result was consistent with the results of the gap analysis on dimension. In addition, a statistically significant positive difference between the perception and expectation was found in Items 1，2，3，4，7， and 16 ($p < .05$). Items 1，2，3, and 4 belonged to the tangibility dimension, and Item 3 had the most significant gap. Satisfaction with these items, especially Item 3, resulted in high outpatient satisfaction with the tangibility dimension.

Table 3 Results of outpatients' expectations and perceived satisfaction on five dimensions and 22 items.

Expectations		Perceptions		Gaps Mean ± SD	*p* value*
Dimension/Item	Mean ± SD	Dimension/Item	Mean ± SD		
Tangibility	4.499 ± 0.600	Tangibility	4.597 ± .483	0.098 ± 0.49	＜.001
E1	4.481 ± 0.677	P1	4.568 ± 0.573	0.087 ± 0.658	.007
E2	4.435 ± 0.671	P2	4.502 ± 0.625	0.068 ± 0.591	.020
E3	4.543 ± 0.680	P3	4.722 ± 0.485	0.179 ± 0.616	＜.001
E4	4.536 ± 0.640	P4	4.597 ± 0.560	0.060 ± 0.510	.016
Reliability	4.584 ± 0.544	Reliability	4.623 ± 0.487	0.039 ± 0.428	.072
E5	4.556 ± 0.611	P5	4.592 ± 0.611	0.036 ± 0.612	.229
E6	4.539 ± 0.608	P6	4.563 ± 0.590	0.024 ± 0.534	.358
E7	4.585 ± 0.612	P7	4.601 ± 0.559	0.017 ± 0.513	.503
E8	4.655 ± 0.577	P8	4.696 ± 0.525	0.041 ± 0.452	.065
E9	4.585 ± 0.657	P9	4.662 ± 0.571	0.077 ± 0.551	.005
Responsiveness	4.579 ± 0.543	Responsiveness	4.578 ± 0.517	0.428 ± 0.435	.955
E10	4.63 ± 0.583	P10	4.674 ± 0.541	0.043 ± 0.47	.060
E11	4.594 ± 0.602	P11	4.597 ± 0.577	0.002 ± 0.509	.923
E12	4.582 ± 0.604	P12	4.568 ± 0.594	-0.014 ± 0.539	.584
E13	4.51 ± 0.659	P13	4.473 ± 0.673	-0.036 ± 0.545	.177
Assurance	4.594 ± 0.518	Assurance	4.610 ± 0.495	0.016 ± 0.436	.465
E14	4.597 ± 0.586	P14	4.614 ± 0.574	0.017 ± 0.532	.518
E15	4.582 ± 0.588	P15	4.589 ± 0.583	0.007 ± 0.559	.792
E16	4.638 ± 0.565	P16	4.717 ± 0.506	0.080 ± 0.526	.002
E17	4.56 ± 0.626	P17	4.519 ± 0.613	-0.041 ± 0.553	.132
Empathy	4.549 ± 0.556	Empathy	4.488 ± 0.593	-0.060 ± 0.473	.010
E18	4.536 ± 0.620	P18	4.449 ± 0.697	-0.087 ± 0.532	.001
E19	4.531 ± 0.621	P19	4.471 ± 0.680	-0.060 ± 0.551	.026
E20	4.582 ± 0.584	P20	4.502 ± 0.670	-0.080 ± 0.562	.004
E21	4.507 ± 0.652	P21	4.447 ± 0.686	-0.060 ± 0.585	.036
E22	4.587 ± 0.619	P22	4.572 ± 0.621	-0.014 ± 0.557	.596

Note: * A paired t-test was used to verify the difference between the levels of expectation and perception.

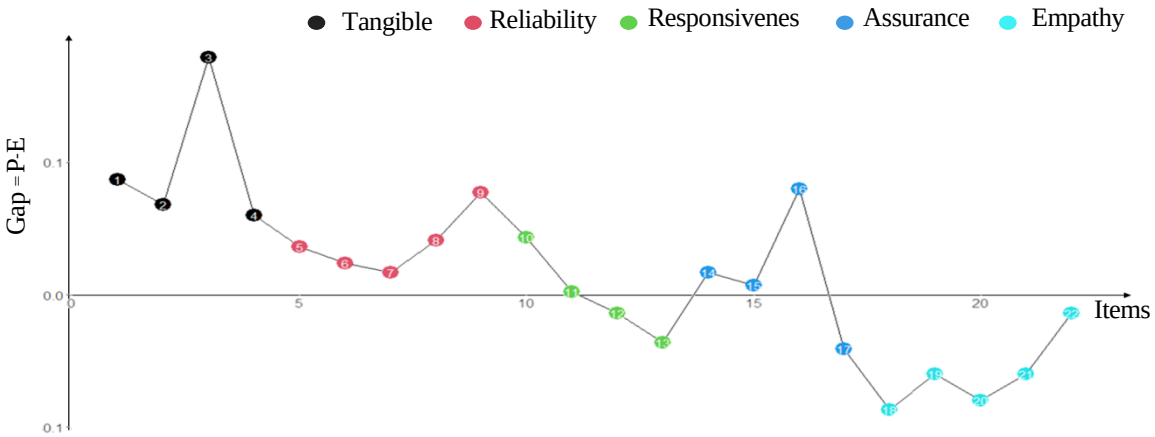

Figure 3 Gap between perceived satisfaction and expectation

Note: A negative gap indicated that the quality of medical services did not meet patients' expectations, and outpatient was not satisfied.

IMPORTANCE AND PERFORMANCE ANALYSIS

Based on the satisfaction survey data we obtained, we drew the original IPA grid (Figures 4 A & B) and the revised IPA grid (Figures 4 C & D). It was found that there was a significant difference in the distribution of evaluation items between the original IPA grid and the revised IPA grid. For example, according to the initial IPA analysis, Items 7, 11, and 16 were in Quadrant I. However, according to the revised IPA analysis, these three items were in Quadrant II. Since the results of the two analysis methods differed, we need to know which one was more applicable.

We applied Pearson correlation analysis to examine the correlation between each service item's expectation and perceived satisfaction values. At the 95% confidence interval, the correlation coefficients between expectations and perceived satisfaction values for all items were significant. This indicated a statistically significant correlation between the expectations and perceived satisfaction values of these 22 items. The assumption of the original IPA was not met, so the revised IPA was applicable.

The revised IPA grid (Figure 4 D) showed that the satisfaction level of the community health service center was good, with high importance and high perceived satisfaction levels for seven items (Quadrant I “keep up good work”). Item 1- “up-to-date equipment” and Item 18- “giving individualized patient services” were in the Quadrant IV “concentrate here” (high importance and low perceived satisfaction), which meant outpatients thought those two items were essential, but outpatients perceived satisfaction was low. The managers need to take action to improve these services item, so that perceived satisfaction will be improved and outpatients will be satisfied.

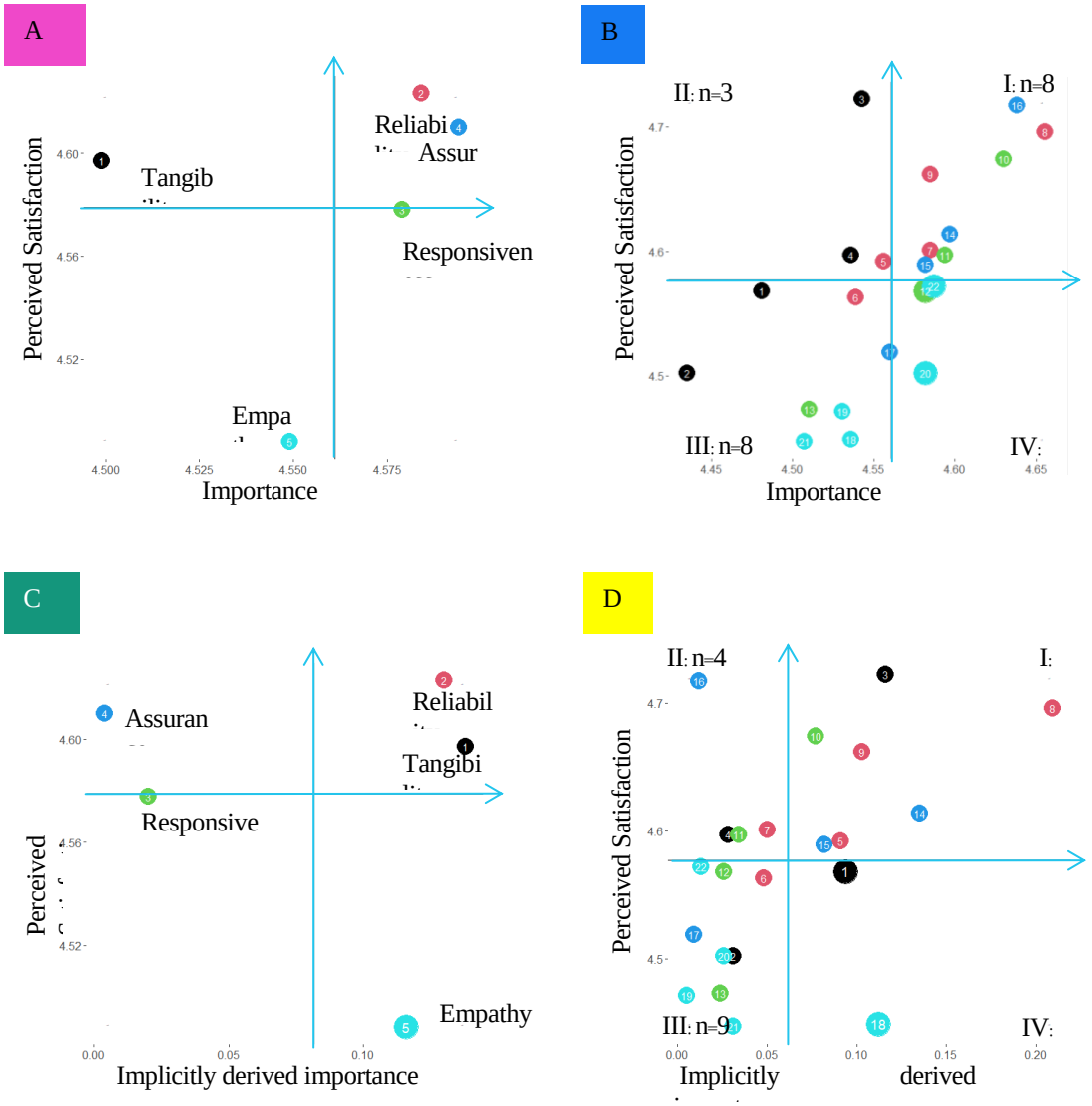

Figure 4 IPA method to analyze outpatient satisfaction

Note： A, B original IPA analysis; C, D revised IPA analysis; D prompts "1. up-to-date equipment" and "18. giving individualized patient services" in Quadrant IV "concentrate here."

DISCUSSION

The results of this study showed that the level of outpatient satisfaction with Dapuqiao Community Health Service Center was 78.02%. Comparing the results of Chinese surveys in similar studies, the patient satisfaction level in this community health center was high (Figure 5). For example, some researchers studied the satisfaction level of community health service centers in Fuzhou, Shenzhen, Nanjing, Nanchang, Yan'an, Dalian, Yinchuan, and Xining, with satisfaction levels of 75.90%, 75.72%, 75.10%, 73.38%, 72.02%, 70.25%, and 60%, respectively [9-15]. They are lower than this study. This may be related to the fact that Shanghai is an economically developed city in China and that Shanghai is a leader in the development of community health service centers in China, with an early start and high starting point of community health services.

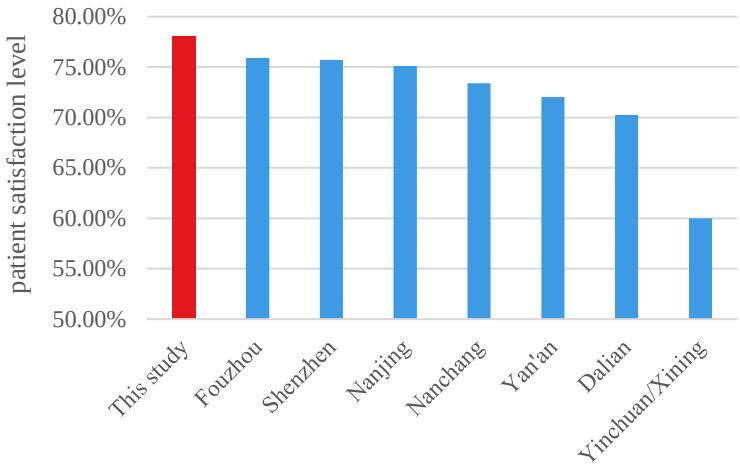

Figure 5 Patient Satisfaction level compared with other studies

Outpatients were satisfied with the tangibility, reliability, responsiveness, and assurance dimensions. Mainly, they were highly satisfied with the tangibility dimension. However, outpatients were not satisfied with the empathy dimension. It is recommended that this community health center have an in-depth understanding of outpatients' personalized needs and expectations, prioritize policies to provide personalized services and meet their needs and expectations. The high outpatient satisfaction on the tangibility dimension was due to the renovation and expansion of the Dapuqiao Street Community Health Center after receiving a US$40 million grant from the government [16]. The renovation resulted in a significant improvement in its external environment and the dress code of the medical staff.

In recent years, Shanghai has focused on developing community service centers, continued to promote the comprehensive reform of community health services, and increased financial investment in community health in each district. From 2021 to 2025, Shanghai has begun a new round of community health service institutions' standardized construction. Each district has determined a phased plan for new construction or expansion of community health service centers to improve the construction of site settings, facilities, and equipment and to reserve space to develop community health service functions. More and more community health service centers will receive government funding for renovation, and it is reasonable to infer that satisfaction with the tangibility dimension of community health service centers in Shanghai will increase across the board, like the community health service centers in this study.

The revised IPA identified key items that need to prioritize measures to improve in this community health service center, which were items in Quadrant IV "concentrate here" (high importance and low perceived satisfaction) [17]. Items in this quadrant included Item 1-"up-to-date equipment" and Item 18-"giving individualized patient services," both of which have higher-than-average implicitly derived importance and lower-than-average patient perceived satisfaction. These two items were necessary for improving service quality and outpatient satisfaction in the community health service center. Managers should focus on their strengths and allocate resources to improve them. Outpatients believed that-"up-to-date equipment" was essential and expected community health service station centers to be equipped with high-tech medical equipment. But the service center was underperforming in providing high-tech medical equipment, and outpatients were not satisfied.

According to a study by the Development Research Center of the State Council of China in cooperation with the World Health Organization, "after the commercialization of hospitals, due to the elimination of the fittest, the technical level and equipment conditions of large hospitals are getting higher and higher, while primary institutions, especially rural township hospitals and urban community hospitals, are gradually shrinking, and many of them are even unable to survive" [18]. High-quality resources are excessively concentrated in large hospitals, and large and medium-sized urban hospitals focus on a large number of high-tech medical equipment. At the same time, the primary health institutions are seriously under-resourced.

For a long time, the infrastructure of community health service centers has been outdated and in poor condition. This study also confirmed that patients are not satisfied with the equipment in community health service centers. The quality of health service centers is difficult to gain the public's trust. As a result, large and medium-sized hospitals attract many patients with common and

multiple diseases and are overcrowded, while community health service centers have difficulty attracting patients. For that reason, there is an urgent need to invest more resources into community medical service centers with "up-to-date equipment" that matches their service items. In addition, patients in this study considered it essential for community hospitals to provide personalized services. In contrast, the perceived satisfaction with the personalized services received was low, suggesting that understanding of patients' needs for personalized services by healthcare institutions is still lacking. Therefore, further research and knowledge of their personalized service needs need to be strengthened in the future, and efforts should be made to improve them.

CONCLUSIONS AND LIMITATIONS

Outpatient satisfaction with the Dapuqiao Community Health Service Center was 78.02%, a high level in similar studies. Service Item 1 – "the up-to-date equipment" and Item 18 – "giving individualized patient services" were identified as important factors by the outpatients, but the perceived satisfaction was low. The managers of this hospital should take steps toward improving the quality of services in Items 1 and 18 to increase outpatient

This study only selected the outpatients of the Dapuqiao Community Health Service Center as a sample, so the findings were not representative for generalization to Shanghai. The sample was drawn among convenience outpatients. Expanding the sample size and adopting random sampling to reduce sampling error can be considered in further studies.

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THE PREVALENCE AND FACTORS ASSOCIATED WITH DEPRESSION AMONG LESBIANS IN CHENGDU, CHINA

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ABSTRACT

Lesbians and their unique subculture have continually been excluded from heterosexual society. In Chinese society, lesbians are an invisible and neglected minority group. Lack of understanding of lesbians and the presence of homophobia makes lesbians less deserving of health services than others, making them depressed. Depression is one of the most common mental disorders, which has become a globally significant public health problem and is particularly common among LGBTQ+, where lesbians were included. The purpose of this study was to evaluate the prevalence of depression and to determine the association between related factors and depression among lesbians who identified themselves as pure girls, a woman with a more feminine appearance, compared to a woman with a masculine male appearance, who lived in Chengdu, China. This study was designed as a cross-sectional study. The study area is in Chengdu, China. Sichuan Province. Data were collected between April and May 2021 with 69 lesbians through an online questionnaire. The questionnaire included sociodemographic and experiences of depression questions. Characteristics of lesbians were presented in frequencies, percentages, mean and standard deviation. Logistic regression was performed to identify the association between related factors and depression. The prevalence of depression among lesbians identifying as pure girls were 39.1%. By using logistic regression analysis, depression was significantly associated with lower age (18–24 years) (OR = 0.16, 95% CI [0.29, 0.94]). There was no association between depression and educational level, annual income, marital status, living status, or employment status. Lesbians who identified as pure girls were more likely to experience a higher prevalence of depression than the general population. Younger lesbians identifying themselves as pure girls were more at risk of depression than older lesbians. This highlights the need for early screening of depression and easy access to a psychological healthcare service system for lesbians in China.

Keywords: *lesbians, depression, China*

INTRODUCTION

In 1997 homosexuality was decriminalized in China. Later, in 2000, homosexuality was characterized as a non-disease according to the law. Even though homosexuality was categorized as a non-disease over 20 years ago, there is still discrimination toward the LGBTQI (Lesbian, gay, transgender, queer, intersex, and other sexual and gender minorities) community (1). Members of the LGBTQI community in China still faces significant health and human rights barriers. This is due to Chinese tradition, religion, ruling policies (1), and China's cultural and family context. The gender belief system perspective that men are better than women is deeply rooted in Chinese culture. This perception that the LGBTQI community may violate traditional gender roles worsens the situation for lesbians (2). Pressure from the family, where the fulfillment of fertility and marriage becomes a filial duty to parents, is most difficult (3). Lesbians are more likely to be discriminated against than heterosexuals, and they are more likely to face adverse psychological effects of discrimination, which often leads to a decline in mental health, including depression (4).

Depression is one of the most common mental diseases and has become a significant global public health problem. Furthermore, depression is a key cause of disability and a leading contributor to spreading disease worldwide. In 2015, 322 million, 4.4% of the world's population, had depression. There has been an upward trend of depression, rising to 18.4% compared to the data of 2015 (5, 6). In 2021, it was estimated that 3.8% of the population suffered from depression, with 5% in adults and 5.7% in adults older than 60. Therefore, globally in 2021, almost 280 million people will suffer from depression (7, 8).

Members of the LGBTQI community are at higher risk for adverse mental health outcomes such as suicidal ideation and depression (9, 10). According to the literature, lesbians experience more depression when compared to the general population. Hence, depression is a significant mental health disorder for the lesbian population (11). In the United States, previous studies indicated that depression was prevalent among 30% to 65% of LGBT people, which corresponded to the study in Thailand, with showed 40% among the LGBT community (12). Studies have also indicated that depression is related to a higher rate of comorbidity with anxiety, and many depressed lesbians struggle with problems concerned with anxiety (13). Accordingly, the sexual minority population, including lesbians, have a higher chance of depression when compared to their heterosexual counterparts (14).

Therefore, this study aims to evaluate the prevalence of depression and to determine the association between related factors related to depression among lesbians who identify themselves as pure girls who live in Chengdu, China.

METHODS

This cross-sectional study was conducted in Chengdu, Sichuan Province, China. Data were collected between April and May 2021. The data collection used the snowball technique. The study participants were 69 lesbians who identified themselves as pure girls, having a more feminine than masculine appearance, who lived in Chengdu, China, for more than 6 months, and were $\geq$ 18. The Lesbians who did not complete the questionnaire were excluded. Respondent's personal information was effectively protected in an anonymous form through an online questionnaire, which allowed respondents to participate effectively. Participants provided sociodemographic data such as age (years), educational level (< middle school, middle and high school, and > high school), monthly income (CNY [1 USD $\approx$ 7 CNY), marital status (single, married, divorced, and cohabiting), living status (not living alone and living alone, and employment status (employed and unemployed). Participants were also asked if they had experienced depression (yes/no).

Statistical analysis was done by using SPSS version 22.0. The characteristics of the participants were presented in frequency, percentage, mean and standard deviation. Logistic regression was performed to determine the association between depression and related factors. Statistical significance was set at a *p*-value < .05.

RESULTS

This study was conducted with 69 lesbians who identified as pure girls, ages ranging between 18 and 57 years, with a mean age of 32.0 years (SD = 7.48). Most participants were 25–35 years (50.7%), had middle and high school education (47.8%), had monthly income 100,000–200,000 CNY [roughly 14,300–28,500 USD] (46.4%), were single (50.7%), lived alone (59.4%), and reported an employed (85.5%) and (Table1).

Table 1 Number and percentage of participants by sociodemographic variables (*n* = 69)

Sociodemographic factors	Number (%)
Age(Years)	
18–24	12 (17.4)
25–35	35 (50.7)
> 35	22 (31.9)
Range	18-57
Mean (±SD)	32.0 (± 7.48)
Educational Level	
< Middle School	14 (20.3)
Middle and High School	33 (47.8)
> High School	22 (31.9)
Monthly Income (CNY)	
< 30,000	9 (13.0)
30,000–100,000	22 (31.9)
100,000–200,000	32 (46.4)
> 200,000	6 (8.7)
Marital Status	
Single	35 (50.7)
Married	8 (11.6)
Divorce	6 (8.7)
Cohabiting	20 (29.0)
Living Status	
Not living alone	28 (40.6)
Living alone	41 (59.4)
Employment Status	
Employed	59 (85.5)
Unemployed	10 (14.5)

Notes: SD = standard deviation; CNY = Chinese Yuan Renminbi [1 USD ≈ 7 CNY]

For the percentage of depression, most participants (60.9%) did not experience depression, and the participants who experienced depression were 39.1% (Table2).

Table 2 Number and percentage of depression

Depression	Number (%)
Without depression	42 (60.9)
With depression	27 (39.1)

Table 3 shows the association between depression and sociodemographic factors. For the association between depression and sociodemographic characteristics, crude logistic regression analysis found that youth lesbians (18–24 years) who identified themselves as pure girls were 0.16 times more likely to be at risk of developing depression than lesbians 35 years and older who identified themselves as pure girls (OR = 0.16, 95%CI [0.29, 0.94]) ($p < .05$).

Table 3 Association between depression and related factors using univariate logistic regression

Variables	Depression	
	OR (95% CI)	*p*-value
Age (years)		
18–24	0.16 (0.29-0.94)	0.043*
25–35	0.49 (0.16-1.45)	0.200
>35	Ref.	
Educational Level		
< Middle School	1.75 (0.44-6.82)	0.420
Middle and High School	1.00 (0.32-3.06)	1.000
> High School	Ref.	
Monthly Income (CNY)		
< 30,000	0.12 (0.01-1.1.72)	0.120
30,000 – 100,000	0.57 (0.09-3.53)	0.547
100,000 – 200,000	0.88 (0.15-5.04)	0.888
> 200,000	Ref.	

Variables	Depression	
	OR (95% CI)	*p*-value
Marital Status		
Single	Ref.	
Married	1.69 (0.36-7.94)	0.505
Divorce	1.69 (0.29-9.65)	0.554
Cohabiting	0.911 (0.290-2.868)	0.874
Living Status		
Not living alone	Ref.	
Living alone	0.98 (0.37-2.64)	0.983
Employment Status		
Employed	Ref.	
Unemployed	0.34 (0.06-1.74)	0.195

Notes: * ($p < .05$); [1 USD ≈ 7 CNY]

DISCUSSION

In this current study, we identified the prevalence of depression by evaluating the association between related factors and depression among lesbians who identified themselves as pure girls, a woman with a more feminine appearance compared with a woman with a masculine male appearance, and who lived in Chengdu, China. The results revealed that younger lesbians (18–24 years) who identified themselves as pure girls were found to be 0.16 times more likely at risk of developing depression compared to older lesbians 35 years and older who identified themselves as pure girls (OR = 0.16, 95% CI [0.29-0.94]) ($p < .05$).

In China, one of the world's most populous countries, the current situation of depression is not expected, and there was an estimation that the prevalence of depression in China increased from 3224.6/100,000 in 1990 to 3990.5/100,000 in 2017. In 2017, the number of depressed patients in China was 56.36 million, accounting for 21.3% of the world's total population (15). One of the findings of this study indicated that 39.1% of lesbians who identify as pure girls in Chengdu, China, have experienced depression. When comparing the prevalence of depression among lesbians who identified themselves as pure girls in this study and the prevalence of depression within the Chinese population in 2017, it is noticeable that the prevalence of depression among lesbians who identified themselves as pure girls was 1.84 times higher than the general Chinese population.

At the younger level, discrimination against lesbians also exists in schools. Over the last decade, research in the United States has shown that LGBT youth have been disadvantaged in school (16). For lesbians in China, the medical students and the nurse's attitude toward homosexuality is even more negative to this population (17). Lesbians also want healthcare providers to know and understand more about their health needs. Still, a lack of understanding of lesbians and a higher degree of homophobia among healthcare providers make lesbians less deserving of health services than others.

Regretfully, there is a higher level of rejection from in-group members among individuals who report higher levels of external identity commitment. This rejection may be due to identity transitions. A loss of social support due to social rejection may also precipitate reconfigurations concerning a sense of self. Thus, social rejection in and of itself is recognized as contributing to psychosocial distress, including depression (14). The belief system that men are better than women is deeply rooted in Chinese culture, and this perception that may violate traditional gender makes the situation of lesbians potentially worse (2). Pressure from the family, where the fulfillment of fertility and marriage becomes a filial duty to parents, is also a significant factor (3). It can be said that all these causes can result in lesbian depression. At its worst, depression can lead to suicide.

CONCLUSION AND LIMITATIONS

Lesbians who identified as pure girls were more likely to experience a higher prevalence of depression than the general population. Especially younger lesbians who identified as pure girls were more at risk of depression than older lesbians. These findings highlight the need for early screening of depression and easy access to the psychological health care service system for younger lesbians in China. The limitation of this study is that the depression questionnaire is not a standardized questionnaire.

RECOMMENDATION

Further study should focus on lesbians' mental health and well-being. Exploring ways to create practical experiments to decrease depression among lesbians within the different socioeconomic and cultural dimensions should be embedded. Importantly, when healthcare providers serve lesbians suffering from depression, they should focus on helping them to identify appropriate sources of social support provided by access psychological health care service system, especially for younger lesbians in China. Doing so could significantly decrease their risk of suicidal tendencies, mainly caused by depression (18).

ETHICAL DECLARATION

The Ethic Approval was approved by the Research Ethics Review Committee for Research Involving Human Research Participants, Health Sciences Group, Chulalongkorn University (COA No.111/202).

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