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HIV Testing and its Associated Factors among Women in Myanmar and Other Selected Southeast Asian Countries

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HIV Testing and its Associated Factors among Women in Myanmar and Other Selected Southeast Asian Countries

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Epidemiology

by

Soe Ohnmar Khin

2022

ABSTRACT OF THE DISSERTATION

HIV Testing and its Associated Factors among Women in Myanmar

and Other Selected Southeast Asian Countries

by

Soe Ohnmar Khin

Doctor of Philosophy in Epidemiology

University of California, Los Angeles, 2022

Professor Sung-Jae Lee, Chair

Introduction: Myanmar has prioritized HIV testing services and prevention of mother-to-child transmission of HIV services to reach the milestone - 95% of people living with HIV know their status and eliminate mother-to-child transmission of HIV. Many people living with HIV had late diagnoses for HIV in many countries in the Southeast Asian region. This study assessed HIV testing and its associated factors among women aged 15-49 years in Myanmar and other selected Southeast Asian countries - Cambodia, the Philippines, and Timor-Leste.

Methods: Multivariable logistic regression analyses were performed using the 2015-16 Myanmar Demographic and Health Survey (DHS) data to determine factors associated with lifetime HIV testing uptake by marital status and having an HIV test as part of antenatal care (ANC) among women in Myanmar. A comparative analysis of the four selected countries was conducted using

data from the 2015-16 Myanmar DHS, the 2014 Cambodia DHS, the 2017 Philippines DHS, and the 2016 Timor-Leste DHS to assess lifetime HIV testing and associated factors among women. Literature review and the conceptual framework adopted from Anderson's Behavioral Model of health services guided the inclusion of potential predictors in this study.

Results: The proportions of lifetime HIV testing among women aged 15-49 years were significantly varied by marital status in Myanmar. Poorest wealth index, living in rural areas, lack of comprehensive knowledge of HIV, having < 4 ANC visits, and no counseling on HIV during ANC were negatively associated with having an HIV test as part of ANC in Myanmar. Lifetime HIV testing rate was highest in Cambodia and lowest in Timor-Leste. Marital status, education level, wealth index, places of residence, and comprehensive knowledge of HIV were significantly associated with lifetime HIV testing uptake among women in all selected Southeast Asian countries.

Conclusion: Health education campaigns for HIV should target women and adolescent girls to increase comprehensive knowledge of HIV. Effective integration of HIV testing services to related healthcare services, and tailoring HIV testing services to rural communities and youth, financial assistance, and a multisectoral approach for creating more educational and employment opportunities are needed to reduce gaps in HIV testing among women.

This dissertation of Soe Ohnmar Khin is approved.

Roger Detels

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San Hone

Sung-Jae Lee, Committee Chair

University of California, Los Angeles

2022

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LIST OF ABBREVIATIONS

3MDG	Three Millennium Development Goal Fund
AEM	AIDS Epidemic Model
AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal care
aOR	Adjusted Odds Ratio
ART	Antiretroviral therapy
CAFE	Computer-assisted field editing
CAPI	Computer-assisted personal interviewing
CBOs	Community-based organizations
CDC	Centers for Disease Control and Prevention
CDHS	Cambodia Demographic and Health Survey
CI	Confidence Interval
COVID	Coronavirus Disease 2019
CSPro	Census and Survey Processing System
DC	Decentralized
DHS	Demographic and Health Survey
EAs	Enumeration areas
FSW	Female sex worker
HIV	Human Immunodeficiency Virus
HSS	HIV Sentinel Surveillance
HTS	HIV testing services
IBBS	Integrated Biological and Behavioral Surveillance
IFSS	Internet file streaming system
INGO	International Non-governmental organization
IRB	Institutional Review Board

LHV	Lady Health Visitor
MCH	Maternal and Child Health
MDHS	Myanmar Demographic and Health Survey
MSM	Men who have sex with men
NAP	National AIDS Program
NCHADS	National Center for HIV/AIDS, Dermatology and STDs
NDHS	the Philippines National Demographic and Health Survey
NGOs	Non-governmental Organizations
NMCHC	National Maternal and Child Health Center
NSP	National Strategic Plan
PITC	Provider-initiated testing and counselling
PLHIV	People living with HIV
PMTCT	Prevention of mother-to-child transmission
PSU	Primary sampling unit
PWID	People who inject drugs
STI	Sexually transmitted infection
TB	Tuberculosis
TLDHS	Timor-Leste Demographic and Health Survey
UCLA	University of California, Los Angeles
UN	United Nations
UNAIDS	Joint United Nations Program on HIV/AIDS
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
VIF	Variance Inflation factor
WHO	World Health Organization

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VITA

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CHAPTER 1

Introduction

HIV epidemic in the world

Globally, the HIV epidemic has been declining over time in terms of HIV incidence and mortality since 2000: 49% reduction in new diagnoses and 55% reduction in deaths between 2000 and 2020 (WHO, 2021c). However, HIV is still a major global public health problem. At the end of 2020, there were approximately 37.7 million people living with HIV, 1.5 million people newly infected with HIV and 27.5 million people living with HIV were on antiretroviral therapy globally. There were 680,000 deaths due to HIV-related causes in 2020. Out of 37.7 million people living with HIV, 53% were women and girls. Half of all new HIV infections in 2020 were among women and girls (UNAIDS, 2021b).

Regarding progress towards 90-90-90 targets of the HIV testing and treatment cascade, 84% of people living with HIV knew their HIV status; 87% of people who were aware of their HIV status were receiving ART; and 90% of people receiving ART achieved viral suppression in 2020. Thus, 66% of people living with HIV were virally suppressed (UNAIDS, 2021b). There are still gaps to reach the 90-90-90 targets and further gaps to reach the 95-95-95 targets as shown in Figure 1-1.

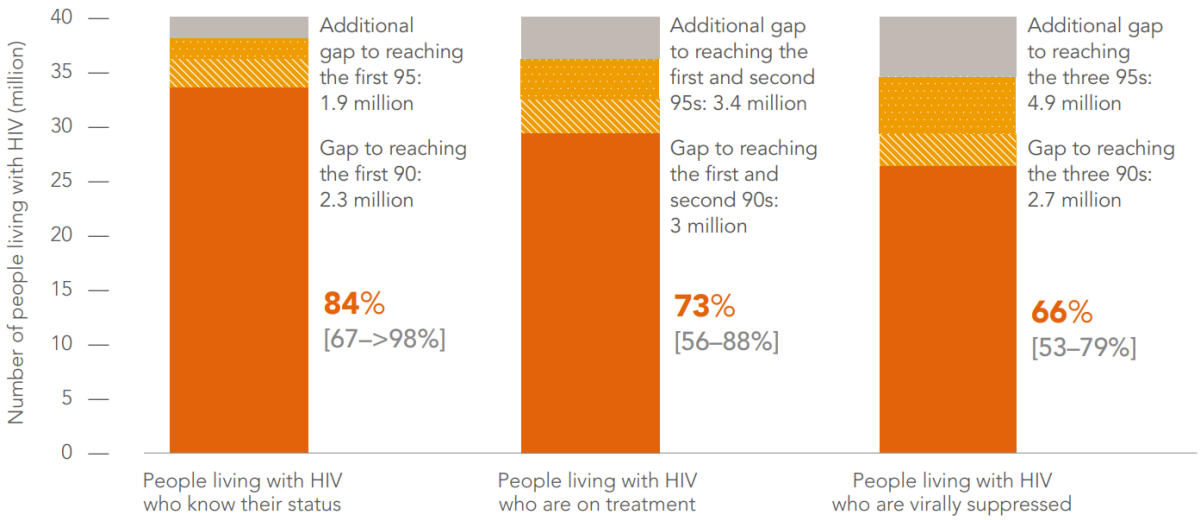

Figure 1-1 Global HIV testing and treatment cascade, 2020 (UNAIDS, 2021a, p. 15). (Source: UNAIDS special analysis, 2021)

The 2025 AIDS targets have been developed focusing on people living with HIV and communities at risk to achieve the Sustainable Development Goal related to HIV – ending the AIDS epidemic by 2030. The 95-95-95 targets of HIV testing and treatment are 95% of people within the sub-population who are living with HIV know their HIV status; 95% of people with the sub-population who are living with HIV who know their HIV status are on antiretroviral therapy; and 95% of people within the sub-population who are on antiretroviral therapy have virally suppressed. The 2025 AIDS targets also include the 10-10-10 targets to remove societal and legal barriers for utilizing HIV services, in which one of the 10s aims that <10% of the general population reports discriminatory attitudes towards people living with HIV by 2025 (UNAIDS, 2020b).

HIV epidemic in the South-East Asian Region

It was documented that HIV was rapidly spreading among injecting drug users and heterosexuals with multiple sexual partners during the late 1980s in several of the South and Southeast Asia countries. Although HIV epidemics began only in the mid-1980s or later in the Southeast Asian region, the extensive spread of HIV infection had been recorded among people having high risk behaviors for acquiring HIV infection. At the beginning of the epidemic in Southeast Asia, HIV transmission occurred predominantly among injecting drugs users. However, heterosexual transmission of HIV among people with multiple sexual partners had been increasing in the region since 1989 (WHO Global Programme on AIDS, 1991). In the Southeast Asian region, an estimated 3.7 million people were living with HIV; 2.2 million people were on ART; 100,000 people became newly infected with HIV; 82,000 deaths due to HIV-related causes in 2020. The region has the second highest number of estimated people living with HIV after the African region (WHO, 2021c).

HIV testing services

HIV testing was first available in 1985 to screen the blood supply from HIV infection (Centers for Disease Prevention and Control, 2006). World Health Organization (WHO) Guideline Development Group in 2015 defined that HIV Testing Services (HTS) should provide HIV testing together with pre-test information and post-test counseling, linkage to appropriate HIV prevention, treatment and care services and other clinical and support services, coordination with laboratory services to support quality assurance and delivery of correct results. Additionally, WHO recommends HTS should be made available through a wide range of approaches, both through facility-based and community-based approaches according to local epidemiology and context

(WHO, 2015). In recent years, WHO recommends HIV self-testing and partner services including provider-assisted referral and social network-based approaches should be offered as an additional approach to HTS (WHO, 2016a, 2021b). All forms of HTS should adhere to the WHO 5 Cs: Consent, Confidentiality, Counselling, Correct test results and Connection to prevention, treatment and care services (WHO, 2015).

HIV testing is an initial and critical step to initiate prevention, treatment and care continuum for people living with HIV. It can only be achieved by getting tested for HIV and knowing the status. According to CDC recommendation, everyone aged 13 to 64 years should get tested for HIV at least once as part of routine health care. People at higher risk should get tested for HIV annually. All pregnant women should be tested for HIV as part of the routine panel of prenatal screening tests (Centers for Disease Prevention and Control, 2006). Preventing new HIV infections among women of reproductive age is also important to eliminate mother to child transmission of HIV.

With massive scaling-up of HIV testing and treatment over the past 20 years, some countries have achieved the 90-90-90 targets by the end of 2020 (UNAIDS, 2021c). Nevertheless, globally, HIV testing goals have not reached the first target of UNAIDS's 90-90-90 Fast-Track Targets – 90% of all people living with HIV to know their status by 2020. This testing gap was also seen among women – only 88% of women living with HIV knew their status globally (UNAIDS, 2020a). The following Figure 1-2 highlights a need to increase HIV testing uptake among women.

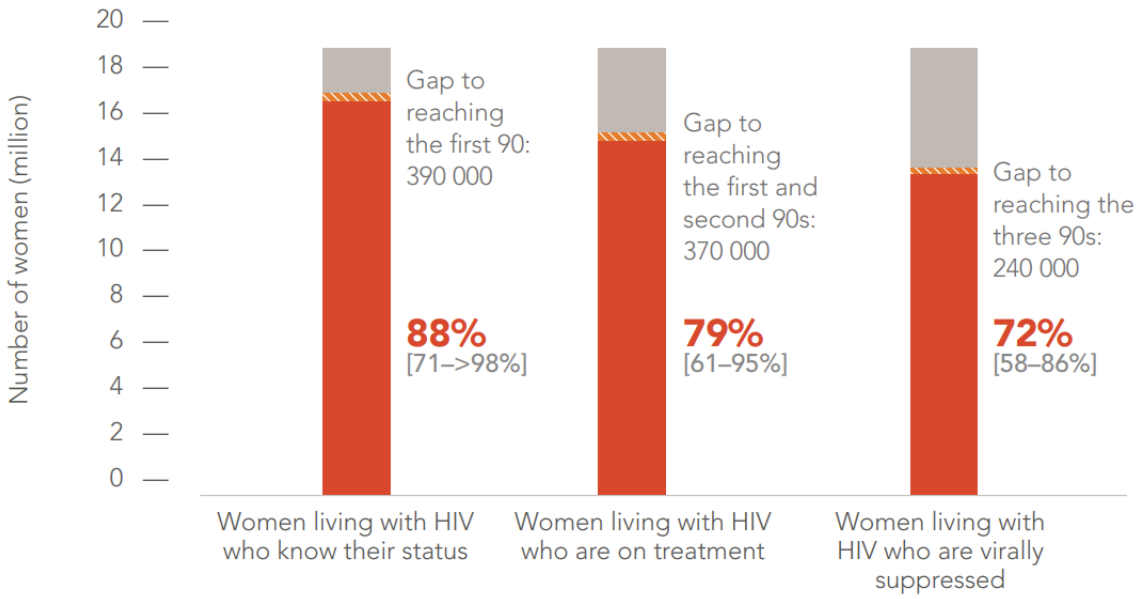

Figure 1-2 HIV testing and treatment cascade, women (aged 15+ years), Global, 2020 (UNAIDS, 2021a, p. 88).

(Source: UNAIDS special analysis, 2021)

Currently, evolving COVID-19 pandemic has challenged the provision of HIV prevention and treatment services in the world. The WHO's survey with 144 countries recorded that disruption in HIV testing service was reported in 38 countries during the COVID-19 pandemic (WHO, 2020). Therefore, it is essential to know pre-existing barriers and facilitators for uptake of HIV testing as baseline. This information will help in the planning and implementation of HIV testing programmes in the individual country in the future.

Many studies have been done to assess the prevalence of HIV testing among key populations and investigated possible barriers and facilitators for HIV testing uptake among key populations. Determinants of HIV testing among key populations have been studied considerably (Minh D. Pham et al., 2019; M. D. Pham et al., 2017; Saw et al., 2014; Veronese et al., 2020). However, only a few studies investigated the HIV testing uptake and its associated factors among the general population in Myanmar (S. M. Oo, 2018; Show et al., 2020; Thinn, 2019). Moreover,

some comparative data analyses have been performed to investigate the situation of HIV testing uptake in sub-Saharan African countries (Staveteig, Head, Croft, & Kampa, 2016; Staveteig, Wang, Head, Bradley, & Nybro, 2013). HIV testing uptake and factors influencing HIV testing uptake among the general population, especially women, need further research attention in Myanmar and other countries in the Southeast Asia region. The DHS program has been implemented nationwide household surveys in the region. Therefore, this present study assessed gaps in HIV testing uptake and its associated factors among women of reproductive age in the general population in four Southeast Asian countries with available data – Myanmar, Cambodia, the Philippines, and Timor-Leste.

Conceptual Framework

Andersen's Behavioral Model of health services suggests that the use of health services may be contributed or predicted by a function of people's predisposition to use services, factors which enable or impede the use of services, and their need for care (Andersen, 1995). The model has been applied in many studies examining the utilization health services in different contexts and different study populations (Babitsch, Gohl, & von Lengerke, 2012).

The model is a multilevel model comprising of individual and contextual levels. However, this current study will only focus on the individual-level aspect of the model. The model conceptualizes factors that are related to the use of health services as a function of 3 major components: predisposing factors, enabling factors, and need factors. Predisposing factors are people's likelihood of using services, and they include demographic characteristics (age, sex), social factors such as education, occupation, ethnicity, and social relationships, and health beliefs such as attitudes, values, and knowledge related to health and health services at the individual

level. Enabling factors enable or impede the use of health services, and they include individual financing components (e.g., income, health insurance) and organizational components (e.g., ways of transportation, time spent to reach and wait for health care). Need factors suggest their need for care and they can be either perceived need for health services or evaluated health needs at the individual level. (Andersen, 1995; Babitsch et al., 2012).

Many studies have applied Andersen's Behavioral Model of health services in investigating factors influencing the utilization of health services including HIV testing uptake (Conserve et al., 2017; Gazimbi & Magadi, 2017; Hirshfield, Downing, Horvath, Swartz, & Chiasson, 2018; Seidu, 2020; Toeng, 2021). Studies have revealed the relationship between women's empowerment (disagreement with reasons for wife beating, women's decision-making power) and their health service utilization such as antenatal care services, HIV testing services (Pratley, 2016; Sado, Spaho, & Hotchkiss, 2014; Sebayang, Efendi, & Astutik, 2017; Thapa, Yang, Kang, & Nho, 2019). Therefore, it is worthwhile to incorporate women's empowerment into the behavioral model framework in this study since empowerment plays an important role in an individual's actions.

After reviewing literature about HIV testing uptake, we applied Andersen's Behavioral Model of health services to construct a conceptual framework for this study including predisposing, enabling, and need factors that may facilitate or impede the HIV testing uptake among women from the Southeast Asian countries. We included age, marital status, occupation, education, comprehensive knowledge of HIV, knowledge of prevention of mother-to-child transmission of HIV, counseling about HIV during ANC visit, and attitude towards PLHIV as predisposing factors. History of STI(s), age at first sexual intercourse and ANC services could be need factors. Wealth index, place of residence, mass media exposure, and women's empowerment were regarded as enabling factors.

CHAPTER 2

Factors associated with lifetime HIV testing among Myanmar women: Secondary data analysis using the 2015-16 Myanmar Demographic and Health Survey

Abstract

Background: HIV testing services are available to women through facility-based and community-based approaches in Myanmar. Low-risk women can get infected through the heterosexual transmission of HIV. HIV testing is critical to know the HIV status of women and to prevent transmission of HIV to their children and husbands or partners. This study assessed factors associated with lifetime HIV testing uptake among women aged 15-49 years by their marital status in Myanmar.

Methods: This study was a cross-sectional study using secondary data from the 2015-16 Myanmar Demographic and Health Survey. A total of 12,885 women aged 15-49 years who completed the survey were included in the analysis. We performed the multivariable logistic regression analyses for lifetime HIV testing uptake by their marital status. Individual sampling weights were applied in the analysis to get nationally representative estimates.

Results: Lifetime HIV testing uptake was significantly different by the marital status of women in Myanmar ($p<0.001$). The proportion of having ever been tested for HIV was highest among currently married women (26.6%) and lowest among never-married women (7.0%). Adolescent girls and women lived in rural areas were less likely to get tested for HIV than older women and those lived in urban areas [aOR = 0.53, (95% CI: 0.37, 0.76)] and [aOR = 0.73, (95% CI: 0.59, 0.89)], respectively. Women aged 20-39 years, currently married, secondary and higher education

levels, the wealthier quintiles of wealth index, comprehensive knowledge of HIV, and positive attitudes towards negotiation for safer sexual relations were more likely to get tested for HIV than their counterparts.

Conclusion: Actions needed to promote comprehensive knowledge of HIV among women through effective health education campaigns targeted to women, especially youth. Availability and accessibility of HIV testing services to rural communities should be increased by the use of trained lay providers and local volunteers, providing a financial assistance mechanism, and implementing an HIV self-testing approach. There should be a multisectoral collaboration to create more educational and occupational opportunities for women's empowerment.

Introduction

HIV epidemic and responses in Myanmar

Myanmar had a population of 52,680,726 with 29.7% of the urban population in 2015 (Worldometer, 2021b). The first case of HIV in Myanmar was reported in 1988. Nationally, HIV prevalence among 15 years and older is below 1%. According to AIDS Epidemic Model (AEM) and Spectrum 5.4, April 2016, there were approximately 224,794 people living with HIV (PLHIV), around 11,000 new HIV infections and 9,675 AIDS deaths in 2015. After reaching the highest HIV prevalence in 2000, the epidemic had been declining steadily with an estimated HIV prevalence of 0.6% among adults age 15 years and above, and 0.4% among adult females in 2015 (National AIDS Programme, 2017).

The HIV epidemic in Myanmar is concentrated among key populations – people who inject drugs (PWID), female sex workers (FSW), and men who have sex with men (MSM). According to Integrated Biological Behavioral Surveillance surveys, it was estimated that HIV prevalence

was 14.6% among FSW in 2015; 11.6% among MSM; and 28.5% among PWID in 2014 (National AIDS Programme, 2017). As shown in Figure 2-1, HIV prevalence among FSW was higher than MSM; HIV prevalence among adult females was 50% lower than adult males, according to Myanmar Spectrum, AEM model (2016) based on IBBS (PWID 2014, FSW & MSM 2015) and HSS 2014.

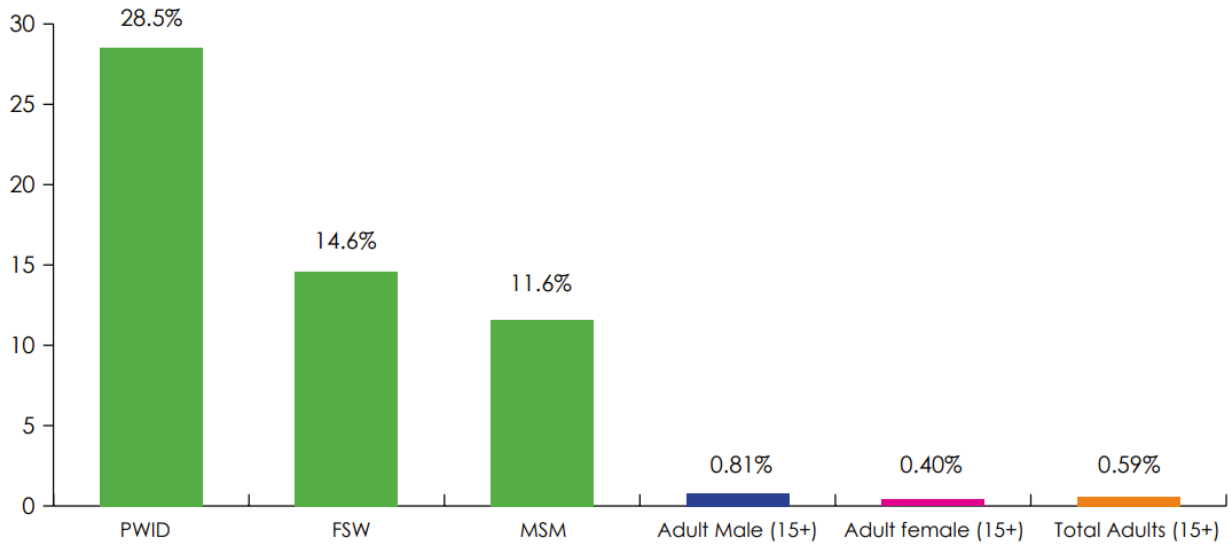

Figure 2-1 HIV prevalence among populations in 2015 (National AIDS Programme, 2017, p. 28).

New HIV infections have been declining steadily annually since 2000, as shown in Figure 2-2. Regarding HIV new infections in 2015, PWID contributed to 28% of new infections through contaminated injection equipment; low-risk women who are often spouses or regular partners of clients of sex workers contributed to 24%; male clients of sex workers contributed to (23%); and MSM contributed to 13%; and FSW and low risk males made up of 8% and 4% of new HIV infections, respectively (National AIDS Programme, 2017).

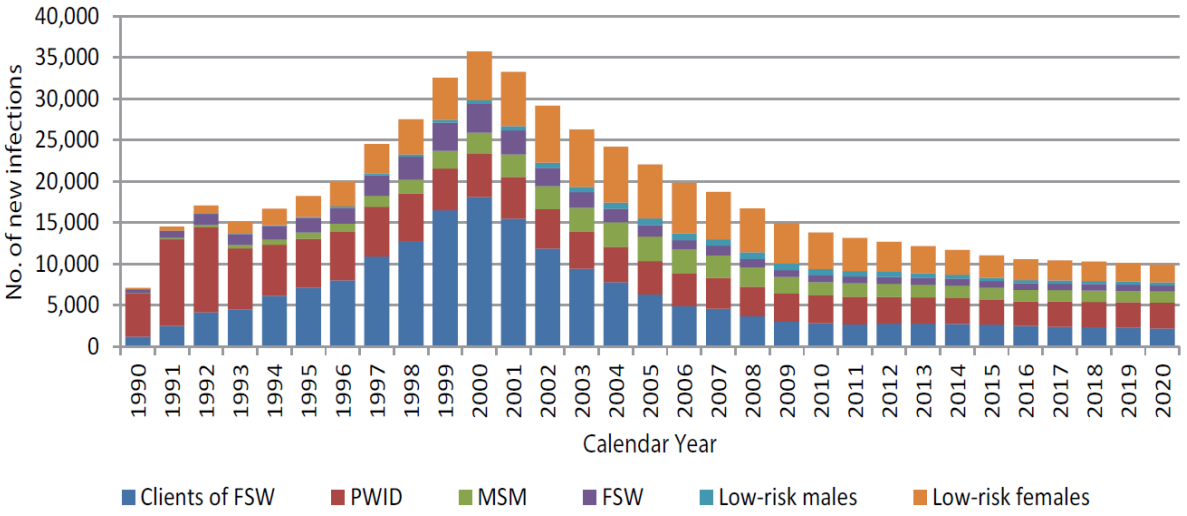

Figure 2-2 Trend of new HIV infections by key population 1990-2020 (National AIDS Programme, 2017, p. 29)

HIV/AIDS response in Myanmar was guided by the second National Strategic Plan on HIV and AIDS 2011-2015 (NSP II). The Technical Strategic Group on HIV and AIDS, UN agencies, international and national NGOs, civil society, PLHIV representatives, Key population Networks, the private sectors, multilateral and bilateral donors collaborated and developed the Myanmar National Strategic Plans on HIV and AIDS. HIV testing was an essential health service and backbone of the strategic priority I – prevention of the transmission of HIV through unsafe behavior in sexual contacts and injection drug use, and the strategic priority II – comprehensive continuum of care for PLHIV (National AIDS Programme, 2015a).

Regarding progress towards 90-90-90 targets in 2015 in Myanmar, 61% of people living with HIV knew their status; 79% of people who know their status were on ART; 87 % of people on ART achieved viral suppression. In 2019, 87% of people living with HIV knew their status; 89% of people who know their status were on ART; 94 % of people on ART achieved viral suppression in Myanmar (H. N. Oo, 2020).

HIV testing services in Myanmar

HIV testing is an essential step for the HIV prevention and care continuum. Myanmar National Strategic Plans for HIV/AIDS prioritize HIV testing services to provide quality services for individuals, couples, and families and improve access to the service for key populations (National AIDS Program, 2020b; National AIDS Programme, 2017, 2019).

There are 3 HIV testing service approaches – Facility-based HIV testing services, Community-based HIV testing services, and Self-Testing. In Facility-based HIV testing services, Provider-initiated testing and counselling (PITC) is routinely offered by health care workers in a health facility such as ANC, TB clinics, clinical settings where higher rates of HIV infection are often observed (STI clinics, hepatitis clinics, services for key populations including harm reduction services for PWID), ART centers/ decentralized (DC) ART sites, inpatient and outpatient hospital settings. Community-based HIV testing services aim primarily to reach key populations and link them to prevention and treatment services. Community-based HIV testing services are provided through outreach or mobile HIV testing services at community-based HTS sites such as bars, clubs, mines and factories (National AIDS Programme, 2019). The country has recently included HIV self-testing approach in the national policy and pilot projects have been implemented (UNAIDS & WHO, 2018).

HIV testing services are a crucial component of the HIV prevention services for the key populations. National AIDS Program (NAP) and implementing partner organizations are the main players in providing prevention services to the key populations and their clients and partners. Although HTS for the key populations gained significant achievement, the estimated HTS coverage among the key populations remained low during the NSP II era (2011-2015). Decentralization of HIV counselling and testing has initiated to shift the testing process from

laboratory technicians to basic health care workers throughout the country since 2013 in Myanmar. NGO staff are also being trained to provide HTS services to reach key populations in hard-to-reach areas (National AIDS Programme, 2015a).

HIV testing coverage among women in Myanmar

There has been an increasing trend in numbers of FSW received HIV testing and post-test counselling since 2013 and the testing coverage among FSW was 45.8% nationally in 2015. In 2018, 63% of FSW were tested for HIV and received the results. HIV testing coverage was around 31% of the estimated PWID population in 2015 and around 51% of PWID knew their HIV status in 2018 (National AIDS Program, 2018; National AIDS Programme, 2015a). Women especially married ones receive an HIV test during child births as part of the prevention of mother-to-child transmission (PMTCT) of HIV services. The PMTCT program covered 99% of townships by the end of 2019 and 89% of pregnant women got tested for HIV during 2019 (National AIDS Program, 2020a).

Justification

HIV testing is the first and foremost step for the continuum of care and prevention of HIV. Heterosexual transmission of HIV contributes substantial amount of new HIV infections to the HIV epidemic in Myanmar. Women can get infected from their husband, intimate partner, or regular partner who may be a client of sex workers, PWID, or MSM. HIV testing uptake among women in the general population needs considerable amount of research attention. Identifying barriers and facilitators for HIV testing uptake of women will help HIV testing services for reaching more women living with HIV to get tested for HIV. Moreover, having tested for HIV

among women is related to their marital status (Tenkorang & Owusu, 2010). Therefore, this study examined factors associated with lifetime HIV testing uptake of women aged 15-49 using the 2015-16 Myanmar Demographic and Health Survey by their marital status.

Specific aims

The specific aims of the proposed study are:

- To assess the proportion of lifetime HIV testing among women aged 15 – 49 in Myanmar; and
- To identify factors associated with lifetime HIV testing uptake among women aged 15 – 49 years in Myanmar.

Methods

Study design

The study was a cross-sectional study using secondary data from the 2015-16 Myanmar Demographic and Health Survey (the 2015-16 MDHS).

Data source

Myanmar Demographic and Health Survey was conducted in 2015 -2016, which is the first and only nation-wide cross sectional household survey using a stratified two-stage sample design. It was implemented by the Ministry of Health and Sports, Myanmar and funded by the United States Agency for International Development (USAID) and the Three Millennium Development Goal Fund (3MDG) (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). The data set is publicly available upon request from the Demographic and Health (DHS) Program.

The primary sampling unit (PSU) in the 2015-16 MDHS is either a census enumeration area or a ward or village tract in a sensitive area not enumerated during the 2014 census. The master sample, a source for household-based surveys in Myanmar, was created based on the 2014 census frame. Probability proportional to size was used to get the master sample with 4,000 primary sampling units (PSUs). At the first stage, a total of 442 clusters (123 urban and 319 rural) were selected from the master sample. At the second stage, equal probability systematic sampling was used to select a fixed number of 30 households from each of the selected clusters. All women aged 15-49 years from every selected household and all men aged 15-49 years from every second of the selected household who were either residents or visitors who stayed in the household the night before the survey were eligible to be interviewed (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

Data collection

After conducting pretest, comprehensive training of trainers and field staff, and evaluation of field staff, the data collection took place from 7 December 2015 to 7 July 2016. After getting voluntary informed consent, eligible women were questioned by female interviewers who were trained to check presence of others and ensure privacy before asking sensitive questions in the survey. Computer-assisted field editing (CAFE) procedures with tablet computers were used and data editing was done with CSPro software (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

Study population

The present analysis included all Myanmar women aged 15-49 years in the general population who completed the interviews in the 2015-2016 MDHS. The total number of eligible women interviewed was 12,885.

Protection of human subjects

The protocol of the 2015-16 Myanmar Demographic and Health Survey was reviewed and approved by the ICF's Institutional Review Board and an Ethical Review Board in the host country. ICF IRB ensures that the survey complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46). The DHS program describes the details about protecting the privacy of DHS respondents on the DHS program website (ICF, n.d.-a). The present study used the publicly available data of the MDHS with no identifying information. The use of data in this analysis was also reviewed and approved by the Institutional Review Board of the University of California, Los Angeles.

Data analysis

The outcome of interest in this study was lifetime HIV testing uptake – ever been tested for HIV among Myanmar women aged 15-49 years. The outcome was coded as binary outcome (yes/no).

Potential predictors related to socioeconomic and demographic characteristics were current marital status (never married/in union, currently married/in union, formerly married/in union), age group in years (15 - 19, 20 - 24, 25 - 29, 30 - 39, 40 - 49), educational level (no education or primary, secondary, higher), occupation (not working, agricultural, manual, non-manual, professional), wealth index (lowest, lower, middle, higher, and highest quintile) (ICF, n.d.-b), place of residence (urban, rural), and regular exposure to mass media (yes, no).

Potential predictors pertained to HIV related knowledge, attitudes towards people living with HIV (PLHIV), and behaviors were comprehensive knowledge about HIV (yes, no), discriminatory attitude towards PLHIV (yes, no), awareness of HIV testing services (yes, no), age

at first sexual intercourse (never had sex, <18, 18 - 20, 20+), history of a sexually transmitted infection (STI) or STI symptoms in the past 12 months (yes, no).

There were three variables related to women's empowerment as potential predictors – participation in decision making either alone or jointly with husband, attitude towards wife beating, and negotiation for safer sex. Participation in decision making was asked only among currently married women or women living with a partner. The variable was categorized into the number of decisions in which a women take part (0, 1 - 2, 3). Attitude towards wife beating was grouped into binary – disagreement over wife beating for all reasons (yes, no). Attitude towards negotiation for safer sexual relations with husband was categorized into 3 groups (no, yes to any one question, yes to both questions). The variables of interest and how they were coded in the analysis were described in detail in Appendix 1.

We performed the analysis using STATA software (version Stata/SE 15.1). We applied individual sampling weights provided in the 2015-16 MDHS dataset in our analysis to get nationally representative estimates. We used 'svyset' and 'svy' commands to correctly specify the effect of complex sampling design in the analysis. In the descriptive analysis, the proportion of lifetime HIV testing uptake with its 95% CI was calculated by the marital status. We summarized socioeconomic and demographic characteristics, HIV/AIDS related knowledge, attitude, and behavior, and women's empowerment of respondents by their marital status using frequency and percent.

We examined associations between each potential predictor and lifetime HIV testing of women using Pearson chi-square test corrected for the survey design. Simple and multivariable logistic regression models using the survey weights were applied to identify individual level factors associated with the odds of lifetime HIV testing uptake among women. Based on literature

and bivariate analysis, we selected the predictors that have a bivariate association with lifetime HIV testing at a p-value < 0.20 to be included in the multivariable logistic regression model (David W. Hosmer, Lemeshow, & Sturdivant, 2013; Herringa, West, & Berglund, 2010). Multicollinearity of independent variables in survey data were assessed by calculating tolerance ($1\text{-}R^2$) and VIF (UCLA Statistical Consulting Group, 2021a). Marital status and age at first sexual intercourse were moderately correlated, thus the latter one was omitted in the multivariable logistic regression model of all women sample. Moreover, awareness about HIV testing (know where to get an HIV test) was omitted in the regression models due to perfect prediction failure. Model specification was assessed using "linktest" command (UCLA Statistical Consulting Group, 2021b). Model fitting was examined using goodness-of-fit tests for complex survey data (Herringa et al., 2010).

Results

In the 2015-16 Myanmar Demographic and Health Survey, a total of 12,885 women aged 15-49 years old completed the survey interviews. The response rate of eligible women was 95.8% and 0.8% of eligible women refused to participate in the survey. Overall, 60.2% of women were currently in union at the time of the survey.

Proportion of lifetime HIV testing uptake

Overall, the proportion of lifetime HIV testing uptake among all women aged 15-49 years was 19.46% (95%CI: 18.31%, 20.67%). As shown in Figure 2-3, proportions of having ever been tested for HIV varied according to their marital status - only 7% (95%CI: 6.09%, 8.14%) of never married women, 16.7% (95%CI: 14.07%, 19.71%) of formerly married women, and 26.6% (95%CI: 24.94%, 28.35%) of currently married women had ever been tested for HIV. The proportions were significantly different ($p<0.001$).

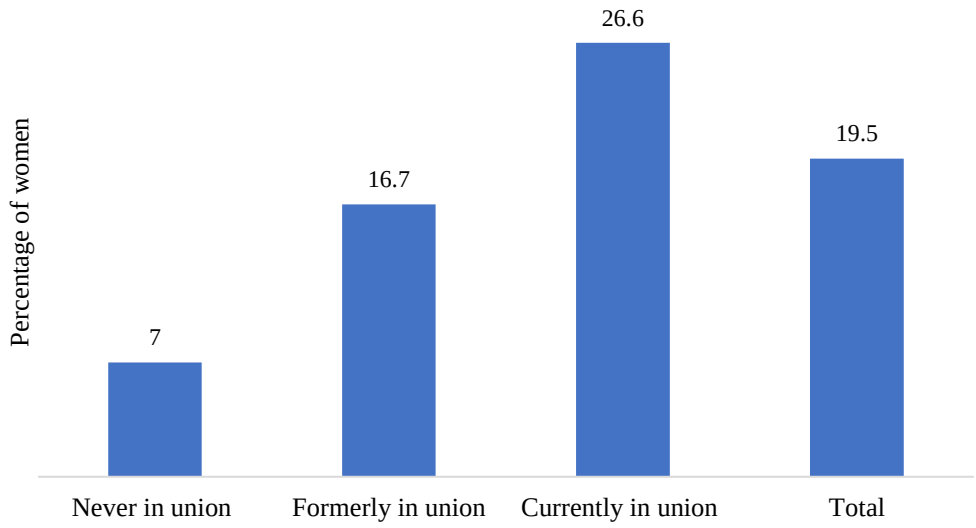

Figure 2-3 Proportion of lifetime HIV testing among women by their marital status

Socioeconomic and demographic characteristics of women

Among never married women, the highest percentage was aged between 15-19 years old with mean age of 25.3 ± 9.2 years. Among women who were formerly in union, the highest percentage was 40-49 years old with mean age of 37.5 ± 8.7 years. Among currently married women, the highest percentage was 30-39 years old with mean age of 34.6 ± 8.4 years. Fifty percent of never married women had secondary level of education, while 67.7% of formerly married women and 62.5% of currently married women had no education or primary level of education. Thirty-five percent of never married women, 37.2% of formerly married women, and 32.1% of currently married women were manual laborers. It includes both skilled and unskilled manual labor, household and domestic services. The highest percentage of never married women (28.5%) was in the richest quintile, whereas the highest percentage of formerly married women (21.9%) and currently married women (20.9%) were in the poorest quintile of wealth index. The majority of never married, formerly married and currently married women lived in rural areas

(65.4%, 68.8% and 73.9% respectively) and reported that they either read newspapers/magazines or listened radio or watched television at least once a week (76.9%, 60.9% and 64.2% respectively), as shown in Table 2-1.

Table 2-1 Socioeconomic and demographic characteristics by their marital status of women aged 15-49 years old, the 2015-16 MDHS

Variables	Marital Status							
	Never in union (n = 4,278)		Formerly in union (n = 848)		Currently in union (n = 7,759)		Total (n = 12,885)	
	No.	%	No.	%	No.	%	No.	%
Age in years								
15 – 19	1,564	36.6	18	2.2	227	2.9	1,810	14.0
20 – 24	969	22.6	65	7.6	834	10.7	1,867	14.5
25 – 29	513	12.0	95	11.2	1,258	16.2	1,867	14.5
30 – 39	757	17.7	245	28.9	2,988	38.5	3,990	31.0
40 – 49	474	11.1	424	50.0	2,452	31.6	3,351	26.0
Total	4,278	100	848	100	7,759	100	12,885	100
Highest educational level								
No education or primary	1,486	34.7	575	67.7	4,850	62.5	6,910	53.6
Secondary	2,130	49.8	231	27.3	2,285	29.5	4,646	36.1
Higher	662	15.5	42	5.0	621	8.0	1,325	10.3
Total	4,278	100	848	100	7,756	100	12,882	100
Occupation								
Not working	1,107	25.9	141	16.7	2,270	29.3	3,518	27.4
Agricultural	526	12.3	124	14.7	1,195	15.4	1,846	14.4
Manual	1,508	35.4	315	37.2	2,485	32.1	4,307	33.5
Non-manual	782	18.3	230	27.2	1,437	18.6	2,450	19.1
Professional	342	8.0	35	4.2	351	4.5	729	5.7
Total	4,265	100	846	100	7,739	100	12,849	100
Wealth index								
Poorest	467	10.9	186	21.9	1,622	20.9	2,274	17.7
Poorer	652	15.3	170	20.0	1,586	20.4	2,408	18.7
Middle	910	21.3	167	19.7	1,556	20.0	2,633	20.4
Richer	1,027	24.0	166	19.6	1,509	19.5	2,702	21.0
Richest	1,221	28.5	160	18.8	1,487	19.2	2,868	22.3
Total	4,278	100	848	100	7,759	100	12,885	100

Place of residence								
Urban	1,481	34.6	265	31.2	2,022	26.1	3,768	29.2
Rural	2,796	65.4	584	68.8	5,737	73.9	9,117	70.8
Total	4,278	100	848	100	7,759	100	12,885	100
Exposure to any mass media at least once a week								
No	988	23.1	331	39.1	2,778	35.8	4,097	31.8
Yes	3,290	76.9	517	60.9	4,981	64.2	8,788	68.2
Total	4,278	100	848	100	7,759	100	12,885	100

No. (%) are weighted numbers and percentages.
Missing values were excluded.

HIV related knowledge, attitude towards people living with HIV, and behaviors

Overall, more than half of respondents (59.4%) knew that the risk of getting HIV can be reduced by use of condoms every time they have sexual intercourse. Seventy percent of women knew that having just one uninfected sex partner who has no other sex partners can reduce the risk of getting HIV. Fifty nine percent of women were aware that a healthy looking person can have HIV infection. Thirty-eight percent and 57% of women did not believe two common local misconceptions about HIV transmission or prevention – HIV can be transmitted by mosquito bites and sharing food with an HIV infected person. Overall, one-fifth of women (19.7%) had comprehensive knowledge of HIV[1].

Overall, 58% of women had discriminatory attitude towards PLHIV reporting that they would not buy fresh vegetables from a vendor who has HIV. Almost all never married women reported that they had never had sexual exposure (99.7%), while 39.8% of formerly married women and 35.5% of currently married women had their sexual debut at under 18 years of age.

[1] Comprehensive knowledge of HIV is a composite measure. The respondents who know that consistent use of condoms during sexual intercourse and having just one uninfected faithful partner can reduce the chances of getting HIV: AND know that a healthy-looking person can have HIV; AND reject the two most common local misconceptions about transmission or prevention of HIV are defined as having comprehensive knowledge of HIV (Croft, 2018).

Less than 1 in 100 never married women, 8.5% of formerly married women, and 7.9% of currently married women had an STI or reported any symptoms of STI in the past 12 months. Overall, more than 6 in 10 women (64.1%) knew where to get an HIV test in Myanmar as shown in Table 2-2.

Table 2-2 HIV related knowledge, attitude toward people living with HIV, and behavior by their marital status among women aged 15-49 years, the 2015-16 MDHS

Variables	Marital Status							
	Never in union (n = 4,278)		Formerly in union (n = 848)		Currently in union (n = 7,759)		Total (n = 12,885)	
	No.	%	No.	%	No.	%	No.	%
Comprehensive knowledge of HIV								
No	3,364	78.6	703	82.9	6,275	80.9	10,341	80.3
Yes	914	21.4	145	17.1	1,484	19.1	2,544	19.7
Total	4,278	100	848	100	7,759	100	12,885	100
Discriminatory attitude towards PLHIV								
No	1,910	44.6	394	46.4	3,105	40.0	5,408	42.0
Yes	2,368	55.4	455	53.6	4,654	60.0	7,477	58.0
Total	4,278	100	848	100	7,759	100	12,885	100
Age at first sexual intercourse								
Never had sex	4,267	99.7	0	0.0	0	0.0	4,269	33.1
<18	1	0.0	337	39.8	2,751	35.5	3,089	24.0
18 - 20	4	0.1	151	17.9	1,634	21.1	1,789	13.9
20+	6	0.1	359	42.4	3,372	43.5	3,737	29.0
Total	4,278	100	848	100	7,759	100	12,885	100
Had an STI or STI symptoms in the past 12 months								
No	4,277	99.98	776	91.5	7,144	92.1	12,197	94.7
Yes	1	0.02	72	8.5	615	7.9	688	5.3
Total	4,278	100	848	100	7,759	100	12,885	100
Awareness of HIV testing service								
No	1,596	37.3	331	39.0	2,699	34.8	4,626	35.9
Yes	2,682	62.7	517	61.0	5,060	65.2	8,259	64.1
Total	4,278	100	848	100	7,759	100	12,885	100

No. (%) are weighted numbers and percentages.

Women's empowerment

Only currently married or in union women were asked about how they participate in household decision making for their own's health care, major household purchases, and visits to family or relatives in the survey. As shown in Table 2-3, few currently married women (5.2%) participated in making none of these decisions, while majority of currently married women in Myanmar (65.3%) participated in all of these decisions either alone or jointly with their husbands. Among these decisions, 83.4% of currently married women made decision for their own health care either alone or jointly with their husband; 74.3% of currently married women participated in decision making for major household purchases either alone or jointly with their husband; 87.7% of currently married women made decision either alone or jointly with their husband for visiting to family or relatives.

Overall, about one fifth of Myanmar women justified wife beating by a husband for going out without telling him; 42% of women agreed with wife beating by a husband is justified for neglecting the children; about 1 in 10 Myanmar women accepted that a husband is justified in hitting or beating his wife if she argues with him and if she refuses to have sexual intercourse (10.1% and 10.4%); and 12.7% of women said wife beating by a husband is justifiable if she burns the food. Thirty-two percent of never married women, 39.2% of formerly married women and 43.6% of currently married women disagreed that a husband is justified in hitting or beating his wife for all five specified reasons.

Regarding attitudes towards negotiation for safer sexual relations with husbands, 61.8% of never married women, 66.4% of formerly married women and 71.3% of currently married women believed that a woman is justified in refusing to have sexual intercourse with her husband if she knows he has sex with other women and asking him to use a condom if she knows he has an STI.

Table 2-3 Women's empowerment by their marital status of women aged 15-49 years, the 2015-16 MDHS

Variables	Marital Status							
	Never in union (n = 4,278)		Formerly in union (n = 848)		Currently in union (n = 7,759)		Total (n = 12,885)	
	No.	%	No.	%	No.	%	No.	%
Number of decisions in which women participate								
0	NA	NA	NA	NA	404	5.2	404	5.2
1 - 2	NA	NA	NA	NA	2,292	29.5	2,292	29.5
3	NA	NA	NA	NA	5,063	65.3	5,063	65.3
Total	NA	NA	NA	NA	7,759	100	7,759	100
Disagreement over all of the reasons for wife beating								
No	2,892	67.6	516	60.8	4,374	56.4	6,592	51.2
Yes	1,386	32.4	333	39.2	3,385	43.6	6,293	48.8
Total	4,278	100	848	100	7,759	100	12,885	100
Attitude toward negotiation for safer sex								
No	712	16.6	101	11.9	739	9.5	1,552	12.0
Yes to any one question	922	21.6	184	21.8	1,486	19.2	2,593	20.1
Yes to both questions	2,643	61.8	563	66.4	5,533	71.3	8,740	67.8
Total	4,278	100	848	100	7,759	100	12,885	100

No. (%) are weighted numbers and percentages.
NA means not available.

Associations between lifetime HIV testing and independent variables by the marital status

As shown in Table 2-4, all independent variables of interest regarding socioeconomic and demographic characteristics, HIV related knowledge, attitude, and behavior, and attitude toward negotiation for safer sex were statistically significantly associated with lifetime HIV testing uptake regardless of their marital status, except self-reported history of an STI or symptoms of STI in the past 12 months among formerly and currently married women (P-value <0.05). Disagreement over all the reasons for wife beating among never married women and age at first sexual intercourse

among formerly married women were also not significantly associated with lifetime HIV testing uptake.

Table 2-4 Bivariate analysis of lifetime HIV testing uptake by marital status of women aged 15-49 years, the 2015-16 MDHS

Variables	Ever been tested for HIV											
	Never in union			Formerly in union			Currently in union			All women		
	No n (%)	Yes n (%)	P-value	No n (%)	Yes n (%)	P-value	No n (%)	Yes n (%)	P-value	No n (%)	Yes n (%)	P-value
Marital status												
Never in union	-	-		-	-		-	-		3,976 (93.0)	301 (7.0)	<0.0001
Formerly in union	-	-		-	-		-	-		706 (83.3)	142 (16.7)	
Currently in union	-	-		-	-		-	-		5,695 (73.4)	2,064 (26.6)	
Age in years												
15 – 19	1,528 (97.7)	36 (2.3)	<0.0001	17 (92.2)	1 (7.8)	0.006	205 (90.1)	22 (9.9)	<0.0001	1,750 (96.7)	60 (3.3)	<0.0001
20 – 24	892 (92.1)	77 (7.9)		50 (77.8)	14 (22.2)		602 (72.3)	231 (27.7)		1,545 (82.7)	322 (17.2)	
25 – 29	453 (88.3)	60 (11.7)		69 (72.9)	26 (27.1)		811 (64.5)	447 (35.5)		1,334 (71.5)	533 (28.5)	
30 – 39	678 (89.6)	79 (10.4)		195 (79.5)	50 (20.5)		2,039 (68.2)	949 (31.8)		2,912 (73.0)	1,078 (27.0)	
40 – 49	425 (89.6)	49 (10.4)		375 (88.3)	50 (11.7)		2,037 (83.1)	415 (16.9)		2,837 (84.7)	514 (15.3)	
Highest educational level												
No education	1,435	51	<0.0001	507	68	<0.0001	3,967	883	<0.0001	5,909	1,001	<0.0001
of primary	(96.6)	(3.4)		(88.2)	(11.8)		(81.8)	(18.2)		(85.5)	(14.5)	
Secondary	2,013	117		173	58		1475	810		3,661	985	
	(94.5)	(5.5)		(74.7)	(25.3)		(64.5)	(35.5)		(78.8)	(21.2)	
Higher	528	134		27	15		250	371		804	521	
	(79.8)	(20.2)		(63.7)	(36.3)		(40.3)	(59.7)		(60.7)	(39.3)	

Occupation												
Not working	1,047	59	<0.0001	119	21	0.0001	1,534	736.4	<0.0001	2,701	817	<0.0001
	(94.7)	(5.3)		(84.7)	(15.3)		(67.6)	(32.4)		(76.8)	(23.2)	
Agricultural	510	16		112	13		1,035	160.3		1,657	189	
	(97.0)	(3.0)		(89.8)	(10.2)		(86.6)	(13.4)		(89.8)	(10.2)	
Manual	1,447	60		264	50		1,951	533.4		3,663	644	
	(96.0)	(4.0)		(84.0)	(16.0)		(78.5)	(21.5)		(85.0)	(15.0)	
Non-manual	689	93		192	38		986	451.1		1,867	583	
	(88.1)	(11.9)		(83.4)	(16.6)		(68.6)	(31.4)		(76.2)	(23.8)	
Professional	273	68		18	17		177	174.5		468	260	
	(80.0)	(20.0)		(50.2)	(49.8)		(50.4)	(49.7)		(64.3)	(35.7)	
Wealth index												
Poorest	452	14	<0.0001	163	22	0.0263	1,398	223.5	<0.0001	2,014	260	<0.0001
	(96.9)	(3.1)		(88.0)	(12.0)		(86.22)	(13.78)		(88.6)	(11.4)	
Poorer	634	18		151	19		1275	310.6		2,060	348	
	(97.2)	(2.8)		(88.8)	(11.2)		(80.41)	(19.59)		(85.6)	(14.4)	
Middle	864	47		136	31		1,226	329.3		2,226	407	
	(94.9)	(5.1)		(81.5)	(18.5)		(78.83)	(21.17)		(84.6)	(15.4)	
Richer	961	66		133	33		1,018	491.8		2,111	591	
	(93.6)	(6.4)		(80.2)	(19.8)		(67.42)	(32.58)		(78.1)	(21.9)	
Richest	1,065	156		123	37		777.4	709.3		1,966	902	
	(87.2)	(12.8)		(77.1)	(22.9)		(52.29)	(47.71)		(68.6)	(31.4)	
Place of residence												
Urban	1,326	156	<0.0001	192	72	<0.0001	1,131	890.9	<0.0001	2,650	1,119	<0.0001
	(89.5)	(10.5)		(72.7)	(27.3)		(55.95)	(44.05)		(70.3)	(29.7)	
Rural	2,651	146		514	70		4,563	1,174		7,728	1,389	
	(94.8)	(5.2)		(88.1)	(11.9)		(79.54)	(20.46)		(84.8)	(15.2)	
Exposure to any mass media at least once a week												
No	932	56	0.1944	291	40	0.007	2,233	544.4	<0.0001	3,457	640	<0.0001
	(94.3)	(5.7)		(87.9)	(12.1)		(80.4)	(19.6)		(84.4)	(15.6)	

Yes	3,044	246		415	102		3461	1520		6,921	1,867	
	(92.5)	(7.5)		(80.3)	(19.7)		(69.49)	(30.51)		(78.8)	(21.2)	
Comprehensive knowledge of HIV												
No	3,177	187	<0.0001	602	101	0.0002	4,913	1,362	<0.0001	8,691	1,650	<0.0001
	(94.4)	(5.6)		(85.6)	(14.4)		(78.3)	(21.7)		(84.0)	(16.0)	
Yes	800	114		105	40		781.5	702.7		1,686	858	
	(87.5)	(12.5)		(72.1)	(27.9)		(52.65)	(47.35)		(66.3)	(33.7)	
Discriminatory attitude towards PLHIV												
No	1,745	164	0.0039	307	86	0.0011	2,162	942	<0.0001	4,215	1,193	<0.0001
	(91.4)	(8.6)		(78.1)	(21.9)		(69.6)	(30.4)		(77.9)	(22.1)	
Yes	2,231	137		399	55		3,532	1,122		6,163	1,314	
	(94.2)	(5.8)		(87.8)	(12.2)		(75.9)	(24.1)		(82.4)	(17.6)	
Had a STI or STI symptoms in the past 12 months												
No	7	3	0.0317	650	125	0.2282	5256	1,888	0.3139	9,883	2,314	<0.0001
	(72.2)	(27.8)		(83.8)	(16.2)		(73.6)	(26.4)		(81.0)	(19.0)	
Yes	0.6	0.4		56	16		438	177		495	193	
	(57.1)	(42.9)		(77.7)	(22.3)		(71.3)	(28.7)		(71.9)	(28.1)	
Age at first sexual intercourse												
Never had sex	3,969	298	0.0092	-	-		-	-		3,971	298	<0.0001
	(93.0)	(7.0)								(93.0)	(7.0)	
<18	0.7	0.3		287	50	0.5283	2,255	495	<0.0001	2,544	546	
	(68.2)	(31.8)		(85.2)	(14.8)		(82.0)	(18.0)		(82.3)	(17.7)	
18 - 20	3.5	0.4		126	25		1,245	389		1,375	415	
	(89.3)	(10.7)		(83.5)	(16.5)		(76.2)	(23.8)		(76.8)	(23.2)	
20+	4	2		293.	67		2,192	1,179		2,489	1,249	
	(59.4)	(40.6)		(81.4)	(18.6)		(65.0)	(35.0)		(66.6)	(33.4)	
Number of decisions in which women participate												

0	NA	NA		NA	NA		332 (82.2)	71.9 (17.8)	0.0019	-#	-#	
1 - 2	NA	NA		NA	NA		1686 (73.54)	606.5 (26.46)		-#	-#	
3	NA	NA		NA	NA		3677 (72.62)	1386 (27.38)		-#	-#	
Disagreement over all of the reasons for wife beating												
No	2,041 (92.8)	159 (7.2)	0.6907	390 (81.5)	68 (14.9)	0.1849	2,955 (75.1)	979 (24.9)	0.0017	5,386 (81.7)	1,206 (18.3)	0.0143
Yes	1,935 (93.1)	142 (6.9)		316 (81.2)	73 (18.8)		2,739 (71.6)	1,086 (28.4)		4,991 (79.3)	1,302 (20.7)	
Attitude towards negotiation for safer sex												
No	691 (97.0)	21 (3.0)	0.0001	91 (90.8)	9 (9.2)	0.0194	662 (89.6)	77 (10.4)	<0.0001	1,445 (93.1)	107 (6.9)	<0.0001
Yes to any one question	877 (95.1)	45 (4.9)		162 (87.6)	23 (12.4)		1,193 (80.3)	293 (19.7)		2,232 (86.1)	361 (13.9)	
Yes to both questions	2,408 (91.1)	235 (8.9)		453 (80.5)	110 (19.5)		3,839 (69.4)	1,694 (30.6)		6,701 (76.7)	2,039 (23.3)	

n (%) are weighted number and percent.

NA means not available.

Missing values were excluded.

-# “Number of decisions in which women participate” was omitted because it was not available among never married and formerly married women.

Factors associated with lifetime HIV testing uptake among women

We examined factors associated with lifetime HIV testing uptake among Myanmar women by their current marital status. Adolescent girls who were never in union were less likely to be tested for HIV compared to those aged between 40-49 years [aOR = 0.24, (95% CI: 0.13, 0.42)]. Compared to never married women with no education or primary level of education, those with secondary and higher education were more likely to have been tested for HIV [aOR = 3.21, (95% CI: 1.72, 5.97)] and [aOR = 1.60, (95% CI: 1.01, 2.56)], respectively. The odds of taking HIV test were 0.40 times among never married women who involved in agriculture and 0.48 times who worked as manual jobs than those who had professional jobs [aOR = 0.40, (95% CI: 0.18, 0.85)] and [aOR = 0.48, (95% CI: 0.26, 0.89)], respectively. However, other socioeconomic and demographic variables, HIV related knowledge, attitude and behaviors, and attitude towards negotiation for safer sex were not found to be significantly related to lifetime HIV testing uptake among never married women.

Age, education, occupation, place of residence, and discriminatory attitude towards people living with HIV were independently associated with lifetime HIV testing uptake among formerly married women as shown in Table 2-5. Younger formerly married women, aged 25-29 and 30-39 years, were more likely to have ever been tested for HIV compared to those who were 40-49 years old. Formerly married women who were unemployed or worked in agriculture or manual or non-manual labor were less likely to get tested for HIV compared to those who had a professional/technical/managerial job. Formerly married women in rural areas were less likely to get tested for HIV than those in urban areas. Discriminatory attitude towards PLHIV had lower odds of having an HIV test among formerly married women.

Among women who were currently married or living in union, almost all factors were significantly associated with lifetime HIV testing uptake, except regular exposure to any mass media, discriminatory attitude towards PLHIV, and women's empowerment variables such as disagreement over wife beating. Compared to currently married women aged 40 - 49 years old, younger women (except aged 15 - 19) were significantly more likely to be tested for HIV. Currently married women with secondary and higher levels of education had higher odds of lifetime HIV testing uptake than those with no or primary level of education. Compared to currently married women with a professional job, women who had other types of occupations and no job had lower odds of lifetime HIV testing uptake. Currently married women in the higher quintile of wealth index were more likely to have ever been tested for HIV compared to those women in the poorest quintile as shown in Table 2-5. Residing in rural areas had lower odds of lifetime HIV testing compared to currently married women living in urban areas [aOR = 0.70, (95% CI: 0.56, 0.87)].

Married women with comprehensive knowledge of HIV were more likely to have an HIV test compared to their counterparts [aOR = 1.53, (95% CI: 1.31, 1.79)]. Currently married women with their first sexual intercourse at earlier age had lower odds of getting tested for HIV compared to those who had their first sexual exposure at 20+ years of age. Women who made all 3 decisions alone or jointly with their husbands had higher odds of lifetime HIV testing uptake than those who did not make decisions [aOR = 1.41, (95% CI: 1.04, 1.93)]. Currently married women who justified a wife can negotiate for safer sexual relation with a husband were more likely to get tested for HIV than those without the positive attitude as shown in Table 2-5.

The analysis including all women revealed the same significant associated factors as currently married women, except marital status as shown in Table 2-5. Overall, women aged 15-

19 years were less likely to have ever been tested for HIV than women aged 40-49 [aOR = 0.53, (95% CI: 0.37, 0.76)]. Compared to never married women, women who were formerly in union and currently married women had greater odds of lifetime HIV testing uptake [aOR = 3.72, (95% CI: 2.81, 4.91)] and [aOR = 5.93, (95% CI: 4.80, 7.32)], respectively.

Table 2-5 Simple and multivariable logistic regression models for lifetime HIV testing among women, the 2015-16 MDHS

Variables	Never in union n = 4,265		Formerly in union n = 846		Currently in union n = 7,736		All women n = 12,848	
	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)
Marital status								
Never in union	NA	NA	NA	NA	NA	NA	1.0 (ref)	1.0 (ref)
Formerly in union	NA	NA	NA	NA	NA	NA	2.64 (2.08, 3.37) ***	3.72 (2.81, 4.91) ***
Currently in union	NA	NA	NA	NA	NA	NA	4.78 (4.06, 5.64) ***	5.93 (4.80, 7.32) ***
Age in years								
15 – 19	0.21 (0.12, 0.35) ***	0.24 (0.13, 0.42) ***	0.64 (0.08, 5.06)	0.67 (0.07, 6.15)	0.54 (0.33, 0.88) *	0.87 (0.54, 1.42)	0.19 (0.14, 0.26) ***	0.53 (0.37, 0.76) ***
20 – 24	0.74 (0.48, 1.16)	0.67 (0.42, 1.07)	2.15 (0.99, 4.67)	1.99 (0.87, 4.54)	1.88 (1.50, 2.36) ***	2.43 (1.88, 3.14) ***	1.15 (0.95, 1.39)	1.81 (1.44, 2.27) ***
25 – 29	1.15 (0.74, 1.78)	0.99 (0.61, 1.61)	2.80 (1.51, 5.21) **	2.75 (1.42, 5.34) **	2.70 (2.22, 3.29) ***	3.00 (2.41, 3.72) ***	2.21 (1.85, 2.63) ***	2.57 (2.12, 3.12) ***
30 – 39	1.01 (0.64, 1.58)	0.97 (0.60, 1.57)	1.95 (1.21, 3.13) **	1.97 (1.17, 3.32) *	2.28 (1.93, 2.71) ***	2.47 (2.05, 2.98) ***	2.04 (1.76, 2.37) ***	2.24 (1.90, 2.63) ***
40 – 49	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Highest educational level¥								
No education or primary	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Secondary	1.64 (1.08, 2.49) *	1.60 (1.01, 2.56) *	2.53 (1.69, 3.79) ***	1.82 (1.10, 3.02) *	2.47 (2.12, 2.87) ***	1.29 (1.09, 1.53) **	1.59 (1.39, 1.81) ***	1.45 (1.24, 1.69) ***
Higher	7.15	3.21	4.26	1.44 (0.45, 4.58)	6.69	1.50	3.82	2.09

	(4.52, 11.31) ***	(1.72, 5.97) ***	(1.97, 9.20) ***		(5.25, 8.52) ***	(1.08, 2.08) *	(3.12, 4.68) ***	(1.59, 2.76) ***
Occupation[¥]								
Professional	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Agricultural	0.12 (0.06, 0.23) ***	0.40 (0.18, 0.85) *	0.12 (0.04, 0.33) ***	0.20 (0.06, 0.65) **	0.16 (0.10, 0.25) ***	0.44 (0.28, 0.69) ***	0.20 (0.15, 0.28) ***	0.42 (0.29, 0.61) ***
Manual	0.17 (0.10, 0.27) ***	0.48 (0.26, 0.89) *	0.19 (0.08, 0.46) ***	0.32 (0.11, 0.91) *	0.28 (0.18, 0.43) ***	0.63 (0.41, 0.96) *	0.32 (0.24, 0.42) ***	0.60 (0.44, 0.84) **
Non-manual	0.54 (0.34, 0.86) **	0.97 (0.57, 1.65)	0.20 (0.08, 0.48) ***	0.25 (0.09, 0.67) **	0.46 (0.30, 0.72) **	0.63 (0.42, 0.94) *	0.56 (0.43, 0.74) ***	0.67 (0.49, 0.90) **
Not working	0.23 (0.14, 0.37) ***	0.72 (0.38, 1.36)	0.18 (0.07, 0.46) ***	0.27 (0.10, 0.74) *	0.49 (0.32, 0.74) **	0.87 (0.58, 1.29)	0.54 (0.41, 0.71) ***	0.81 (0.59, 1.11)
Wealth index								
Poorest	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Poorer	0.91 (0.44, 1.88)	0.69 (0.34, 1.40)	0.93 (0.44, 1.92)	0.76 (0.34, 1.72)	1.52 (1.21, 1.92) ***	1.43 (1.12, 1.82) **	1.31 (1.06, 1.62) *	1.33 (1.07, 1.67) *
Middle	1.70 (0.80, 3.57)	0.98 (0.47, 2.04)	1.67 (0.88, 3.16)	1.01 (0.44, 2.31)	1.68 (1.33, 2.12) ***	1.46 (1.13, 1.90) **	1.42 (1.13, 1.77) **	1.48 (1.16, 1.89) **
Richer	2.15 (1.12, 4.14) *	1.00 (0.51, 1.95)	1.82 (0.95, 3.46)	0.73 (0.29, 1.82)	3.02 (2.39, 3.82) ***	2.02 (1.55, 2.65) ***	2.17 (1.75, 2.69) ***	1.87 (1.46, 2.41) ***
Richest	4.58 (2.43, 8.64) ***	1.42 (0.72, 2.81)	2.18 (1.16, 4.08) *	0.65 (0.25, 1.69)	5.71 (4.49, 7.26) ***	2.59 (1.88, 3.56) ***	3.55 (2.87, 4.39) ***	2.34 (1.74, 3.14) ***
Place of residence								
Rural	0.47 (0.34, 0.64) ***	1.11 (0.75, 1.63)	0.36 (0.24, 0.54) ***	0.43 (0.25, 0.75) **	0.33 (0.27, 0.39) ***	0.70 (0.56, 0.87) **	0.43 (0.37, 0.50) ***	0.73 (0.59, 0.89) **
Urban	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)

Exposure to any mass media at least once a week								
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	1.35 (0.86, 2.12)	0.96 (0.60, 1.52)	1.78 (1.17, 2.72) **	1.07 (0.64, 1.82)	1.80 (1.53, 2.12) ***	1.00 (0.85, 1.18)	1.46 (1.25, 1.70) ***	1.01 (0.86, 1.19)
Comprehensive knowledge of HIV								
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	2.43 (1.79, 3.29) ***	0.98 (0.68, 1.42)	2.30 (1.47, 3.60) ***	0.95 (0.52, 1.73)	3.24 (2.80, 3.76) ***	1.53 (1.31, 1.79) ***	2.68 (2.36, 3.04) ***	1.36 (1.18, 1.57) ***
Discriminatory attitude towards PLHIV								
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	0.65 (0.49, 0.87) **	1.06 (0.78, 1.43)	0.49 (0.32, 0.76) **	0.56 (0.36, 0.86) **	0.73 (0.64, 0.83) ***	0.95 (0.83, 1.09)	0.75 (0.67, 0.84) ***	0.93 (0.83, 1.05)
Age at first sexual intercourse								
Never had sex	0.11 (0.01, 0.88) *	0.13 (0.02, 1.05)	-	-!	-	-	0.15 (0.13, 0.18) ***	-^
<18	0.68 (0.03, 16.04)	0.91 (0.03, 29.90)	0.76 (0.49, 1.20)		0.41 (0.35, 0.48) ***	0.62 (0.53, 0.74) ***	0.43 (0.37, 0.50) ***	
18 - 20	0.18 (0.01, 3.57)	0.12 (0.01, 2.08)	0.87 (0.48, 1.58)		0.58 (0.49, 0.68) ***	0.74 (0.62, 0.88) **	0.60 (0.51, 0.70) ***	
20+	1.0 (ref)	1.0 (ref)	1.0 (ref)		1.0 (ref)	1.0 (ref)	1.0 (ref)	
Had an STI or STI symptoms in the past 12 months								
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	-!	1.0 (ref)	-!	1.0 (ref)	1.0 (ref)
Yes	9.93 (0.75, 131.66)	2.32 (0.01, 484.35)	1.49 (0.78, 2.86)		1.12 (0.90, 1.40)		1.67 (1.35, 2.06) ***	1.04 (0.83, 1.29)

Number of decisions in which women participate								
0	NA	NA	NA	NA	1.0 (ref)	1.0 (ref)	-#	-#
1 - 2	NA	NA	NA	NA	1.66 (1.24, 2.22) **	1.36 (1.00, 1.87)		
3	NA	NA	NA	NA	1.74 (1.30, 2.33) ***	1.41 (1.04, 1.93) *		
Disagreement over all the reasons for wife beating								
No	1.0 (ref)	-!	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	0.94 (0.71, 1.26)		1.33 (0.87, 2.03)	1.17 (0.73, 1.88)	1.20 (1.04, 1.38) *	1.02 (0.88, 1.19)	1.16 (1.03, 1.32) *	0.99 (0.87, 1.12)
Attitude towards negotiation for safer sex								
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes to any one question	1.69 (0.80, 3.58)	1.30 (0.61, 2.78)	1.40 (0.57, 3.44)	1.23 (0.46, 3.31)	2.12 (1.44, 3.10) ***	1.62 (1.14, 2.32) **	2.18 (1.64, 2.90) ***	1.54 (1.17, 2.02) **
Yes to both questions	3.18 (1.77, 5.69) ***	1.66 (0.89, 3.11)	2.39 (1.09, 5.24) *	1.89 (0.77, 4.67)	3.81 (2.64, 5.48) ***	2.12 (1.52, 2.95) ***	4.10 (3.06, 5.49) ***	2.03 (1.52, 2.70) ***

* p-value <0.05
** p-value <0.01
***p-value <0.001
Missing values were excluded from the multivariable analysis. Percentage of missing values of ¥ "variables" ranged from 0.02% to 0.35%.
NA means not available.
Note: Women who have never had sex were assumed not having STIs. Women who have never heard of AIDS were assumed not having discriminatory attitudes towards PLHIV.
! "variables" were not included in the multiple logistic regression models as p-value ≥0.20 in the bivariate analysis.
^ "age at first sexual intercourse" was dropped due to correlation with marital status.
# "Number of decisions in which women participate" was omitted because it was not available among never married and formerly married women.
The multivariable logistic regression models of never married and formerly women had P-value <0.05 in the goodness of fit test.

Discussion

Our study demonstrated that lifetime HIV testing uptake varied by the marital status. Currently married women and formerly married women had higher odds of having ever been tested for HIV than never married women. Many studies have found that married women were more likely to get tested for HIV (Lakhe, Diallo Mbaye, Sylla, & Ndour, 2019; Nigatu, Kabeta, Taye, & Belina, 2021; Takarinda et al., 2016). Women who are never married or living in union may consider themselves that they have lower risk of HIV acquisition. This low risk perception may result in low uptake of HIV testing among never married women. On the other hand, ever married women could be more likely to be tested for HIV during antenatal care visits or child births since Myanmar had increased coverage of the prevention of mother-to-child transmission of HIV (PMTCT) services (National AIDS Program, 2020a).

We found a gap in HIV testing among adolescent girls (15-19 years). This finding was in agreement with the research finding conducted in the Democratic Republic of Congo - younger women were significantly less likely to have taken HIV test (Walker, 2018). Adolescent girls and young women were disproportionately accounted for new HIV infections in 2017 (UNAIDS, 2019b). Getting necessary information for HIV and testing for HIV can enable them to start appropriate prevention, treatment, and care services for HIV. Youth friendly healthcare services for HIV were needed in Myanmar, and expansion of youth centers and development of adolescents and youth friendly healthcare services can increase their accessibility of HIV services (UNFPA Myanmar, 2013). Sexual and reproductive health training for high schools and university students and provision of counseling and HIV services tailored to youth can increase HIV testing uptake among young women (Department of Public Health, 2017).

Education is strongly associated with having tested for HIV among women (Pepito & Newton, 2020; Tenkorang & Owusu, 2010). Studies have shown that having a better education was positively correlated with voluntary counseling and testing uptake of HIV (Nigatu et al., 2021; Pepito & Newton, 2020). A higher level of education is a predictor of being tested for HIV among women in some African countries (Lakhe et al., 2019; Takarinda et al., 2016; Tenkorang & Owusu, 2010). Similar to these findings, the odds of ever being tested for HIV was higher among women with higher educational attainment in Myanmar.

Myanmar has included the National Life Skills Education curriculum covering reproductive health, HIV and STIs in secondary schools' curriculum since 2008 (UNAIDS, 2019a). Thus, girls who attended secondary schools had possibly received information about HIV. A national survey conducted in the United States reported that about 5 in 10 adults who did not complete high school had low health literacy (Kutner, Greenberg, Jin, & Paulsen, 2006). Education attainment may increase health literacy of individuals, which can enable them to make health-related decisions and access healthcare services. Therefore, health education programs for HIV should consider strategies tailored to women with low education and out of school women to increase their health literacy regarding HIV/AIDS, in addition to the effective implementation of the curriculum based Life Skills Education.

In the present study, the most common occupation of Myanmar women was manual labor. Types of occupation were reported as significant factors associated with HIV testing uptake in other studies conducted in Ethiopia and Cambodia (Nigatu et al., 2021; Toeng, 2021). Our result showed that unemployed women and employed women working in jobs other than professional jobs were less likely to get tested for HIV regardless of their marital status. Professional/technical/managerial jobs generally offer fair amount of salary, demand high

education level and possibly provide social protection for health. More job opportunities should be provided to empower women economically, which in turn may increase access to the needed healthcare services including HIV testing services.

Socioeconomic inequalities have impacted uptake of HIV testing despite scaling-up of testing (Ante-Testard et al., 2020). Odds of lifetime HIV testing was higher among women belonging to the relatively wealthier quintiles than those in the poorest quintile of wealth index. This could be the fact that women may need payments for transportation to reach an HIV testing center even though the testing is free of charge in Myanmar. Or they may need to use private vehicles, for example, motorcycles to reach the HIV testing centers in areas where no cheaper public transportation is available. Findings from 16 sub-Saharan African countries also found that the wealthiest women were more likely to report HIV testing uptake than the poorest women (Ante-Testard et al., 2020). Financial assistance such as cash transfers can increase utilization of important HIV prevention services such as voluntary testing and counselling of HIV (UNDP, 2017).

Place of residence can be considered as a proxy for access to available healthcare services, including HIV testing services. The present study reflects the geographical distribution of the population in Myanmar. Women residing in rural areas were found to have lower odds of HIV testing uptake (Gazimbi & Magadi, 2017). Unlike the result reported by Gazimbi & Magadi (2017), a study using the 2013 Philippines Demographic and Health Survey has reported that women living in a rural area were positively associated with ever been tested for HIV (Pepito & Newton, 2020). Our result agrees with Gazimbi & Magadi (2017) – lower likelihood of HIV testing uptake among rural women. Geographically spread out villages with poor transportation compounded by heavy workloads of primary healthcare providers may make not all needed

healthcare services readily available and accessible in rural areas, especially in remote areas. Decentralization of HIV testing services and task shifting of HIV screening test with trained lay providers using rapid diagnostics tests could be applied to increase accessibility of HIV testing services to rural women.

Regular exposure to any mass media (newspapers, magazines, radios, and televisions) was high among Myanmar women. Contrary to the other studies (D. Alemu, 2019; Nigatu et al., 2021; Pepito & Newton, 2020), we found that exposure to media was not a significant factor for HIV testing uptake. It was probably because HIV related information was not available in the media sources they exposed or was not absorbed by people. Or, the survey did not simply include the media sources used to distribute health messages about HIV/AIDS, for example, pamphlets, social media.

Knowledge of HIV informs people how to avoid getting infected with HIV. We found that comprehensive knowledge of HIV was found to be an independent correlate of lifetime HIV testing uptake among women and subsample of currently married women. Greater odds of lifetime HIV testing was seen among women having comprehensive knowledge of HIV. This finding was in agreement with a study conducted in Congo which reported that women with no HIV knowledge were significantly less likely to have taken HIV test (Walker, 2018). Women who are well informed with comprehensive knowledge of HIV may adopt appropriate health seeking behaviors such as getting tested based on their needs. Hence, sustained provision of health messages regarding HIV including benefits of getting tested for HIV should be provided through adolescent health, reproductive and maternal health services. Additionally, health messages should be developed in appropriate languages and disseminated via popular media to overcome language barriers and increase coverage of general population.

Negative attitudes towards people living with HIV are found to be associated with never being tested for HIV (Genberg et al., 2009). The present study found that a remarkable proportion of women with discriminatory attitudes towards PLHIV and lower HIV testing rate among formerly married women in Myanmar. HIV discrimination can hinder people living with HIV from getting tested for HIV. Implementation of HIV self-testing can allow women to screen HIV in private and increase universal coverage of HIV testing. Healthcare services should be provided without discrimination. Moreover, health education campaigns should include messages that emphasize reduction of stigma and discrimination against HIV/AIDS. Raising awareness for the elimination of discrimination against HIV among the general population is needed to create an enabling environment for PLHIV.

The result identified gap in HIV testing among currently married women with early sexual initiation (<20+ years of age). These findings may be due to the lack of comprehensive knowledge of HIV at a younger age and inequitable access to HIV services for youth. Importantly, currently married women who gave birth later could be tested for HIV as part of antenatal care or during delivery.

Co-infection with sexually transmitted infections (STIs) can increase the risk of getting infected with HIV. Clinicians generally pay attention to ordering laboratory tests for HIV in symptomatic STI patients. As a result, HIV testing rate can be higher among people with STIs. This study found that self-reported proportion of STIs or symptoms of STIs was very low among Myanmar women in general population. This could be the fact that in women compared to men, symptoms of common STDs are probably mistaken with normal discharge or a yeast infection (Centers for Disease Control and Prevention, 2011). A study by Detels et al (2011) showed that proportion of asymptomatic gonorrhoeae and chlamydia was similar and over 80% in both men

and women (Detels et al., 2011). Thus, diagnosis of STIs or symptoms of STIs may not be found as a significant predictor of HIV testing uptake in women in the general public. Furthermore, increased reporting of never had sex and skipping the questions inquiring history of STIs among women who reported no sexual exposure can also be another reason for low self-reported STIs prevalence among the respondents. This study did not find significant association between self-reported STIs or symptoms of STIs and having been tested for HIV among women in Myanmar. This finding is in contrast to the finding from Senegal where women with any STI in the last 12 months was independently associated with being tested for HIV (Lakhe et al., 2019).

Empowerment enables women to take control of their choices including decisions for their own healthcare and to reduce gaps in gender relations and power balance in a family. Although most Myanmar married women had high empowerment regarding participation in decision-making and gender relations, we did not find any link between HIV testing uptake and women's disagreement towards wife beating in Myanmar. A similar pattern was seen in the study with 33 sub-Saharan African countries (Yaya, Shibre, Idriss-Wheeler, & Uthman, 2020). However, we found that participation in all 3 decisions and positive attitude towards negotiation for safer sex played significant roles in HIV testing uptake among women of reproductive age in Myanmar. Thapa et.al (2019) aslo reported a similar association between positive attitude towards negotiation for safer sex with HIV testing (Thapa et al., 2019). Women who believe that women can negotiate for safer sex with husbands and who participate in decision making are noted as empowered and able to make their own choices including access to their needed healthcare services.

Limitations and strengths

We acknowledged that there were some limitations in this study. A cross-sectional survey did not allow us to make causal interpretation of the reported association due to lack of temporality. For instance, HIV test was taken before any changes to their HIV knowledge level. There might be reporting bias in recalling prior lifetime HIV testing. Social desirability bias can affect reporting of sexual debut and history of STIs. Lifetime HIV testing was predicted based on the factors that could change over time such as knowledge and attitudes, hence interpretations of the reported association should be made with caution. However, the results were based on a large and nationally representative sample of Myanmar women aged 15-49, thus the estimates were representative at national level. Use of the well-trained field staff and the modified questionnaires after pretest could reduce inaccuracies in the measurements. Sampling design and implementation addressed to prevent bias and application of the sampling weights allowed our results representative at the national level.

Conclusion

We conducted a secondary data analysis using the 2015-2016 Myanmar Demographic and Health Survey to identify factors associated with having ever been tested for HIV among women aged 15-49 years by their marital status in Myanmar. Overall, our study demonstrated disparity in HIV testing uptake among women aged 15-49 years in Myanmar in terms of socioeconomic and demographic characteristics, HIV knowledge and discrimination, participation in making decisions and attitude towards negotiation for safer sexual relation.

Since lack of comprehensive knowledge of HIV is one of the barriers to preventing people from getting tested for HIV, efforts should be made to promote knowledge of how to avoid

acquisition of HIV and the importance of HIV testing and to correct local misconceptions about transmission of HIV. Efforts should be made to explore any underlying reasons to eliminate discriminatory attitudes towards people living with HIV in Myanmar. Health education programs should target women especially young women to promote their HIV/AIDS literacy. Sustained dissemination of HIV/AIDS prevention and control messages highlighting the importance of HIV testing through popular mass media such as social media, television, and radio is also needed to raise awareness of HIV testing services and ways to prevent HIV transmission.

Making HIV testing services more accessible in rural areas is necessary. Decentralization makes HIV testing services more reachable to people living with HIV. Awareness should be raised about the availability of these testing centers in their areas. HIV self-testing with linkage to confirmatory testing should be implemented to provide options for women who were not reached by the existing services. Moreover, supportive measures should be made for the community to utilize the HIV testing service, for instance, cash rewards for getting tested and provision of other logistics supplies. HIV testing programs should focus more on youths because earlier sexual exposure may have higher possibility of getting HIV infection due to inadequate knowledge of HIV prevention and inequitable access to the services. Youth friendly HIV testing services should also be expanded. Furthermore, integration of PMTCT services and adolescents and reproductive health services could increase accessibility of HIV testing services to women of reproductive age, particularly young women.

Our study showed that HIV testing rates were higher among empowered women who had positive attitude for negotiation for safer sex and participated in decision-making. Thus, there are actions needed to empower women for their rights to control over their body and health but also to increase education and economic empowerment of women. Combination of these behavioral

and structural interventions can increase access to and uptake of HIV testing among women in Myanmar.

CHAPTER 3

Factors associated with HIV testing as part of antenatal care (ANC) among Myanmar pregnant women: Secondary data analysis using the 2015-16 Myanmar Demographic and Health Survey

Abstract

Background: Awareness of the HIV status of pregnant women as early as possible is critical to receive necessary prevention of mother-to-child transmission (PMTCT) services. Myanmar has prioritized the PMTCT program since early 2000 and scaled up the program for extensive geographical coverage. Provider-initiated counseling and testing (PICT) are offered routinely in ANC services. Myanmar is committing to eliminating mother-to-child transmission of HIV by 2025. Thus, HIV testing of pregnant women is crucial. This study examined factors associated with having an HIV test as part of ANC among pregnant women in Myanmar.

Methods: This study was a cross-sectional study using secondary data from the 2015-16 Myanmar Demographic and Health Survey. Inclusion criteria for this study were women who had given birth in the past 2 years and who received antenatal care (ANC). The outcome was to have an HIV test as part of ANC. A multivariable logistic regression model with sampling weights was applied to identify factors associated with HIV testing uptake during ANC.

Results: Nearly half of the respondents (47.1%) had an HIV test as part of ANC. The respondents with higher quintiles of wealth index, who had comprehensive knowledge of HIV, who had at least 4 ANC visits, and who received counseling on HIV during ANC were more likely to have an HIV test as part of ANC than those in the poorest quintile, who lacked comprehensive knowledge of HIV, who received < 4 ANC visits, and who did not receive counseling on HIV during ANC. The

respondents living in rural areas were less likely to have an HIV test as part of ANC than those living in urban areas [aOR = 0.53, (95% CI: 0.35, 0.82)].

Conclusion: Action is needed to increase HIV testing of pregnant women during ANC visits in rural areas. A financial assistant mechanism should be established to support pregnant women in poor households. Volunteer health workers should be recruited, trained, and supervised to deliver HIV testing services at the community level.

Introduction

Health services and ANC services in Myanmar

The Ministry of Health takes main responsibility to provide comprehensive healthcare services through primary healthcare approach, in collaboration with private sectors and international non-governmental organizations (INGOs), non-governmental organizations (NGOs) and community-based organizations (CBOs) to the rural and urban populations in Myanmar. Health Assistants, Lady Health Visitors (LHV), and midwives assigned at rural health centers and sub-rural health centers mainly deliver primary healthcare services to the rural community, 70% of the country's total population. Station/Township/District hospitals and Specialist hospitals and urban health centers at State and Regional levels provide healthcare services to the population in the catchment areas and referrals (Ministry of Health, 2014).

ANC is provided to all pregnant women through community-based and hospital-based care as part of the Maternal and Child Health (MCH) services. Pregnant women residing in rural areas may face difficulties in accessing appropriate antenatal care due to limited resources of healthcare services. However, due to the continuous efforts to improve the MCH services, antenatal care coverage was increased from 63.1% in 2005 to 82% in 2013 and 80% in 2015 in Myanmar

(Ministry of Health, 2014). According to the nationally representative household survey, 59% of pregnant women had at least four ANC visits, whereas 13% of pregnant women had no ANC visits. About 8 in 10 pregnant women received ANC with skilled providers – doctor, nurse, midwife, and LHV in Myanmar. Fifty-nine percent of pregnant women in urban areas received ANC by doctor while 60% of pregnant women in rural areas received ANC by nurse/midwife/LHV (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

HIV situation among adult females and pregnant women

According to the HIV estimates and projections from the AIDS Epidemic Model, HIV prevalence among adult female aged 15 years and above was 0.4%, and that of among female sex workers was 14.6% in 2015 in Myanmar. Low-risk women who are often spouses or regular partners of clients of sex workers contributed to 24% of new HIV infections, and female sex workers contributed to 8% of new HIV infections among key populations in 2015 (National AIDS Programme, 2017). According to the results from the 2013 round of HIV Sentinel Surveillance (HSS) carried out by the National AIDS Program (NAP), HIV prevalence among pregnant women attending antenatal clinics was 0.6% in Myanmar (National AIDS Programme, 2014). Based on the program data, HIV prevalence among pregnant women was around 0.52% in 2018 (National AIDS Program, 2018).

HIV testing services for pregnant women

The World Health Organization (WHO) promotes a comprehensive approach for prevention of mother-to-child transmission of HIV. The approach includes prevention of women of reproductive age from getting infected with HIV, prevention of unwanted pregnancy among

women living with HIV, prevention of HIV transmission from a woman living with HIV to her infant, and provision of appropriate treatment, care and support to mothers living with HIV and their children and families (WHO, 2010).

Without antiretroviral treatment (ART), the risk of transmission of HIV infection from an infected pregnant woman to her child ranges from 15% to 45% (WHO, 2018, as cited in Avert, n.d.-b). Thus, awareness of HIV serostatus as early as possible is critical to start the treatment to prevent vertical HIV transmission. The U.S. CDC recommendations for HIV testing of pregnant women include opt-out HIV testing for all pregnant women early in every pregnancy to know their HIV status and initiate treatment for prevention of HIV transmission to their infants (Centers for Disease Prevention and Control, n.d.).

Prevention of mother-to-child transmission (PMTCT) of HIV program offers an opportunity to provide HIV testing to all pregnant women. The National Strategic Plan for HIV/AIDS has prioritized the PMTCT program since early 2000 in Myanmar. Community-based and hospital-based PMTCT programs have been functioning since 2001 and the number of PMTCT sites has increased substantially. Major components of PMTCT program in Myanmar include pre-test counselling to all pregnant women receiving ANC, HIV testing, post-test counselling, encouraging spouses to be tested, providing those who are HIV positive with lifelong antiretroviral therapy as early as possible counselling for infant feeding options, pARV for exposed infants and follow-up infant testing. All these activities are provided together with routine ANC services. Pregnant women residing in urban areas can access the PMTCT services in urban health centers or primary-level hospitals or referral hospitals while those living in rural areas can access the services in rural and sub-rural health centers (San Hone, 2017).

The National AIDS Program has initiated decentralization of HIV counselling and testing with the aim of shifting laboratory technicians to basic healthcare workers across Myanmar since 2013 (National AIDS Programme, 2015a). HIV counselling and testing services have been integrated into routine ANC services provided by basic health staff. By the end of 2015, PMTCT programmes, with on-site HIV counselling and testing services for all pregnant women, included confirmatory testing and antiretroviral drugs provision for HIV-positive pregnant women were implemented in 301 townships and 38 hospitals in Myanmar (National AIDS Programme, 2017).

HIV testing is provided routinely unless it is refused (opt-out approach) in both health centers and hospitals (Maternal and Reproductive Health Division, 2018). Provider-initiated counseling and testing (PICT) are offered routinely in ANC services as part of facility-based HIV testing services (National AIDS Programme, 2019). As a result of the continuous efforts, coverage of PMTCT services has been increased over the years. HIV testing uptake among pregnant women attending ANC was gradually increased during 2013 – 2015. Based on the estimated number of pregnancies, 90% of pregnant women received pre-test counselling for HIV, 89% got tested and 88% received post-test counselling by the end of 2019 (National AIDS Program, 2020a).

Justification

HIV testing of pregnant women is integral not only to know their HIV status and subsequent HIV testing and prevention of HIV infection to their infants, but also getting to know HIV status of their sexual partners. Since HIV testing services for pregnant women are widely available through PMTCT program, utilization of the services by pregnant women is essential to achieve HIV testing coverage for pregnant women. In order to achieve the goal of elimination of

mother-to-child transmission of HIV by 2025 in Myanmar, HIV testing uptake of pregnant women is a key step. There may be many factors which potentially facilitate or impede HIV testing uptake of pregnant women. Understanding factors influencing the uptake of HIV testing among pregnant women will be useful for further scaling up of HIV testing services. Therefore, this study aimed to examine factors associated with HIV testing uptake among pregnant women using the 2015-16 Myanmar Demographic and Health Survey.

Specific aims

The specific aims of the proposed study are:

- To assess the proportion of pregnant women who tested for HIV during antenatal care in Myanmar; and
- To determine factors associated with HIV testing uptake during antenatal care among pregnant women in Myanmar.

Methods

Study design

The study was a cross-sectional study using secondary data from the 2015-16 MDHS.

Data source

Myanmar Demographic and Health Survey was conducted in 2015 -2016, which is the first and only nation-wide cross sectional households survey using a two-stage stratified sampling design. It was implemented by the Ministry of Health and Sports, Myanmar and funded by the United States Agency for International Development (USAID) and the Three Millennium Development Goal Fund (3MDG) (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). The data set is publicly available upon request from the Demographic and Health Program.

The primary sampling unit (PSU) in the Myanmar Demographic and Health Survey is based on either a census enumeration area or a ward or village tract in a sensitive area not enumerated during the 2014 census. Probability proportional to size was used to get the master sample with 4,000 PSUs. At the first stage, a total of 442 clusters (123 urban and 319 rural) were selected from the master sample. Field work could not conduct in one cluster due to the deteriorating security concern. At the second stage, equal probability systematic sampling was used to select a fixed number of 30 households from each of the selected clusters. All women aged 15-49 years from every selected household and all men aged 15-49 years from every second of the selected households who were either residents or visitors who stayed in the household the night before the survey were eligible to be interviewed (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

Data collection

After conducting pretest, comprehensive training of trainers and field staff and evaluation of field staff, data collection took place from 7 December 2015 to 7 July 2016. After getting voluntary informed consent, eligible women were interviewed by interviewers who were also trained to ensure privacy and check the presence of others before asking sensitive questions in the survey. Computer-assisted field editing (CAFE) procedures with tablet computers were used and data editing was done with CSPro software (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

Study population

The present analysis included all women aged 15-49 years in the general population who had last births in since January 2013 and who received antenatal care and completed the interviews in the 2015-2016 MDHS. There were 1669 women who gave birth in the 2 years preceding the

survey. Among them, 1479 women received antenatal care. Therefore, total weighted number of available women who met the criteria was 1,479.

Protection of human subjects

The protocol of the 2015-16 Myanmar Demographic and Health Survey was reviewed and approved by the ICF's Institutional Review Board and an Ethical Review Board in the host country. ICF IRB ensures that the survey complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46). The DHS program describes the details about protecting the privacy of DHS respondents on the DHS program website (ICF, n.d.-a). The present study used the publicly available data of the MDHS with no identifying information. The use of data in this analysis was also reviewed and approved by the Institutional Review Board of the University of California, Los Angeles.

Data analysis

The outcome of interest was HIV testing as part of ANC – were you tested for HIV as part of your ANC. The outcome was coded as binary outcome (yes/no).

Potential predictors related to socioeconomic and demographic characteristics were age in years (15 - 19, 20 - 24, 25 - 29, 30 - 39, 40 - 49), educational level (no education or primary, secondary, and higher), occupation (not working, agricultural, manual, non-manual, professional), wealth index (poorest, poorer, middle, richer, and richest quintiles) (ICF, n.d.-b), place of residence (urban/rural), and exposure to mass media (yes, no).

Potential predictors pertained to HIV related knowledge, attitudes towards people living with HIV (PLHIV), and behaviors were comprehensive knowledge about HIV (yes, no), knowledge of prevention of mother-to-child transmission (yes, no), discriminatory attitude towards PLHIV (yes, no), age at first sexual intercourse (never had sex, <18, 18 - 20, 20+), history

of an STI or STI symptoms in the past 12 months (yes, no), awareness of HIV testing services (yes, no). We also included information of ANC visits as potential predictors – having ANC <4 months of pregnancy (yes, no), having at least 4 ANC visits (yes, no), and counseling on HIV during antenatal care visits (yes, no).

There were two variables related to women's empowerment as potential predictors – attitude towards wife beating and negotiation for safer sex. Regarding attitude towards wife beating, we recoded the variable as binary based on the respondents' disagreement towards all five reasons in which a husband is justified in hitting or beating his wife (yes, no). Attitude towards negotiation for safer sex was constructed based on the questions asking whether women agree that a wife is justified to ask husband to use condom if she knows he has an STI, or in refusing to have sex with her husband if she knows he has sex with other women (no, yes to any one question, yes to both questions). The potential predictors of interest and how they were coded in the analysis were described in detail in Appendix 1.

We applied individual sampling weights provided in the 2015-16 MDHS dataset in our analysis to get nationally representative estimates. We used Stata's 'svyset' and 'svy' commands to correctly specify the effect of complex sampling design in the analysis. In the descriptive analysis, proportion of HIV testing as part of ANC with its 95% CI was calculated after applying the sampling weights. We summarized socioeconomic and demographic characteristics of respondents, HIV/AIDS related knowledge, attitude, and behavior, ANC visits and women's empowerment using frequency and percentages.

In the bivariate analysis, associations between each potential predictor and HIV testing as part of ANC of pregnant women were examined using Pearson chi-square test corrected for the survey design. Simple and multivariable logistic regression models using survey weights were

applied to identify individual-level factors associated with the odds of testing HIV as part of ANC among women who gave birth in the 2 years preceding the survey and who received antenatal care. Based on literature and bivariate analysis, we selected the predictors that have a bivariate association with having an HIV test as part of ANC at a p-value less than 0.20 to be included in the multivariable logistic regression model (David W. Hosmer et al., 2013; Herringa et al., 2010). Multicollinearity of independent variables in the survey data was assessed by calculating tolerance ($1\text{-}R^2$) and VIF (UCLA Statistical Consulting Group, 2021a). There was no multicollinearity among the independent variables. Awareness about HIV testing was omitted in the multivariable logistic regression model due to a perfect prediction failure. Model specification was assessed using "linktest" command (UCLA Statistical Consulting Group, 2021b). Model fitting was examined using goodness-of-fit tests for complex survey data (Herringa et al., 2010). We performed the analysis using STATA software (version Stata/SE 15.1).

Results

A total of 12,885 women aged 15-49 years old completed the survey interviews in the 2015-2016 Myanmar Demographic and Health Survey. Among them, there were 1,479 women who had last births in the 2 years preceding the survey and who had ANC visits.

Proportion of HIV testing uptake as part of antenatal care (ANC)

The proportion of having HIV test as part of ANC was calculated among women who had had given birth in the past 2 years and who received antenatal care during their pregnancy. Among 1479 respondents, almost half of the respondents (697) tested for HIV as part of ANC [47.14%, (95%CI: 43.74%, 50.56%)]. Among those who tested for HIV as part of ANC, almost all the respondents received the test result (89.32%).

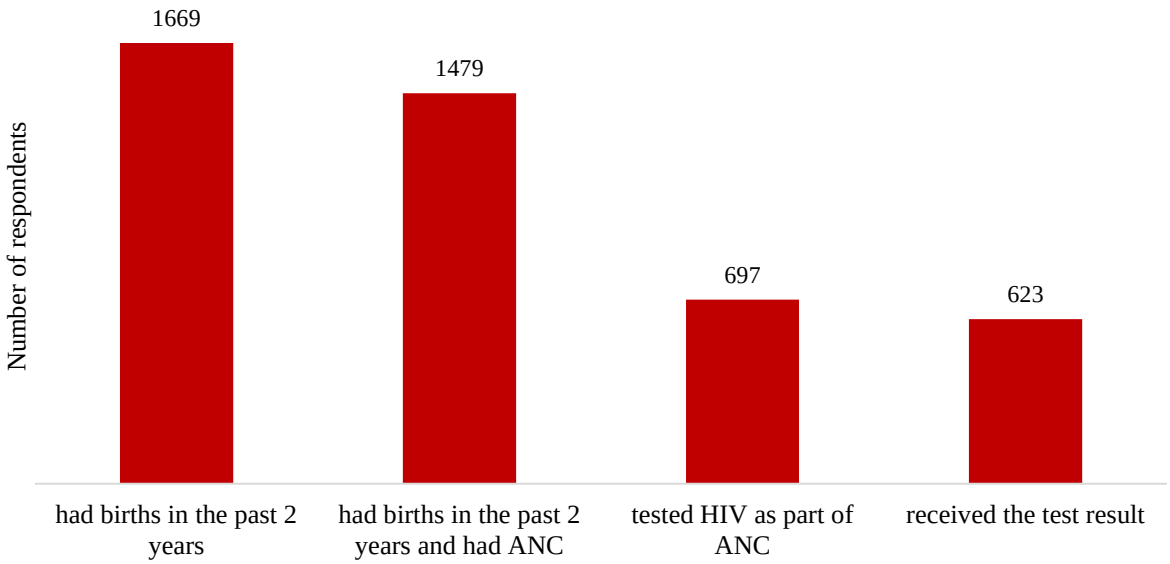

Figure 3-1 Number of pregnant women who had an HIV test as part of ANC and received the result

Characteristics of the respondents

The average age of women who had last births in 2013-2015 and received antenatal care was 29.2 ± 6.6 years, and 25.9% of the respondents were aged between 15 to 24 years old. Slightly over half of the respondents (55.8%) attained no education or primary level as their highest education followed by 34.6% of women with secondary level of education; however, only 9.7% of women reached higher education level. Less than half of women (43.6%) were unemployed and 25.7% of women worked as manual laborers including household and domestic services. There were only 3.5% of women worked in professional/technical/managerial jobs. About one-fifth of women (23.3%) were in the poorest quintile of wealth index, while 18.2% of women were in the richest one of wealth index. About seventy percent of women (72.9%) resided in rural areas. The majority of women (61.5%) reported that they either read newspapers/magazines or listened to radio or watched television at least once a week.

The majority of respondents (63.5%) knew that risk of getting HIV can be reduced by consistent use of condoms during sexual intercourse. Seventy three percent of women knew that having an uninfected faithful partner can reduce risk of getting HIV. Fifty nine percent of respondents were aware that a healthy-looking person can have HIV infection. Women did not have two common local misconceptions about HIV transmission or prevention – HIV can be transmitted by mosquito bites (37.7%) and sharing food with a person who has HIV (55.0%). Overall, 18.8% of women had comprehensive knowledge of HIV. About half of women (47.9%) had knowledge for prevention of mother-to-child transmission – they knew that HIV can be transmitted from mother to child during pregnancy, during delivery, and by breastfeeding; and the risk of mother-to-child transmission can be reduced by the mother taking special drugs. Sixty percent of women had discriminatory attitude towards PLHIV where the respondents indicated that they would not buy fresh vegetables from a vendor who has HIV. Only 7.2% of women had an STI or reported any symptoms of STI in the past 12 months. Nearly half of the respondents (45.6%) had their sexual debut after 20 years of age. A quarter of the respondents (25.4%) said that they did not know places for HIV testing in Myanmar.

Two-thirds of respondents (66.2%) received at least four ANC visits for their last births. Less than half of respondents (43.7%) received ANC within the first trimester of gestation. More than 3 in 10 women (38.6%) received counseling on HIV during their ANC visits[2].

Half of the respondents reported that all five specified reasons for wife beating by a husband (going out without telling him, neglecting the children, arguing with him, refusing to have sexual intercourse, and burning the food) are not justifiable. Seventy four percent of the respondents believed that a woman is justified in refusing to have sexual intercourse with her

[2] Counseling on HIV during ANC visits means that the respondents were given information about all three topics: 1) babies getting HIV from their mother, 2) preventing HIV, and 3) getting tested for HIV (Croft, 2018).

husband if she knows he has sex with other women and in asking him to use a condom if she knows he has an STI.

Table 3-1 Sociodemographic and economic characteristics, HIV related knowledge, attitudes toward PLHIV, and behaviors, Women's empowerment

Variables	No.	%
Socio-economic and demographic characteristics		
Age in years		
15 - 19	60	4.0
20 - 24	324	21.9
25 - 29	418	28.3
30 - 39	588	39.7
40 - 49	89	6.1
Total	1,479	100
Highest educational level		
No education or primary	825	55.8
Secondary	511	34.6
Higher	143	9.7
Total	1,479	100
Occupation		
Not working	643	43.6
Agricultural	160	10.8
Manual	379	25.7
Non-manual	242	16.4
Professional	52	3.5
Total	1,476	100
Wealth index		
Poorest	344	23.3
Poorer	320	21.6
Middle	261	17.6
Richer	284	19.2
Richest	270	18.2
Total	1,479	100
Place of residence		
Urban	401	27.1
Rural	1,078	72.9
Total	1,479	100
Exposure to any mass media at least once a week		
No	569	38.5
Yes	910	61.5
Total	1,479	100
HIV related knowledge, attitude, and behaviors		
Comprehensive knowledge of HIV		

No	1,201	81.2
Yes	278	18.8
Total	1,479	100
Knowledge of prevention of mother-to-child transmission		
No	771	52.1
Yes	708	47.9
Total	1,479	100
Discriminatory attitude towards PLHIV		
No	591	40.0
Yes	888	60.0
Total	1,479	100
Had an STI or STI symptoms in the past 12 months		
No	1,373	92.8
Yes	106	7.2
Total	1,479	100
Age at first sexual intercourse		
<18	486	32.9
18 – 20	318	21.5
20+	675	45.6
Total	1,478	100
Awareness of HIV testing services		
No	375	25.4
Yes	1,104	74.6
Total	1,479	100
Antenatal care (ANC)		
Had 4+ ANC visits		
No	500	33.8
Yes	979	66.2
Total	1,479	100
Attended ANC <4 months of pregnancy		
No	833	56.3
Yes	646	43.7
Total	1,479	100
Counseling on HIV during ANC		
No	908	61.4
Yes	571	38.6
Total	1,479	100
Women's empowerment		
Disagreement over all of the reasons for wife beating		
No	733	49.6
Yes	746	50.4
Total	1,479	100
Attitude toward negotiation for safer sex		
No	120	8.1

Yes to any one question	263	17.8
Yes to both questions	1,096	74.1
Total	1,479	100

No. (%) are weighted numbers and percentages.
Missing values were excluded.

Associations between HIV testing as part of ANC and independent variables

Except for history of STI or symptoms of STI in the past 12 months and discriminatory attitude towards PLHIV, all independent variables of interest regarding socioeconomic and demographic characteristics, HIV related knowledge and behavior, ANC visits and women's empowerment were statistically significantly associated with HIV testing as part of ANC among women who gave births in the past 2 years and who had antenatal care visit(s) (P-values < 0.05) as shown in Table 3-2.

Table 3-2 Bivariate analysis of HIV testing as part of ANC by the independent variables

Variables	HIV testing as part of ANC			
	No	Yes	Total	P-value
	n (%)	n (%)	n (%)	
Age in years				
15 - 19	46 (77.4)	13 (22.6)	59 (100.0)	0.0001
20 - 24	196 (60.5)	128 (39.5)	324 (100.0)	
25 - 29	210 (50.3)	208 (49.7)	418 (100.0)	
30 - 39	279 (47.5)	308 (52.5)	587 (100.0)	
40 - 49	50 (56.2)	39 (43.8)	89 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Highest educational level				
No education or primary	516 (62.6)	309 (37.4)	825 (100.0)	<0.001

Secondary	236 (46.1)	276 (53.9)	511 (100.0)	
Higher	30 (20.9)	113 (79.1)	143 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Occupation				
Not working	321 (49.9)	323 (50.1)	644 (100.0)	0.0029
Agricultural	110 (68.9)	50 (31.1)	160 (100.0)	
Manual	216 (57.2)	162 (42.8)	379 (100.0)	
Non-manual	108 (44.7)	134 (55.3)	242 (100.0)	
Professional	25 (47.6)	27 (52.4)	52 (100.0)	
Total	782 (52.9)	695 (47.1)	1,476 (100.0)	
Wealth index				
Poorest	245 (71.1)	100 (28.9)	344 (100.0)	<0.001
Poorer	183 (57.1)	137 (42.9)	320 (100.0)	
Middle	144 (55.2)	117 (44.8)	261 (100.0)	
Richer	130 (45.7)	154 (54.3)	284 (100.0)	
Richest	80 (29.8)	189 (70.2)	270 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Place of residence				
Urban	122 (30.3)	279 (69.7)	401 (100.0)	<0.001
Rural	660 (61.2)	418 (38.8)	1,078 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Exposure to any mass media at least once a week				
No	356 (62.6)	213 (37.4)	569 (100.0)	<0.001
Yes	426 (46.8)	485 (53.2)	910 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Comprehensive knowledge of HIV				
No	702 (58.4)	500 (41.6)	1,201 (100.0)	<0.001
Yes	80 (28.9)	197 (71.1)	278 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	

Knowledge of prevention of mother-to-child transmission				
No	457 (59.2)	314 (40.8)	771 (100.0)	<0.001
Yes	325 (45.9)	383 (54.1)	708 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Discriminatory attitude towards PLHIV				
No	302 (51.0)	289 (49.0)	591 (100.0)	0.3317
Yes	480 (54.1)	408 (45.9)	888 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Had a STI or STI symptoms in the past 12 months				
No	716 (52.2)	656 (47.8)	1,372 (100.0)	0.1004
Yes	65 (61.4)	41 (38.6)	106 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Age at first sexual intercourse				
<18	308 (63.3)	178 (36.7)	486 (100.0)	<0.001
18 - 20	183 (57.7)	134 (42.3)	317 (100.0)	
20+	290 (43.0)	385 (57.0)	675 (100.0)	
Total	781 (52.9)	697 (47.1)	1,478 (100.0)	
Had 4+ ANC visits				
No	366 (73.3)	134 (26.7)	500 (100.0)	<0.001
Yes	415 (42.4)	563 (57.6)	979 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Attended ANC <4 months of pregnancy				
No	480 (57.6)	353 (42.4)	833 (100.0)	0.0003
Yes	302 (46.8)	344 (53.2)	646 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Counseling on HIV during ANC				
No	626 (68.9)	282 (31.1)	908 (100.0)	<0.001
Yes	156 (27.3)	415 (72.7)	571 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	

Disagreement over all reasons for wife beating				
No	421 (57.4)	312 (42.6)	733 (100.0)	0.0031
Yes	361 (48.4)	385 (51.6)	746 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	
Attitude towards negotiation for safer sex				
No	88 (73.7)	31 (26.3)	120 (100.0)	<0.001
Yes to any one questions	159 (60.3)	104 (39.7)	263 (100.0)	
Yes to both questions	535 (48.8)	561 (51.2)	1,096 (100.0)	
Total	782 (52.9)	697 (47.1)	1,479 (100.0)	

n (%) are weighted number and percent.
P-values are based on the Pearson chi-square tests corrected for the survey design.
Missing values were excluded from the analysis.

Factors associated with HIV testing as part of ANC among pregnant women

The respondents in the higher wealth quintiles had greater odds of having an HIV test as part of ANC compared to those in the poorest quintile. The respondents living in rural areas had lower odds of having an HIV test as part of ANC compared to those living in urban areas [aOR = 0.53, (95% CI: 0.35, 0.82)]. We did not find statistically significant associations between age, education, occupation, regular exposure to mass media and uptake of an HIV test as part of ANC as shown in Table 3-3.

The respondents who had comprehensive knowledge of HIV were more likely to be tested for HIV during their antenatal care visits compared to those who did not have it [aOR = 1.70, (95% CI: 1.16, 2.50)]. Nevertheless, having knowledge of prevention of mother-to-child transmission of HIV was not independently associated with being tested for HIV as part of ANC. Pregnant women who visited ANC at least four times were highly likely to get tested for HIV as part of

ANC than those who received fewer than 4 ANC visits [aOR = 2.06, (95% CI: 1.54, 2.75)]. Pregnant women who received counseling on HIV during ANC had greater odds of getting tested for HIV as part of ANC compared to those who did not receive counseling on HIV [aOR = 5.37, (95% CI: 3.95, 7.30)].

We did not find significant independent associations between self-reported history of an STI or symptoms of STIs, age at the first sexual encounter, women's empowerment variables and the uptake of HIV testing as part of ANC among the respondents.

Table 3-3 Simple and multivariable logistic regression analysis for HIV testing as part of ANC among pregnant women, the 2015-16 MDHS

Variables	HIV testing as part of ANC	
	OR (95%CI)	aOR (95%CI)
Age in years		
15 - 19	0.37 (0.17, 0.85) *	0.56 (0.21, 1.51)
20 - 24	0.84 (0.50, 1.42)	1.01 (0.51, 2.01)
25 - 29	1.27 (0.76, 2.13)	1.13 (0.58, 2.18)
30 - 39	1.42 (0.86, 2.33)	1.21 (0.62, 2.39)
40 - 49	1.0 (ref)	1.0 (ref)
Highest educational level		
No education or primary	1.0 (ref)	1.0 (ref)
Secondary	1.96 (1.48, 2.59) ***	1.14 (0.79, 1.64)
Higher	6.32 (3.81, 10.49) ***	1.86 (0.94, 3.65)
Occupation[¥]		
Professional	1.0 (ref)	1.0 (ref)
Agricultural	0.41 (0.18, 0.93) *	0.70 (0.28, 1.76)
Manual	0.68 (0.33, 1.41)	1.03 (0.44, 2.44)
Non-manual	1.13 (0.54, 2.34)	0.77 (0.33, 1.77)

Not working	0.91 (0.46, 1.81)	0.95 (0.43, 2.11)
Wealth index		
Poorest	1.0 (ref)	1.0 (ref)
Poorer	1.84 (1.29, 2.64) **	1.71 (1.12, 2.62) *
Middle	1.99 (1.40, 2.83) ***	1.54 (1.00, 2.37) *
Richer	2.91 (1.95, 4.34) ***	1.73 (1.10, 2.72) *
Richest	5.77 (3.75, 8.88) ***	2.10 (1.15, 3.82) *
Place of residence		
Rural	0.28 (0.19, 0.39) ***	0.53 (0.35, 0.82) **
Urban	1.0 (ref)	1.0 (ref)
Exposure to any mass media at least once a week		
No	1.0 (ref)	1.0 (ref)
Yes	1.91 (1.45, 2.52) ***	0.81 (0.58, 1.14)
Comprehensive knowledge of HIV		
No	1.0 (ref)	1.0 (ref)
Yes	3.46 (2.48, 4.83) ***	1.70 (1.16, 2.50) **
Knowledge of prevention of mother-to-child transmission		
No	1.0 (ref)	1.0 (ref)
Yes	1.71 (1.33, 2.20) ***	1.12 (0.83, 1.53)
Discriminatory attitude towards PLHIV		
No	1.0 (ref)	-!
Yes	0.89 (0.69, 1.13)	
Had a STI or STI symptoms in the past 12 months		
No	1.0 (ref)	1.0 (ref)
Yes	0.69 (0.44, 1.08)	0.98 (0.55, 1.75)
Age at first sexual intercourse[¥]		
<18	0.44 (0.33, 0.58) ***	0.82 (0.59, 1.14)
18-20	0.55 (0.40, 0.77) **	0.77 (0.52, 1.14)
20+	1.0 (ref)	1.0 (ref)

Had 4+ ANC visits		
No	1.0 (ref)	1.0 (ref)
Yes	3.72 (2.84, 4.87) ***	2.06 (1.54, 2.75) ***
Attended ANC <4 months of pregnancy		
No	1.0 (ref)	1.0 (ref)
Yes	1.55 (1.22, 1.96) ***	1.32 (0.98, 1.78)
Counseling on HIV during ANC		
No	1.0 (ref)	1.0 (ref)
Yes	5.90 (4.49, 7.76) ***	5.37 (3.95, 7.30) ***
Disagreement over all the reasons for wife beating		
No	1.0 (ref)	1.0 (ref)
Yes	1.44 (1.13, 1.83) **	1.29 (0.98, 1.72)
Attitude towards negotiation for safer sex		
No	1.0 (ref)	1.0 (ref)
Yes to any one question	1.84 (1.10, 3.08) *	1.46 (0.83, 2.57)
Yes to both questions	2.93 (1.85, 4.66) ***	1.33 (0.80, 2.20)

* p-value <0.05
** p-value <0.01
***p-value <0.001
! "variable" was not included in the multivariable logistic regression model as p-value ≥0.20 in the bivariate analysis.
Missing values were excluded from the multivariable analysis. Missing data of ¥ "variables" ranged from 0.06% to 0.12%.
Note: Women who have never had sex were assumed not having STIs. Women who have never heard of AIDS were assumed not having discriminatory attitudes towards PLHIV.

Discussion

Nearly half of pregnant women tested for HIV as part of ANC in Myanmar. Compared to Cambodia, and sub-Sharan African countries, the testing rate was relatively lower in Myanmar (Gunn et al., 2016; Toeng, 2021). According to the National AIDS Program data, 87 % of pregnant women who attended ANC and pre-test counselling got tested for HIV in 2015 in Myanmar (National AIDS Programme, 2015a). The difference could be explained by HIV prevalence among pregnant women, ANC coverage, effectiveness of PMTCT services, and source of data. Additionally, our estimate was based on the interviewer administered and self-reported HIV testing uptake, thus it can be underestimated by the participants' recall for prior HIV testing in the past 2 years and social desirability issue. This study only included pregnant women who attended ANC visits. Pregnant women who did not had ANC visits were different from ANC attendees in terms of the potential predictors and they did not test for an HIV as part of ANC.

Our study identified lower rate of HIV testing during ANC among pregnant women in the poorest wealth quintile, living in rural areas, those with lack of comprehensive knowledge of HIV, and who did not receive pre-test HIV counseling in Myanmar.

The wealth index is an important predictor for HIV testing uptake among pregnant women (Gunn et al., 2016; Toeng, 2021; Worku, Teshale, & Tesema, 2021). Women in the poorest quintile of wealth index had the lower HIV testing uptake than women in the higher quintiles. According to the 2017 Myanmar Living Conditions Survey, it was estimated that one-fourth of the Myanmar people were living at or below the poverty line (The World Bank Group, 2019). Additionally, out of pocket payment was about 70% of total health expenditure in 2015 in Myanmar (WHO, n.d.). Thus, household wealth is often the main resource to pay expenses of healthcare services for family members with no health insurance coverage.

Although HIV testing is free of charge in Myanmar, there are still other costs incurred by pregnant women for accessing antenatal care services, for example, transportation charges, costs of other diagnostic tests, loss of daily wages for time spent for visiting ANC services. Consequently, pregnant women may have challenges to receive ANC as recommended – at least 4 ANC visits. Furthermore, the nationwide household survey suggested that the richest are more likely to receive ANC from the skilled providers than the poorest (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). There should be a financial aid scheme to support pregnant women to attend the recommended ANC visits, so that they can get tested for HIV during ANC visits.

We observed that there was a gap between HIV testing uptake of pregnant women residing in rural areas and that of in urban areas in Myanmar. Similar to our finding, a study conducted in Mozambique also found that pregnant women from rural areas in Mozambique were less likely to receive an HIV test during antenatal care visits than those in urban areas (Yaya, Oladimeji, Oladimeji, & Bishwajit, 2019). Lower testing rates in rural areas could be explained by many reasons.

It is critical to receive ANC services to initiate HIV testing services during pregnancy. Women in rural areas had low ANC utilization rate than those in urban areas (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). Although point-of-care HIV testing for all antenatal care attendees as part of decentralization process was initiated in 2013 in Myanmar, long travel times and costs for rural residents and increased workloads of providers in the rural settings were main challenges during the initial decentralization of HIV testing for prevention of mother to child transmission of HIV (S. Hone, Li, Lee, Comulada, & Detels, 2019). HIV testing services had limited availability and accessibility for pregnant women in Myanmar rural areas during 2013-2015.

In rural settings, antenatal care services are mainly provided by midwives who are also responsible for immunization and other diseases control activities in Myanmar due to the scarcity of human resources for health. They are also main service providers of HIV screening to pregnant women at the community level. Due to excessive workloads, they may face challenges to provide ANC services for pregnant women especially in rural remote areas. Health education or pre-test information for HIV can be provided by trained local volunteers or peers. As recommended by the WHO, trained lay providers in screening of HIV using rapid diagnostic tests will share tasks of busy healthcare providers especially in the limited manpower setting. They can also be trained to provide all HIV testing services ranging from pre-test information and HIV screening using rapid diagnostic test kits to supporting in linkage to prevention, treatment and care services (WHO, 2021a). Outreach ANC and HIV screening activities delivered by professional healthcare providers and trained lay providers together can make the services accessible to pregnant women in hard-to-reach areas.

The present study demonstrated that having comprehensive knowledge of HIV enabled women to get tested for HIV as part of ANC in Myanmar. Similarly, other studies done in Kenya and East African countries have reported that higher and comprehensive knowledge of HIV among pregnant women is associated with increased likelihood of HIV testing during ANC (Haider, Kingori, & Gebre, 2021; Worku et al., 2021). To promote voluntary acceptance of HIV testing among pregnant women, effective health education programs about HIV/AIDS should be provided in a sustainable manner. Providing comprehensive knowledge of HIV and correcting misconceptions about HIV/AIDS can empower pregnant women for getting an HIV test. In addition to integration with ANC services, HIV/AIDS health education program should be

integrated with reproductive health education program in schools and universities to reach adolescents and young women.

In addition to knowledge of HIV transmission, knowing how to prevent vertical transmission of HIV infection can facilitate pregnant women to get tested for HIV during antenatal period. However, we found that it was not a significant predictor for having an HIV test as part of ANC among women who had given birth in the past 2 years and who received ANC. It is possible that knowing how to prevent mother-to-child transmission alone may not be enough to get tested for HIV. And pregnant women can opt out of an HIV test. This finding is in agreement with the finding based on the 2014 Cambodia Demographic and Health Survey (Toeng, 2021). In contrast, a study conducted in northern Ethiopia showed that pregnant women with comprehensive knowledge of mother-to-child transmission of HIV were more likely to get tested for HIV (Y. M. Alemu, Ambaw, & Wilder-Smith, 2017).

Our result demonstrated that the odds of getting tested for HIV as part of ANC was higher among pregnant women who received at least 4 ANC visits. Attending recommended ANC visits is very important for pregnant women to have good maternal and child health outcomes. Frequent antenatal care visits also allow healthcare providers to deliver health messages related to prevention of mother-to-child transmission of diseases including HIV and STI, HIV testing services, and appropriate prevention, treatment, and care services. Importantly, HIV testing should be offered to all pregnant women during their first ANC visit to increase the coverage of HIV testing of pregnant women.

Evidence supports that voluntary HIV testing uptake of ANC attendees can be increased by PICT (Hensen et al., 2012). Pre-test counselling of HIV is an important step for prevention of mother-to-child transmission of HIV and equips pregnant women with information about HIV and

PMTCT. Low awareness of the benefits of PMTCT services among pregnant women has challenged the initial decentralization of HIV testing for PMTCT in Myanmar (S. Hone et al., 2019). We also found that pregnant women who received information about vertical transmission of HIV and ways to prevent the transmission during their ANC visits were more likely to get tested for HIV as part of ANC compared to those who did not receive HIV counseling during the visits. Toeng (2021) also found that pregnant women who received adequate pre-test counseling had higher odds of being tested for HIV as part of ANC in Cambodia. A similar result was reported in Kenya (Haider et al., 2021).

Our result also highlighted that women who were given information about vertical transmission of HIV and ways to prevent acquisition of HIV facilitate them to get tested for HIV during ANC. The result showed that not all antenatal care attendees reported receiving HIV counseling. Pre-test information for HIV should be provided to all pregnant women attending antenatal care visits. Myanmar has a diversity of languages depending on ethnicity, therefore, the use of appropriate local languages is fundamental to communicate with ANC attendees effectively in disseminating health messages and counseling of HIV.

Limitations and strengths

There are some limitations to be noted in this study. Although privacy was prioritized for interviewing sensitive questions during the interviews and HIV test results were not asked, the study findings might still be affected by social desirability bias, especially in reporting history STIs and sexual behavior. It was likely to have reporting bias because prior HIV testing in the past 2 years was a self-reported measurement and poor recall of what information was given during ANC. The survey was a cross-sectional in nature which lack the temporal sequences of the predictors

and the outcome. HIV testing uptake as part of ANC in the past 2 years was predicted from some of the variables could change over time, thus caution should be made on interpretation of the reported associations. Despite having these limitations, the sampling design and implementation ensured the findings were nationally representative and prevented selection bias. Furthermore, well-developed and reviewed DHS questionnaires could reduce measurement errors.

Conclusion

Our study underscored a necessity for scaling up HIV testing for pregnant women during their ANC visits in rural settings and for establishing mechanisms for financial assistance to the poor pregnant women. Implementation of HIV testing services by trained lay providers could increase the accessibility of the services to pregnant women in the rural community. Volunteer health workers should be recruited, trained, and supervised to deliver HTS at community level and to support linkage to prevention, treatment, and care services. Together with use of trained lay providers in delivering HTS, financial assistance mechanisms, for example, cash transfers program could promote accessibility of ANC services and HTS. Consequently, it can increase prenatal HIV testing coverage of pregnant women.

There is also action needed to encourage ANC providers to provide information regarding HIV, mother-to-child transmission of HIV, and importance of getting tested for HIV as early as possible to all pregnant women during their ANC visits. Our study provided evidence that counseling on HIV during ANC is a significant predictor for having an HIV test as part of ANC. Well-informed pre-test information could empower ANC attendees to accept HIV testing. Raising awareness about HIV/AIDS, advantages of PMTCT and utilization of ANC services by the trained local volunteers could reduce extreme workloads carried out by professional healthcare providers.

Regular training and refresher courses for HIV testing services to all ANC providers and local volunteers should be provided. Moreover, monitoring of HIV testing services should be done to ensure the services are provided according to the guideline. Close collaboration with healthcare providers from private hospitals and clinics should be carried out to deliver HIV testing services according to the guideline.

Myanmar is pledging to eliminate mother-to-child transmission of HIV and syphilis in the National Strategic Plan for HIV/AIDS (2021-2025) (National AIDS Program, 2020b). Given the extensive geographical coverage of the PMTCT services, a combination of structural and behavioral interventions is absolutely essential to achieve more than 95% of pregnant women who know their HIV status. More research is also needed to explore what deters pregnant women from getting tested for HIV specifically in rural areas, from the viewpoints of all stakeholders.

CHAPTER 4

Factors associated with lifetime HIV testing among women in 4 Southeast Asian countries: Further analysis of the Demographic and Health Surveys

Abstract

Background: The Southeast Asia region has the second-highest number of people living with HIV after the African region. Although many countries in the Southeast Asia region have been trying to increase HIV testing coverage, many people living with HIV do not know their HIV status in the early stage of infection. This study compared proportions of lifetime HIV testing uptake among women aged 15-49 years and identified associated factors in four selected Southeast Asian countries – Myanmar, Cambodia, the Philippines, and Timor-Leste.

Methods: This study was a cross-sectional study using secondary data from the 2015-16 Myanmar Demographic and Health Survey, the 2014 Cambodia Demographic and Health Survey, the 2017 Philippines National Demographic and Health Survey, and the 2016 Timor-Leste Demographic and Health Survey. All women aged 15-49 years who completed the surveys were included in the analysis. The outcome of interest was lifetime HIV testing uptake. We conducted multivariable logistic regression analysis for lifetime HIV in each country and ran a fixed effects multiple logistic regression model for the pooled sample.

Results: The proportions of lifetime HIV testing uptake among women aged 15-49 years were 42.1% in Cambodia, 19.5% in Myanmar, 4.6% in the Philippines, and 3.7% in Timor-Leste. The proportions were significantly different. Marital status, education level, wealth index, and comprehensive knowledge of HIV were significant factors associated with lifetime HIV testing uptake among women in all four countries. Women living in rural areas were less likely to have ever been tested for HIV than those residing in urban areas in all countries, except Timor-Leste.

Adolescent girls were less likely to get tested for HIV than women aged 40-49 years in Myanmar, whereas adolescent girls were more likely to get tested than women aged 40-49 years in Cambodia. The likelihood of lifetime HIV testing uptake was high among women who had a positive attitude towards negotiating safer sexual relations with husbands in Myanmar and Cambodia.

Conclusion: A multisectoral collaboration of related sectors and organizations is necessary to uplift the socio-economic status of women to overcome the barriers to HIV testing. Health education programs for HIV should reach women and youth who did not attain secondary and higher education. It is critical to make HIV testing services available and accessible to women in rural areas.

Introduction

HIV epidemic in the Southeast Asia Region

Approximately 1 in 10 people living with HIV (PLHIV) globally were from the Southeast Asia region in 2015. There was an estimated 3.5 million people living with HIV in the region, nearly 39% of whom are women and girls (WHO, 2016b). HIV prevalence among adults aged 15-49 years in the region was 0.3% and percentage of PLHIV who know their status ranged from 26% to 89% in 2015. The HIV epidemic is diverse among countries of the region (Pendse, Gupta, Yu, & Sarkar, 2016). Myanmar is one of the five high-burden countries in the region (WHO, 2016b).

HIV epidemic and HIV testing services in Myanmar

The Southeast Asian country, Myanmar, had 52 million people in 2015, with 29.7% residing in urban areas (Worldometer, 2021b). Myanmar has one of the highest HIV prevalence in the Asia-Pacific region in key geographic areas (National AIDS Programme, 2017). In the

Southeast Asia region, Myanmar has the second highest number of people living with HIV (Avert, n.d.-a). The first case of HIV was reported in 1988. The HIV epidemic has been declining steadily since 2000 (National AIDS Programme, 2015a). HIV prevalence among adults aged 15-49 years is 0.8% in 2018. The estimated number of people living with HIV is 240,000 and the number of women age 15 years and above living with HIV was 87,000 in 2018 in Myanmar (WHO, 2019c). Regarding progress towards 90-90-90 targets, 87 % of people living with HV knew their status; 89% of people who know their status were on ART; and 94% of people who are on ART achieved viral suppression in 2019 in Myanmar (H. N. Oo, 2020). Thus, 72.8% percent of HIV-infected had achieved viral suppression.

The national response to HIV/AIDS epidemic is guided by a series of 5 years period long National Strategic Plan on HIV and AIDS based on the evolving epidemic. The National Strategic Plans for HIV/AIDS set priority to scale up quality HIV testing services. Myanmar delivers HIV testing services (HTS) in 3 main approaches – facility-based HIV testing services, community-based HIV testing services, and HIV self-testing. Provider-initiated testing and counseling (PICT) are offered in health facilities such as ANC, TB clinics, STI clinics, hepatitis clinics, harm reduction services for PWID, ART centers/DC ART sites and hospitals. Community-based HIV testing services are provided through outreach or mobile HTS at bars and clubs, cruising sites, mines and factories(National AIDS Programme, 2019). Although HIV self-testing has been recently included in the national policy, only pilot projects have been implemented (UNAIDS & WHO, 2018). PICT is offered routinely in ANC services as part of facility-based HIV testing services (National AIDS Programme, 2019). HIV testing for pregnant women was performed by trained lab technicians at health facility laboratories until 2012. Point-of-care (POC) testing approach was launched for the PMTCT program in late 2013 (S. Hone et al., 2019).

HIV epidemic and HIV testing services in Cambodia

Cambodia had a population of 15,521,436, with 22.2% living in urban areas in 2015 (Worldometer, 2021a). The first HIV cases were detected in Cambodia in 1991. Since then, HIV has spread rapidly in Cambodia. The main mode of transmission of HIV is sexual transmission (WHO & NCHADS - Ministry of Health, 2001). Because of high coverage of antiretroviral treatment and HIV prevention programmes, HIV prevalence among the general population aged 15-49 has been decreasing in Cambodia since 1998. The number of new HIV infections among females aged 15+ and total adults has been decreasing since 2000, and the AIDS-related mortality among total adults and females aged 15+ has also declined since 2003 (The National AIDS Authority, 2015). HIV prevalence among adults aged 15-49 years was 0.5% in 2018. The estimated number of people living with HIV was 73,000 and 37,000 were women age 15 and above living with HIV in 2018 (WHO, 2019a). Regarding the 90-90-90 progress towards 2020 targets in 2019 in Cambodia, 82% (73-90) of people living with HIV knew their status; >98% (89->98) of people who know their status were on ART; 97% (86->98) of people on ART achieved viral suppression (UNAIDS, 2020a).

According to the national HIV testing services guideline, Cambodia provides HIV testing and counseling through different approaches – health provider-initiated testing and counseling at health facilities; community-based HIV testing services through mobile outreach campaigns during special events, testing at workplaces, testing in places of worship and entertainment establishments; strategic mixed approaches of HIV testing services (facility-based HTS and community-based HTS); and HIV self-testing (NCHADS, 2017). All pregnant women can receive HIV testing services through both facility-based and community-based HTS. Cambodia was piloted and adopted the “Linked Response” approach in 2008 to strengthen linkage of reproductive

health services and HIV services including PMTCT services by improving referral system between facility-based services and community-based services. It was revised in 2013 as the "Boosted Linked Response" to achieve virtual elimination of mother-to-child transmission of HIV and syphilis (NCHADS & NMCHC, 2013; Sim et al., 2015). Since 2013, health provider-initiated testing and counselling has been integrated into antenatal care in Cambodia to routinely offer HIV testing to all pregnant women during their visits, while pregnant. Women who never visit ANC can be tested through outreach ANC at the community level (NCHADS, 2017). Adolescents and young women can get HTS integrated with all existing reproductive health services (NCHADS, 2017). HIV self-testing is routinely implemented in Cambodia (UNAIDS & WHO, 2018).

HIV epidemic and HIV testing services in the Philippines

The Philippines had a population of 105,172,925, with 46.6% living in urban areas in 2017 (Worldometer, 2021c). The first case of HIV infection was reported in 1984 in the Philippines (Department of Health/Epidemiology Bureau, 2016). Although the HIV epidemic in the Philippines was low and slow in the beginning from 1984 to 2006, the number of new HIV infections has increased dramatically in recent years (WHO, n.d). The predominant mode of HIV transmission was male to female sexual transmission from 1984 to 2009, however, male to male sexual transmission has steadily increased since the beginning of 2010 (Global AIDS Monitoring, 2018a). HIV transmission among people who inject drugs decreased after reaching the highest cases among people who inject drugs in 2010, contributing to 9% of the total reported cases (Department of Health/Epidemiology Bureau, 2016). HIV prevalence among adults aged 15 years and above was estimated to be 0.1% in 2018. It was estimated that 4,600 women age 15 years and above living with HIV out of 77,000 people living with HIV in 2018 in the Philippines (WHO,

2019d). Regarding the 90-90-90 progress towards 2020 targets in the Philippines, 71% (66-77) of people living with HIV knew their status; 61% (56-65) of people who know their status were on ART; but no available data on % of people on ART achieved viral suppression in 2019(UNAIDS, 2020a).

Public and private health facilities across the Philippines from primary care facilities to treatment hubs in hospitals provide HIV testing and counseling as part of facility-based HIV testing services. Additionally, many community-based organizations offer HIV testing and screening either in their laboratory facilities or community-based screening such as through door-to-door or workplace screening in the country. The country also planned to introduce HIV self-testing demonstration projects (WHO, 2019b). There are commercially available HIV home test kits being offered online together with pre-test and post-test counselling in the Philippines (HIVTESTKIT.PH, n.d.). All pregnant women regardless of risk are routinely offered HIV testing (Health Technology Assessment Study Group, 2018).

HIV epidemic and HIV testing services in Timor-Leste

The population of Timor-Leste was 1,219,288, with 31.1% living in urban areas in 2016 (Worldometer, 2021d). The first case of HIV was reported in Timor-Leste in 2003 (Ministry of Health, 2017, as cited in Estrela+, 2017). The HIV epidemic in Timor-Leste is low and concentrated among key populations – MSM, commercial sex workers and people who inject drugs (National AIDS Programme, 2015b). HIV prevalence of general population was less than 1% and that of key populations was less than 5% based on results from IBBS (2011). The main mode of transmission is sexual transmission in Timor-Leste (National AIDS Programme, 2015b). Approximately 98% of reported HIV cases were transmitted homosexually and heterosexually;

however, detailed understanding of the key drivers of the epidemic was limited (Global AIDS Monitoring, 2018b). As of December 2017, the cumulative number of HIV cases reported was 725 and 467 of them were enrolled in HIV care (Global AIDS Monitoring, 2018b). According to the estimation and projection, HIV prevalence among adults aged 15-49 was 0.10% in 2016 and estimated to be 0.14% in 2020. It was estimated that there were 305 females living with HIV and 53 new HIV infections among females in 2016 (National AIDS Programme, 2015b). In progress towards 90-90-90 targets in 2019 in Timor-Leste, 81% (63->98) of people living with HIV knew their status; 54% (42-72) of people who know their status were on ART; but no available data on % of people on ART who achieved viral suppression (UNAIDS, 2020a).

As the national response to HIV/AIDS in Timor-Leste, HIV testing services are being offered increasingly in a range of services including earlier implementation of PICT (Global AIDS Monitoring, 2018b). Health facilities – a national hospital in Dili and 5 referral hospitals located in larger districts provide diagnosis and treatment of HIV/AIDS and sexually transmitted infections as part of a basic service package. The community health clinics provide HIV testing but not every community health clinic can dispense ART. Health posts providing services at sub-district and community level provide promotion of HIV prevention and referral for HIV testing. Community based HIV testing services started in 2014. Faith based health services and other non-governmental organizations (NGOs) and community-based organizations also provide HIV services. A PMTCT program was implemented only in 6 districts out of a total of 13 districts in the country in 2014 (National AIDS Programme, 2015b). Despite the scaling up of HIV testing services, there are still significant gaps for HIV testing for ANC attendees, key populations and other at-risk groups (National AIDS Programme, 2015b).

Justification

Early treatment and subsequent viral suppression significantly reduce transmission of HIV infection in sexual partners (Cohen et al., 2016). Pregnant women living with HIV who are on ART reduce the risk of transmission of HIV infection to their babies (WHO, 2018, as cited inAvert, n.d.-b). Receiving antiretroviral treatment (ART) as early as possible depends on early testing of HIV of people living with HIV.

Myanmar, Cambodia, the Philippines, and Timor-Leste have low HIV prevalence settings with concentrated epidemic among key populations – men who have sex with men, sex workers (entertainment workers), and people who inject drugs. According to the UNAIDS Global AIDS Monitoring, 2020, 59.8% of people had initial CD4 cell count <200 cells/mm^3 at the time of diagnosis in Cambodia; 63.7% in Myanmar, 75.7% in the Philippines, and no data available in Timor-Leste, (UNAIDS & WHO, 2018). These figures highlight HIV testing gaps which leave untreated people living with HIV with high viral loads and lead to further spread of HIV transmission to others.

It was estimated that 82% of adult females (15+) living with HIV knew their status in Cambodia; 65% of adult women living with HIV were aware of their status in the Philippines; and 92% of adult women living with HIV knew their HIV status in Timor-Leste in 2020, but no available data on percent of women who knew their status in Myanmar (UNAIDS, 2020a). While a range of HIV testing strategies is being offered in the countries, the information regarding factors that hinder or facilitate HIV testing uptake is needed to inform policymakers and HIV program implementers. Therefore, this study aimed to assess factors associated with having ever been tested for HIV among adult women in these four countries.

Specific aims

The specific aims of the proposed study are:

- To compare the prevalence of lifetime HIV testing uptake among women aged 15-49 in the four selected Southeast Asian countries; and
- To identify factors associated with lifetime HIV testing among women aged 15-49 in four selected Southeast Asian countries and the pooled sample.

Methods

Study design

The study was a secondary data analysis using datasets of the Demographic and Health Surveys from 4 Southeast Asian countries: Myanmar (2015-16 MDHS), Cambodia (2014 CDHS), the Philippines (2017 NDHS), and Timor-Leste (2016 TLDHS).

Data sources

Demographic and health surveys are cross-sectional national surveys with a stratified two-staged sampling design. Myanmar Demographic and Health Survey was implemented by the Ministry of Health and Sports, Myanmar and funded by the United States Agency for International Development (USAID) and the Three Millennium Development Goal Fund (3MDG) (program, ICF, Rockville, & Ministry of Health and Sports, 2017). The 2014 Cambodia Demographic and Health Survey (CDHS) was conducted by the Directorate General for Health of the Ministry of Health and the National Institute of Statistics of the Ministry of Planning (National Institute of Statistics/Cambodia, Directorate General for Health/Cambodia, & ICF International, 2015). The 2017 Philippines National Demographic and Health Survey (NDHS) was implemented by the Philippines Statistics Authority (Philippine Statistics Authority - PSA & ICF, 2018). The 2016

Timor-Leste Demographic and Health Survey (TLDHS) was conducted by the General Directorate of Statistics of the Ministry of Planning and Finance in collaboration with the Ministry of Health (General Directorate of Statistics, Ministry of Finance/Timor Leste, & ICF, 2018). The data sets are publicly available upon request from the DHS Program.

Sampling

The primary sampling unit (PSU) in the Myanmar Demographic and Health Survey, was based on either a census enumeration area or a ward or village tract in a sensitive area not enumerated during the 2014 census. The master sample with 4,000 PSUs, stratified by each state/region into urban and rural areas, was selected using probability proportional to size. At the first stage, a total of 442 clusters (123 urban and 319 rural) were selected with equal probability systematic sampling, independently from each sampling stratum. At the second stage, equal probability systematic sampling was used to select a fixed number of 30 households from each of the selected clusters. All women aged 15-49 from every selected household and all men aged 15-49 from every second of the selected household who were either residents or visitors who stayed in the household the night before the survey were eligible to be interviewed (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017).

The 2014 Cambodian Demographic and Health Survey used the sampling frame which was the complete list of enumeration areas (EAs) based on the 2008 Cambodia General Population Census updated by the National Institute of Statistics in 2012 (National Institute of Statistics/Cambodia et al., 2015). It consists of 28,455 EAs covering the whole country. A stratified two-stage sampling was applied in the 2014 CDHS. In the first stage, 611 EAs were selected with probability proportional to EA size from the sampling frame. In the second stage, a fixed number of 24 households from every urban cluster and that of 28 households from every rural cluster were

selected with systematic sampling method. All women aged 15-49 in the selected households and men aged 15-49 in one-third of all the selected households were eligible for the individual survey (National Institute of Statistics/Cambodia et al., 2015).

The 2017 Philippines National Demographic and Health Survey applied a two-stage stratified sampling design. The master sampling frame was created, based on the 2010 Census of Population and Housing which was updated on the 2015 Census of Population. In the first stage, 1,250 primary sampling units (PSUs) were systematically selected from the master sample frame. A fixed number either 26 or 20 housing units were selected from each sampled PSU using systematic random sampling in the second stage. All de facto women aged 15-49 were eligible to be interviewed. The survey did not include men (Philippine Statistics Authority - PSA & ICF, 2018).

The sampling frame for the 2016 Timor-Leste Demographic and Health Survey was based on the 2015 Timor-Leste Population and Housing Census. It consists of a complete list of 2320 EAs. Similar to other Demographic and Health Surveys, TLDHS used a stratified two-stage sampling design. 455 EAs were selected with probability proportional to the size of EA in the first stage. Twenty-six households were randomly selected from each of the selected EA in the second stage of sampling. All women aged 15-49 years who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible for an individual interview. All de facto men aged 15-49 years from one-third of the sampled households were eligible for the men's survey. HIV related questionnaires were asked only to the eligible women from the same household selected for the men's survey (General Directorate of Statistics et al., 2018).

The current analysis included only women samples from these surveys. All four countries received technical assistance provided by ICF through the Demographic and Health Surveys (DHS) Program.

Data collection

Pretest, comprehensive training of trainers and field staff and evaluation of field staff took place before starting the fieldwork. All four DHS surveys were interviewed administered surveys. Interviewers were trained to ensure privacy and check the presence of others before asking sensitive questions. Data collection of the 2015-16 MDHS took place from 7 December 2015 to 7 July 2016 using computer-assisted field editing (CAFE) procedures with tablet computers, and data editing was done with CSPro software (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). The 2014 CDHS collected data from June 2014 to January 2015. The completed questionnaires were entered (100% double entry) and edited by specially trained data processing personnel on personal computers (National Institute of Statistics/Cambodia et al., 2015).

Data collection for the 2017 NDHS and the 2016 TLDHS took place from August 14 to October 27, 2017, and 16 September to 22 December 2016, respectively. Both surveys used computer assisted personal interviewing (CAPI) in administering questionnaires and transferred interviews to the central office via a secure Internet file streaming system (IFSS), and data editing was done with CSPro software (General Directorate of Statistics et al., 2018; Philippine Statistics Authority - PSA & ICF, 2018).

Study population

All women aged 15-49 years who were either permanent residents of the selected households or visitors who stayed in the household the night before the survey were eligible for the Woman's Questionnaire in Myanmar, Cambodia, the Philippines, and Timor-Leste. This study

included all women aged 15 – 49 years who were interviewed in Myanmar in 2015 -2106; those who were interviewed in Cambodia in 2014-2015; those who were interviewed in the Philippines in 2017; those who were interviewed in Timor-Leste in 2016). The total weighted numbers of women who completed the survey were 12,885 in MDHS data set; 17,578 in CDHS data set; 25,074 in NDHS data set; and 12,607 in TLDHS data set in which only 4,305 women were asked about HIV/AIDS related questionnaires.

Protection of human subjects

All protocols of the Demographic and Health Surveys were reviewed and approved by the ICF's Institutional Review Board and an Ethical Review Board in the host country. ICF IRB ensures that the survey complies with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46). The DHS program describes the details about protecting the privacy of DHS respondents on the DHS program website (ICF, n.d.-a). The present study used the publicly available data of DHS with no identifying information. The use of data in this analysis was also reviewed and approved by the Institutional Review Board of the University of California, Los Angeles.

Data analysis

The outcome of interest was lifetime HIV testing uptake – ever been tested for HIV among women aged 15-49 years in Myanmar, Cambodia, the Philippines, and Timor-Leste. The outcome was coded as a binary outcome (yes/no).

Potential predictors related to socioeconomic and demographic characteristics were age in years (15 - 19, 20 - 24, 25 - 29, 30 - 39, 40 - 49), place of residence (urban/rural), current marital status (never in union, currently in union, formerly in union), educational level (no education or primary, secondary, and higher), occupation (not working, agricultural, manual, non-manual,

professional), wealth index (lowest, lower, middle, higher, and highest quintile), exposure to mass media (yes, no), problems in accessing health care (yes, no).

Potential predictors pertained to HIV-related knowledge, attitudes toward people living with HIV (PLHIV), and behaviors were: comprehensive knowledge about HIV (yes, no), discriminatory attitude towards PLHIV (yes, no), awareness of HIV testing services (yes, no), age at first sexual intercourse (never had sex, <18, 18 - 20, 20+), history of an STI or STI symptoms in the past 12 months (yes, no), and total number of sex partners in lifetime (0, 1, 2, 3+).

There were three variables related to women's empowerment as potential predictors. Participation in decision making was asked only among currently married women or women living with a partner, therefore we omitted this variable in this study. The other two predictors were - disagreement over wife beating for any reasons (yes, no), and attitude towards negotiation for safer sexual relation with husbands (no, yes to any one question, yes to both questions). Appendix 1. describes the variables of interest and recodes in the analysis of this study in detail. Some of the variables of interest were not available in all four country datasets.

We analyzed the data using STATA software (version Stata/SE 15.1). We conducted data analysis of each country separately and the pooled country sample. In our analyses, we used 'svyset' and 'svy' commands to correctly specify the effect of complex sampling design. Individual women sampling weights provided in each country's survey dataset were applied to get nationally representative estimates. In the descriptive analysis, proportions of lifetime HIV testing uptake and 95% CIs of each country were calculated and visualized using a bar graph. Proportions were compared using chi-square test for survey data. Socio-demographic and economic characteristics, HIV/AIDS related knowledge, attitude, and behavior, and women's empowerment were summarized by countries using frequency and percent.

We applied multiple logistic regression models to determine factors associated with the odds of lifetime HIV testing among women in each country. Before pooling the datasets of four countries, we de-normalized the weights and gave an equal weight to each country's survey to avoid domination by the large countries as recommended (Pullum, 2015). We ran a fixed effects multiple logistic regression model to identify factors associated with the odds of lifetime HIV testing uptake among women in the pooled country sample. We included "country" as a covariate in the model as recommended (Pullum & Elkasabi, 2019).

We examined associations between each potential predictors and lifetime HIV testing (have you ever been tested for HIV?) of women by univariable regression models. Simple and multivariable logistic regression models using survey weights were applied to identify individual level factors associated with the odds of lifetime HIV testing uptake among women. Based on literature and bivariate analysis, we selected the predictors that have a bivariate association with lifetime HIV testing at p-value < 0.20 to be included in the multiple logistic regression models (David W. Hosmer et al., 2013; Herringa et al., 2010). Multicollinearity of independent variables in survey data were assessed by calculating tolerance ($1\text{-}R^2$) and VIF (UCLA Statistical Consulting Group, 2021a). Marital status and age at first sexual intercourse were moderately correlated, thus the later one was omitted in the multiple logistic regression models. Self-reported history of an STI or symptoms of STIs and total lifetime number of sexual partners were not available in all countries, therefore, these variables were omitted in the multiple logistic regression analysis. Moreover, awareness about HIV testing (know where to get an HIV test) was not included in the regression models due to perfect prediction failure. Model specification was assessed using "linktest" command (UCLA Statistical Consulting Group, 2021b). Model fitting was examined using goodness-of-fit tests for complex survey data (Herringa et al., 2010).

Results

Socioeconomic and demographic characteristics of women

There were 12,885 women in Myanmar; 17,578 women in Cambodia; 25,074 women in the Philippines; and 4,305 women in Timor-Leste in this study. The results showed that the majority of the respondents (around 60%) in all four countries (Myanmar, Cambodia, the Philippines, and Timor-Leste) were currently married or living together with a partner at the time of survey. Adolescents and young women (aged 15-24 years) were the highest proportion of respondents in Cambodia, the Philippines and Timor-Leste, while the respondents aged 35-39 were the highest proportion in Myanmar. Just more than half of women attained no or primary level of education in Cambodia and Myanmar (59.9% and 53.6%, respectively), whereas half of the women in the Philippines and Timor-Leste had secondary level of education (49.8% and 51%, respectively). The highest percentages of respondents in the Philippines and Timor-Leste were unemployed (46.2% and 63.6%, respectively); however, the highest percentage of respondents in Myanmar reported being manual laborers (33.5%) and that of in Cambodia was agricultural workers (35%). The distribution of wealth index was similar in all four countries. The majority of respondents resided in rural areas in Myanmar (70.8%), Cambodia (81.5%), and Timor-Leste (66.9%), whereas equal rural/urban residence distribution was found in the Philippines. Regarding media exposure, 68.2% of respondents in Myanmar, 68.6% of respondents in Cambodia, 84.5% of respondents in the Philippines, and 42.4% of respondents in Timor-Leste were exposed to any media (TV, newspapers, magazines, radio) at least once a week.

The response rates of eligible women in four selected countries were 95.8% in the 2015-16 Myanmar Demographic and Health Survey, 97.6% in the 2014 Cambodia Demographic and

Health survey, 97.6% in the 2017 Philippines National Demographic and Health Survey, and 97% in the 2016 Timor-Leste Demographic and Health Survey.

Table 4-1 Sociodemographic and economic characteristics of women aged 15-49 in four selected Southeast Asian countries

Variables	Myanmar (n = 12,885)		Cambodia (n = 17,578)		The Philippines (n = 25,074)		Timor-Leste (n = 4,305)	
	No.	%	No.	%	No.	%	No.	%
Marital status								
Never in union	4,278	33.2	4,428	25.2	8,971	35.8	1,567	36.4
Currently in union	7,759	60.2	11,898	67.7	15,016	59.9	2,628	61.0
Formerly in union	848	6.6	1,252	7.1	1,086	4.3	110	2.5
Total	12,885	100	17,578	100	25,074	100	4,305	100
Age in years								
15 - 19	1,810	14.0	2,893	16.5	4,897	19.5	984	22.8
20 - 24	1,867	14.5	3,017	17.2	4,175	16.7	782	18.2
25 - 29	1,867	14.5	2,836	16.1	3,717	14.8	692	16.1
30 - 39	3,990	31.0	4,886	27.8	6,603	26.3	982	22.8
40 - 49	3,351	26.0	3,947	22.5	5,682	22.7	866	20.1
Total	12,885	100	17,578	100	25,074	100	4,305	100
Highest educational level								
No education or Primary	6,910	53.6	10,531	59.9	3,445	13.7	1,629	37.8
Secondary	4,646	36.1	6,237	35.5	12,491	49.8	2,194	51.0
Higher	1,325	10.3	810	4.6	9,137	36.4	481	11.2
Total	12,882	100	17,578	100	25,074	100	4,305	100
Occupation								
Not working	3,518	27.4	3,729	21.3	11,553	46.2	2,735	63.6
Agricultural	1,846	14.4	6,115	35.0	1,390	5.6	477	11.1
Manual	4,307	33.5	3,971	22.7	5,888	23.5	438	10.2
Non-manual	2,450	19.1	2,891	16.5	2,484	9.9	487	11.3
Professional	729	5.7	782	4.5	3,705	14.8	165	3.8
Total	12,849	100	17,488	100	25,020	100	4,302	100
Wealth index								
Poorest	2,274	17.7	3,143	17.9	4,209	16.8	692	16.1
Poorer	2,408	18.7	3,314	18.9	4,629	18.5	841	19.5

Middle	2,633	20.4	3,381	19.2	4,918	19.6	836	19.4
Richer	2,702	21.0	3,612	20.6	5,527	22.0	941	21.8
Richest	2,868	22.3	4,128	23.5	5,791	23.1	995	23.1
Total	12,885	100	17,578	100	25,074	100	4,305	100
Place of residence								
Urban	3,768	29.2	3,251	18.5	12,252	48.9	1,427	33.1
Rural	9,117	70.8	14,327	81.5	12,822	51.1	2,878	66.9
Total	12,885	100	17,578	100	25,074	100	4,305	100
Exposure to any mass media at least once a week								
No	4,097	31.8	5,520	31.4	3,876	15.5	2,480	57.6
Yes	8,788	68.2	12,058	68.6	21,198	84.5	1,824	42.4
Total	12,885	100	17,578	100	25,074	100	4,305	100

No. and % are weighted numbers and percentages.
Missing values were excluded.

HIV related knowledge, attitude towards people living with HIV, and behaviors

We found that 40% of respondents in Cambodia, 24.6% in the Philippines, 19.7% in Myanmar, and 9.6% of Timor-Leste had comprehensive knowledge of HIV. Only one-fifth of respondents from Cambodia and nearly one-third of respondents from Timor-Leste reported discriminatory attitudes towards PLHIV, whereas more than half of respondents in the other countries reported the discriminatory attitude. Five precents of respondents in Myanmar, 5.6% in Timor-Leste, and 8.7% in Cambodia reported history of having an STI or STI symptoms in the past 12 months. With the available data, more than 9 in 10 respondents in Cambodia and Timor-Leste, and more than 8 in 10 respondents in the Philippines reported that they had only one lifetime sexual partner. The majority of respondents in Myanmar and Cambodia (64.1% and 78.1%, respectively) and less than half of respondents in the Philippines (45.4%) knew a place for an HIV test. Only 6.8% of respondents in Timor-Leste knew where to get an HIV test as shown in Table 4-2.

Table 4-2 HIV related knowledge, attitude, and behaviors of women aged 15-49 in four selected Southeast Asian countries

Variables	Myanmar (n = 12,885)		Cambodia (n = 17,578)		The Philippines (n = 25,074)		Timor-Leste (n = 4,305)	
	No.	%	No.	%	No.	%	No.	%
Comprehensive knowledge of HIV								
No	10,341	80.3	10,710	60.9	18,913	75.4	3,891	90.4
Yes	2,544	19.7	6,868	39.1	6,161	24.6	413	9.6
Total	12,885	100	17,578	100	25,074	100	4,305	100
Discriminatory attitude towards PLHIV								
No	5,408	42.0	14,127	80.4	10,663	42.5	2,950	68.5
Yes	7,477	58.0	3,451	19.6	14,411	57.5	1,355	31.5
Total	12,885	100	17,578	100	25,074	100	4,305	100
Had an STI or STI symptoms in the past 12 months								
No	12,197	94.7	16,044	91.3	NA	NA	4,063	94.4
Yes	688	5.3	1,534	8.7	NA	NA	241	5.6
Total	12,885	100	17,578	100	NA	NA	4,305	100
Age at first sexual intercourse								
Never had sex	4,269	33.1	4,374	24.9	7,624	30.4	1,479	34.4
<18	3,089	24.0	5,483	31.2	6,514	26.0	1,182	27.5
18 - 20	1,789	13.9	2,950	16.8	3,904	15.6	668	15.5
20+	3,737	29.0	4,759	27.1	7,028	28.0	975	22.7
Total	12,885	100	17,566	100	25,070	100	4,304	100
Total lifetime number of sex partners								
0	NA	NA	4,371	24.9	7,624	30.4	1,479	34.6
1	NA	NA	12,125	69.1	14,194	56.6	2,595	60.7
2	NA	NA	968	5.5	2,556	10.2	73	1.7
3+	NA	NA	90	0.5	689	2.7	126	2.9
Total	NA	NA	17,554	100	25,063	100	4,273	100

Awareness of HIV testing places								
No	4,626	35.9	3,855	21.9	13,695	54.6	4,013	93.2
Yes	8,259	64.1	13,723	78.1	11,379	45.4	292	6.8
Total	12,885	100	17,578	100	25,074	100	4,305	100

NA means not available.
No. and % are weighted numbers and percentages.
Missing values were excluded.

Women's empowerment

Regarding attitude towards wife beating by a husband, nearly ninety percent of respondents from the Philippines and almost half of respondents from Myanmar and Cambodia reported disagreement over wife beating for any reasons - going out without telling him, neglecting the children, burning the food, arguing with him, and refusing to have sexual intercourse. About a quarter of respondents (25.5%) in Timor-Leste disagreed that wife beating by a husband is justifiable. Regarding attitude towards negotiation for safer sexual relations with husbands, the majority of respondents in Myanmar (67.8%), Cambodia (71.2%) and the Philippines (77.5%) believed that a woman is justified in refusing to have sexual intercourse with her husband if she knows he has sex with other women and asking him to use a condom if she knows he has an STI. In Timor-Leste, only 19.4% of respondents had such positive attitude towards negotiation for safer sexual relations with husbands.

Table 4-3 Women's empowerment of women aged 15-49 years in four selected Southeast Asian countries

Variables	Myanmar (n = 12,885)		Cambodia (n = 17,578)		The Philippines (n = 25,074)		Timor-Leste (n = 4,305)	
	No.	%	No.	%	No.	%	No.	%
Disagreement on all of the reasons for wife beating								
No	6,592	51.2	8,757	49.8	2,734	10.9	3,207	74.5
Yes	6,293	48.8	8,821	50.2	22,340	89.1	1,098	25.5
Total	12,885	100	17,578	100	25,074	100	4,305	100
Attitude toward negotiation for safer sex								
No	1,552	12.0	757	4.3	2,285	9.1	2,654	61.7
Yes to one question	2,593	20.1	4,306	24.5	3,356	13.4	816	19.0
Yes to both questions	8,740	67.8	12,516	71.2	19,433	77.5	834	19.4
Total	12,885	100	17,578	100	25,074	100	4,305	100

No. and % are weighted numbers and percentages.

Proportion of lifetime HIV testing uptake of currently married women aged 15-49 years in the selected countries in Southeast Asia Region

Lifetime HIV testing rate among women aged 15-49 was highest in Cambodia and lowest in Timor-Leste. The proportions were significantly different ($p<0.001$). The proportions of lifetime HIV testing uptake among women aged 15-49 years were 42.1% (95% CI: 40.9%, 43.4%) in Cambodia, 19.5% (95% CI: 18.3%, 20.7%) in Myanmar, 4.6% (95% CI: 4.0%, 5.2%) in the Philippines, and 3.7% (95% CI: 3.0%, 4.6%) in Timor-Leste.

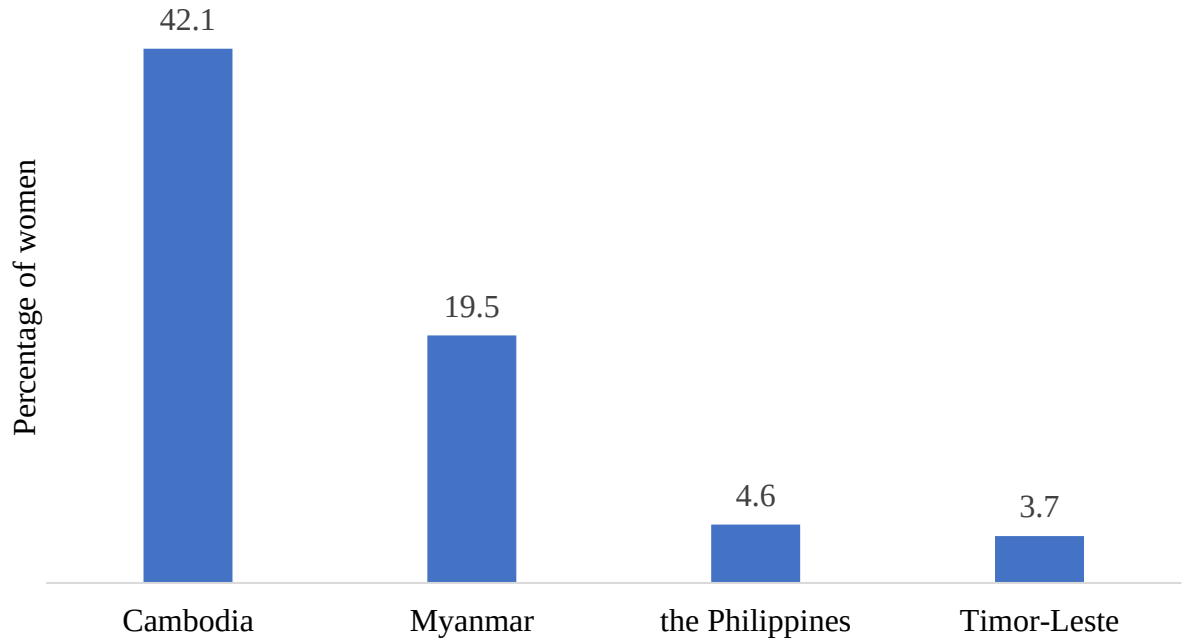

Figure 4-1 Proportion of lifetime HIV testing among women age15-49 years in 4 Southeast Asian countries

Factors determining lifetime HIV testing uptake among women aged 15-49 years in four Southeast Asian countries

The results of the logistic regression analyses by country and pooled sample are shown in Table 4-4. Respondents who were currently married and who were formerly married had greater likelihood of having ever been tested for HIV, compared to the respondents who were never married in all four countries. Compared to the respondents aged 40-49 years, younger women were significantly more likely to get tested for HIV in all four countries, but adolescent girls (15-19 years) were less likely to be tested for HIV in Myanmar.

Respondents with secondary and higher education level were more likely to get tested for HIV in their lifetime than respondents with no education or primary education in all four countries. Respondents who were working in agricultural labor were less likely to get tested for HIV than respondents who worked in professional/technical/managerial jobs in all countries and the pooled sample. Unemployed women in the Philippines, Timor-Leste and the pooled sample were also less likely to get tested for HIV than women who worked in professional/technical/managerial jobs.

Wealth index was not significantly associated with lifetime HIV testing among respondents in Timor-Leste. Respondents in the middle wealth quintile and above in Myanmar, the Philippines, and the pooled sample had significantly higher odds of lifetime HIV testing compared to those in the poorest quintile, whereas the significantly higher odds was found among respondents in the richest wealth quintile in Cambodia. Respondents residing in rural areas in Myanmar, Cambodia, the Philippines, and the pooled sample were less likely to get tested for HIV than those from urban areas. Regular exposure to any mass media (TV, newspapers, magazines, or radio) was found to be a significant determinant for increased HIV testing uptake among respondents in Cambodia and the pooled sample.

Respondents with comprehensive knowledge of HIV were more likely to be tested for HIV than those who did not have it in Myanmar, Cambodia, Timor-Leste, and in the pooled sample. Respondents who reported discriminatory attitudes towards people living with HIV had significantly lower odds of lifetime HIV testing than those with no discriminatory attitude in Cambodia, while the results of Myanmar, the Philippines and the pooled sample also showed similar direction of association although the results were not statistically significant. However, respondents with discriminatory attitudes towards PLHIV had higher odds of HIV testing than their counterparts in Timor-Leste.

Respondents who disagreed on any reasons to justify wife beating by a husband were regarded as empowered respondents in our study. We expected that empowered respondents were more likely to get tested for HIV than their counterparts. However, we found a significant negative association between disagreement over wife beating and lifetime HIV testing among respondents in Timor-Leste and the pooled sample. Higher odds of lifetime HIV testing uptake was found among respondents with positive attitude towards negotiation for safer sexual relations with husbands in Myanmar, Cambodia, and the pooled sample, but the findings were not significant in the Philippines and Timor-Leste.

Table 4-4 Simple and Multivariable logistic regression analysis for lifetime HIV testing uptake among women by country and pooled sample

Variables	Myanmar		Cambodia		The Philippines		Timor-Leste		Pooled sample	
	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)	OR (95%CI)	aOR (95%CI)
Country										
Myanmar	NA	NA	NA	NA	NA	NA	NA	NA	1.0 (ref)	1.0 (ref)
Cambodia	NA	NA	NA	NA	NA	NA	NA	NA	3.01 (2.75, 3.30) ***	3.50 (3.11, 3.92) ***
The Philippines	NA	NA	NA	NA	NA	NA	NA	NA	0.20 (0.17, 0.23) ***	0.11 (0.09, 0.13) ***
Timor-Leste	NA	NA	NA	NA	NA	NA	NA	NA	0.16 (0.13, 0.20) ***	0.13 (0.10, 0.17) ***
Marital status										
Never in union	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Currently in union	4.78 (4.06, 5.64) ***	5.95 (4.82, 7.35) ***	8.80 (7.63, 10.15) ***	19.54 (16.03, 23.80) ***	1.91 (1.41, 2.57) ***	2.02 (1.30, 3.13) **	3.59 (2.06, 6.23) ***	4.61 (2.08, 10.20) ***	5.59 (5.05, 6.18) ***	9.05 (7.79, 10.52) ***
Formerly in union	2.64 (2.08, 3.37) ***	3.73 (2.83, 4.92) ***	5.22 (4.31, 6.31) ***	14.57 (11.24, 18.88) ***	3.07 (2.06, 4.58) ***	2.84 (1.69, 4.75) ***	3.85 (1.35, 11.01) *	5.82 (1.89, 17.88) **	5.07 (4.40, 5.83) ***	6.76 (5.61, 8.16) ***
Age in years										
15 - 19	0.19 (0.14, 0.26) ***	0.53 0.37, 0.76) ***	0.53 (0.44, 0.63) ***	3.00 (2.39, 3.76) ***	0.18 (0.10, 0.30) ***	0.56 (0.28, 1.12)	0.36 (0.14, 0.92) *	1.13 (0.43, 2.97)	0.34 (0.29, 0.39) ***	1.36 (1.14, 1.62) **
20 - 24	1.15 (0.95, 1.39)	1.81 (1.44, 2.27) ***	3.47 (3.07, 3.94) ***	6.97 (5.88, 8.25) ***	1.08 (0.79, 1.48)	1.54 (0.97, 2.44)	1.62 (0.74, 3.53)	1.83 (0.86, 3.87)	1.80 (1.63, 1.98) ***	3.46 (3.04, 3.93) ***

25 - 29	2.21 (1.85, 2.63) ***	2.57 (2.12, 3.12) ***	5.72 (4.98, 6.57) ***	7.07 (6.02, 8.29) ***	1.70 (1.18, 2.45) **	2.04 (1.40, 2.98) ***	3.03 (1.45, 6.32) **	2.20 (1.08, 4.47) *	2.75 (2.48, 3.06) ***	4.08 (3.60, 4.62) ***
30 - 39	2.04 (1.76, 2.37) ***	2.24 (1.90, 2.63) ***	3.37 (3.01, 3.76) ***	3.43 (3.05, 3.86) ***	1.63 (1.20, 2.21) **	1.67 (1.23, 2.28) **	2.25 (1.08, 4.71) *	1.38 (0.64, 2.98)	2.31 (2.12, 2.53) ***	2.69 (2.43, 2.99) ***
40 - 49	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Highest educational level[¥]										
No education or Primary	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Secondary	1.59 (1.39, 1.81) ***	1.45 (1.25, 1.69) ***	1.21 (1.11, 1.33) ***	1.34 (1.20, 1.50) ***	2.13 (1.32, 3.44) **	1.62 (0.97, 2.69)	3.64 (2.06, 6.45) ***	2.19 (1.22, 3.93) **	0.76 (0.71, 0.82) ***	1.40 (1.28, 1.52) ***
Higher	3.82 (3.12, 4.68) ***	2.09 (1.59, 2.76) ***	1.37 (1.16, 1.62) ***	1.39 (1.11, 1.75) **	5.96 (3.74, 9.49) ***	2.48 (1.49, 4.11) ***	12.47 (6.71, 23.17) ***	3.81 (1.80, 8.08) **	0.83 (0.74, 0.93) **	2.23 (1.88, 2.66) ***
Occupation[¥]										
Professional	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Agricultural	0.20 (0.15, 0.28) ***	0.42 (0.29, 0.61) ***	0.41 (0.34, 0.49) ***	0.55 (0.43, 0.71) ***	0.10 (0.05, 0.18) ***	0.33 (0.18, 0.61) ***	0.05 (0.02, 0.12) ***	0.34 (0.11, 1.00) *	0.83 (0.71, 0.96) *	0.45 (0.36, 0.55) ***
Manual	0.32 (0.24, 0.42) ***	0.60 (0.44, 0.84) **	0.73 (0.60, 0.88) **	0.84 (0.64, 1.10)	0.40 (0.26, 0.60) ***	0.60 (0.40, 0.91) *	0.33 (0.17, 0.65) **	0.92 (0.43, 1.97)	0.79 (0.68, 0.91) **	0.65 (0.53, 0.80) ***
Non-manual	0.56 (0.43, 0.74) ***	0.67 (0.49, 0.91) **	0.86 (0.72, 1.04)	0.81 (0.63, 1.04)	0.71 (0.46, 1.10)	0.73 (0.47, 1.13)	0.31 (0.16, 0.62) **	0.56 (0.28, 1.12)	1.13 (0.97, 1.30)	0.66 (0.54, 0.81) ***
Not working	0.54 (0.41, 0.71) ***	0.81 (0.59, 1.11)	0.63 (0.51, 0.77) ***	0.90 (0.69, 1.18)	0.22 (0.15, 0.33) ***	0.43 (0.30, 0.62) ***	0.13 (0.07, 0.26) ***	0.47 (0.23, 0.93) *	0.44 (0.38, 0.51) ***	0.66 (0.54, 0.81) ***
Wealth index										
Poorest	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)

Poorer	1.31 (1.06, 1.62) *	1.33 (1.07, 1.67) *	1.10 (0.94, 1.28)	0.98 (0.83, 1.16)	2.33 (1.41, 3.86) **	1.64 (0.99, 2.73)	1.39 (0.43, 4.50)	0.85 (0.26, 2.74)	1.11 (0.99, 1.26)	1.15 (1.02, 1.30) *
Middle	1.42 (1.13, 1.77) **	1.48 (1.16, 1.89) **	1.27 (1.09, 1.48) **	1.08 (0.91, 1.30)	3.85 (2.44, 6.08) ***	2.01 (1.20, 3.37) **	2.49 (0.85, 7.25)	1.21 (0.37, 3.89)	1.28 (1.12, 1.46) ***	1.33 (1.16, 1.51) *
Richer	2.17 (1.75, 2.69) ***	1.87 (1.46, 2.40) ***	1.40 (1.20, 1.65) ***	1.09 (0.90, 1.32)	4.79 (3.02, 7.58) ***	2.03 (1.16, 3.52) *	3.47 (1.21, 9.92) *	1.15 (0.34, 3.85)	1.52 (1.32, 1.74) ***	1.44 (1.25, 1.65) **
Richest	3.55 (2.87, 4.39) ***	2.34 (1.74, 3.13) ***	2.23 (1.91, 2.60) ***	1.63 (1.29, 2.06) ***	8.23 (5.07, 13.37) ***	3.00 (1.66, 5.44) **	9.85 (3.59, 27.05) ***	1.89 (0.58, 6.21)	2.44 (2.14, 2.79) ***	2.05 (1.73, 2.43) ***
Place of residence										
Urban	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Rural	0.43 (0.37, 0.50) ***	0.73 (0.59, 0.89) **	0.59 (0.54, 0.65) ***	0.70 (0.59, 0.84) ***	0.33 (0.24, 0.47) ***	0.43 (0.30, 0.62) ***	0.31 (0.20, 0.48) ***	0.86 (0.48, 1.55)	0.90 (0.82, 0.98) *	0.68 (0.60, 0.77) ***
Exposure to any mass media at least once a week										
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	1.46 (1.25, 1.70) ***	1.01 (0.86, 1.19)	1.40 (1.27, 1.53) ***	1.23 (1.11, 1.37) ***	1.51 (1.06, 2.14) *	1.02 (0.71, 1.46)	3.09 (2.06, 4.65) ***	1.40 (0.88, 2.24)	1.59 (1.47, 1.73) ***	1.12 (1.02, 1.23) *
Comprehensive knowledge of HIV										
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	2.68 (2.36, 3.04) ***	1.36 (1.18, 1.57) ***	1.71 (1.58, 1.85) ***	1.28 (1.16, 1.41) ***	1.50 (1.18, 1.91) **	0.97 (0.73, 1.29)	5.53 (3.42, 8.93) ***	1.92 (1.14, 3.22) *	2.95 (2.76, 3.15) ***	1.33 (1.22, 1.45) ***
Discriminatory attitude towards PLHIV										
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	0.75 (0.67, 0.84) ***	0.93 (0.83, 1.05)	0.45 (0.41, 0.51) ***	0.67 (0.58, 0.76) ***	0.73 (0.57, 0.92) **	0.82 (0.63, 1.08)	5.07 (3.03, 8.48) ***	2.86 (1.61, 5.08) ***	0.52 (0.48, 0.56) ***	0.93 (0.85, 1.02)

Disagreement over all the reasons for wife beating										
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	-!	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes	1.16 (1.03, 1.32) *	0.99 (0.87, 1.12)	1.05 (0.98, 1.13)	0.96 (0.88, 1.06)	1.15 (0.81, 1.62)		0.32 (0.19, 0.53) ***	0.31 (0.17, 0.55) ***	0.92 (0.86, 0.97) **	0.90 (0.84, 0.97) **
Attitude towards negotiation for safer sex										
No	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)	1.0 (ref)
Yes to one question	2.18 (1.64, 2.90) ***	1.54 (1.17, 2.02) **	6.79 (5.06, 9.11) ***	2.31 (1.63, 3.26) ***	1.67 (0.82, 3.39)	1.30 (0.63, 2.68)	1.20 (0.69, 2.08)	0.60 (0.31, 1.17)	5.99 (4.88, 7.34) ***	1.35 (1.10, 1.66) **
Yes to both questions	4.10 (3.06, 5.49) ***	2.03 (1.53, 2.70) ***	6.61 (4.96, 8.81) ***	2.30 (1.64, 3.23) ***	2.84 (1.55, 5.21) **	1.59 (0.85, 2.98)	2.14 (1.37, 3.34) **	0.91 (0.54, 1.55)	7.16 (5.89, 8.71) ***	1.59 (1.30, 1.95) ***

* p-value <0.05
** p-value <0.01
***p-value <0.001
Missing values were excluded from the multivariable analyses. Percentage of missing observations of ¥ "variables" ranged from 0.01% to 0.59%.
NA means not available.
Note: Women who have never heard of AIDS were assumed not having discriminatory attitudes towards PLHIV.
-! "variables" were not included in the multiple logistic regression models as P-value ≥ 0.2 in the bivariate analysis.
The multivariable logistic regression models of Timor-Leste and pool sample had P-value <0.05 in the goodness of fit test.

Discussion

In this study of examination of lifetime HIV testing among women aged 15-49, Cambodia had the highest percentage of women reporting lifetime HIV testing, compared to the other three countries in Southeast Asia. Cambodia had experienced the HIV epidemic first, compared to the other countries in Southeast Asia. The epidemic was predominantly among sex workers and mainly driven by heterosexual transmission. Cambodia's multisectoral and effective response to the HIV/AIDS epidemic was implemented earlier with high political commitment (R. Detels, personal communication, March 1, 2022). Implementation of the "Linked Response" approach had tremendously increased proportion of ANC attendees tested for HIV in Cambodia (Sim et al., 2015). Integration of health providers-initiated HIV testing and counseling approach in ANC started in 2013 in Cambodia. More than 7 in 10 pregnant women reported knowing their status in 2014 (The National AIDS Authority, 2015). Outreach ANC at the community level provides HIV testing for pregnant women who never visit ANC (NCHADS, 2017). Additionally, HIV testing is free and HIV services including testing were greatly funded by the Royal Government of Cambodia, the US Government, and external donors (Thin, Prum, & Johns, 2019). It can reduce the out-of-pocket payments by the people and increase HIV testing uptake. These factors could explain higher HIV testing rates among women in Cambodia.

Approximately 2 in 10 Myanmar women aged 15-49 had ever been tested for HIV based on our result. Due to decentralization of HIV testing services (HTS), shifting the testing process from laboratory-based testing to rapid HIV tests by basic health care workers, initiated since 2013, numbers of people being tested and received HTS had significantly increased from 2014 to 2015 (National AIDS Programme, 2015a). Although Myanmar has initiated point-of-care HIV testing strategy for the PMTCT services in 2013 to increase HIV testing coverage and provision of

treatment to pregnant women receiving antenatal care, there were challenges faced by the primary care providers such as over workloads, long travel times, and insufficient supply of HIV test kits (S. Hone et al., 2019). It was very clear that pregnant women need to have adequate antenatal care visits with skilled providers to receive quality antenatal care, including HIV testing and counseling. However, only three-fifths of women who had a live birth in 2010-2015 had four or more ANC visits (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). In 2015, 87% of pregnant women who attended ANC and received pre-test counselling got tested for HIV (National AIDS Programme, 2015a). Despite high coverage of the PMTCT program and decentralization of HTS, this study underscored the need for HTS targeted to women of reproductive age who did not utilize the PMTCT services.

Changing HIV transmission pattern in the Philippines over the last decade, predominantly male-to-male sexual transmission only 6% of the reported cumulative cases of HIV diagnosis were females as of March 2021 (Department of Health/Epidemiology Bureau, 2021). This could be one of the reasons for low HIV testing rate among women of reproductive age in the Philippines. Additionally, awareness of HIV testing sites among women aged 15-49 years has been low (52% in 2008 and 45% in 2017) (Philippine Statistics Authority - PSA & ICF, 2018). There was no policy for free HIV testing (UNAIDS & WHO, 2018). This can explain why we observed very low HIV testing uptake among Filipino women (4.6%). However, heterosexual transmission is still driving the HIV epidemic in the Philippines and recent significant rising number of HIV infections among adolescent girls and young women through sexual contact (Department of Health/Epidemiology Bureau, 2021). Therefore, it is very critical to take actions to increase HIV testing uptake among women, especially among adolescent girls.

Less than 4 in 100 Timorese women of reproductive age (15-49 years) had ever been tested for HIV. HIV prevalence in Timor-Leste is very low and concentrated, main drivers of HIV epidemic have still under studied, and there was limited access to HIV services (Global AIDS Monitoring, 2018b). In 2014, less than half of the Districts were covered by PMTCT program, and 19.3% of pregnant women were tested for HIV and received their results (National AIDS Programme, 2015b). Moreover, there were educational and economic inequality between women and men in Timor-Leste. Women were economically dependent and had lower education levels than men, consequently, had poor access to health services (Asia Development Bank, 2014). There was evidence that proportion of women who had HIV prevention knowledge and who aware of HIV testing places had been very low (General Directorate of Statistics et al., 2018). These conditions possibly support the striking low percentage of HIV testing uptake among women aged 15-49 in Timor-Leste.

This study identified gaps in HIV testing among women who were never married women, low education level, unemployed, poor wealth, living in rural areas, who did not have comprehensive knowledge of HIV, who hold discriminatory attitudes towards PLHIV, and unempowered women in negotiation for safer sexual relations in Myanmar and Cambodia. In the Philippines, our results highlighted low HIV testing uptake among never married women, less educated, unemployed or non-professional jobs, poor wealth, and residing in rural areas. Our study also underlined actions need to increase HIV testing uptake among women who were never married, low education level, unemployed or working in agriculture, and poor knowledge of HIV in Timor-Leste.

Marital status is a significant determinant for HIV testing uptake. Ever married women were more likely to get tested for HIV in all four countries, and this finding was consistent with

the findings from previous studies (Lakhe et al., 2019; Nigatu et al., 2021; Pepito & Newton, 2020; Tenkorang & Owusu, 2010). This can be partly justified that ever-married women have more chances of being tested for HIV from prevention of mother-to-child transmission of HIV (PMTCT) services. The PMTCT program has been scaling up and achieved high coverage and made universal to all pregnant women especially in Myanmar and Cambodia to eliminate mother-to-child transmission of HIV.

Previous studies have reported that age is a significant predictor of HIV testing uptake among women (Gazimbi & Magadi, 2017; Takarinda et al., 2016). Out study highlighted low HIV testing uptake among adolescent girls (15-19 years) compared to older women (40-49 years) in Myanmar. Eighty six percent of women aged15-19 reported never having sexual intercourse in Myanmar (Ministry of Health and Sports - MoHS/Myanmar & ICF, 2017). It could be the reason for lower odds of HIV testing among adolescent girls compared to women aged 40-49 in Myanmar. However, it is very important to make effort to increase HIV testing uptake among youth including adolescents.

We found that HIV testing uptake was increased as their education levels of women increase. This finding is possibly due to an impact of sexual and reproductive health education program in schools, and women with higher education may access information about prevention and control of HIV infections. The finding was consistent with the findings from previous studies (Lakhe et al., 2019; Takarinda et al., 2016). Health education program about HIV/AIDS and reproductive health should also reach adolescent girls and young women who are out of school, and adult women in the community.

Economically empowered women can potentially make their own decision for their healthcare and access to health services. Overall, we found that women who did not work in

professional/technical/managerial jobs were less likely to be tested for HIV in Myanmar, Cambodia, the Philippines, and Timor-Leste. Our result emphasized HIV testing gaps among women working in agriculture in all four countries and unemployed women in the Philippines and Timor-Leste. Generally, the practice of farming takes place in rural areas where availability and accessibility to health services are challenging. There is an action needed to know why working women were not being tested for HIV.

We found that the respondents in the middle and above wealth quintiles were more likely to get tested than those in the poorest. This could be the fact that women who have assets may be more accessible to health care services. They can afford other costs incurred rather than HIV testing fees. The finding was in agreement with the results from previous studies (Lakhe et al., 2019; Nigatu et al., 2021; Pepito & Newton, 2020). There should be a mechanism taking place to cover out-of-pocket payments for getting an HIV test. Creating more job opportunities for women could potentially help to reduce the testing gap.

Consistent with a previous study, our result showed that respondents from rural areas were less likely to get tested than those from the urban areas in Myanmar, Cambodia, and the Philippines (Gazimbi & Magadi, 2017). However, the association was not significant in Timor-Leste. It could be the fact that there are few health facilities and under-staffed in rural remote and hard to reach areas in developing countries. Additionally, HIV testing centers are generally more available in urban areas, and areas populated with key populations. Therefore, women in the general population from rural areas may have poor availability and accessibility to HIV testing services. Recruiting and training of local community health workers for decentralization and mobile HIV testing services could make the services proximity to rural residences. HIV self-testing should be another alternative in countries that have not implemented it yet.

Although there was high proportion of women aged 15-49 who had regular exposure to mass media (TV, newspapers, magazines, radio), we did not find the significant independent association with HIV testing uptake, except in Cambodia. The finding was not consistent with the study's finding done in Ethiopia (Nigatu et al., 2021). It was possible that information about HIV and HIV testing services was not widely available in mass media, or the messages did not reach people. Having high prevalence of media exposure, HIV testing programs should use this as an opportunity to disseminate health messages strategically.

Comprehensive knowledge of HIV was a significant predictor for lifetime HIV testing uptake in Myanmar, Cambodia, and Timor-Leste. Our findings were consistent with the findings from the studies done in Kenya and Mozambique, and 8 sub-Sharan Africa countries in which prior HIV testing is positively associated with having comprehensive knowledge of HIV (Budu et al., 2021; Wang, Alva, & Wang, 2012). People who know ways to prevent getting infected with HIV and know healthy-looking person can have HIV infection may think that getting tested for HIV is important to stay uninfected and access to treatment if infected to stop further spread of HIV infection. Evidence of positive association between comprehensive knowledge of HIV and HIV testing uptake informs the policymakers and program implementers of the importance of continued and effective dissemination of health messages of HIV/AIDS, HIV testing services and the benefits of getting tested.

Our results showed that discriminatory attitude towards PLHIV was a significant barrier to getting tested for HIV, specifically in Cambodia. Our findings were supported by the findings from previous studies (Genberg et al., 2009; S. Hone et al., 2019; Smolak & El-Bassel, 2013). Possible reasons we found the opposite association among respondents in Timor-Leste might be due to low HIV testing prevalence and high proportion of respondents who have never heard of AIDS.

Discriminatory attitude towards PLHIV may discourage them to get tested for HIV to know their HIV serostatus. Strategies to eliminate discrimination toward PLHIV should be implemented in both community-initiated and provider-initiated approaches. Especially for women in the general population, the health education program including reducing HIV stigma and discrimination can be integrated into routine antenatal care services.

We expected that women who were intolerant to domestic violence would be more likely to get tested for HIV, but our analysis did not show any significant associations in Myanmar, Cambodia, and the Philippines. This finding was consistent with the result from previous studies done in the Philippines and sub-Saharan African countries (Pepito & Newton, 2020; Yaya et al., 2020). However, we found a significant negative association between disagreement over any reasons for wife beating and HIV testing among Timorese women. Although the percentage of women who reported that their disagreement over wife beating ranged from moderate to high in all four countries, except in Timor-Leste, it was not associated with HIV testing uptake - possibly, the variable we used is an indirect indicator of empowerment.

Our result showed that likelihood of HIV testing uptake was high among women who had a positive attitude towards negotiation for safer sexual relations with husbands in Myanmar and Cambodia. A previous study conducted in Nepal also highlighted a positive association between attitude towards safer sex negotiation and HIV testing uptake (Thapa et al., 2019). Women's empowerment to have their right to sexual and reproductive health decision making is necessary not only to increase HIV testing uptake but also to increase the health status of women.

Limitations and strengths

As with other studies, there are some limitations of the study that need to be considered. Since the findings were based on the cross-sectional survey data, we cannot ascertain the temporality of the reported associations. Hence, we cannot make causal interpretations. Lifetime HIV testing uptake can precede the potential predictors in individuals, for example, getting tested for HIV can provide an opportunity to get comprehensive knowledge of HIV. The results are based on self-reported behaviors. It is possible to have social desirability bias for sexual behaviors such as number of sex partners and history of STIs. As lifetime HIV testing uptake was predicted by the factors that could change over time, such as knowledge of HIV, discriminatory attitude, wealth index, interpretations should be made cautiously. Comparison of the estimates should be made with caution since the variables included in each regression analysis are not the same. Additionally, results from the pooled sample should be interpreted with caution since it combined data from four heterogenous countries. Low percentage of HIV testing uptake and small sample size in the Timor-Leste resulted in wide 95% confidence intervals.

Despite these limitations, our results are based on large and nationally representative samples of the selected countries. The pooled country sample provided more stable estimates. The DHS program provided high quality and reliable data. The sample design and implementation of the surveys reduced selection bias. The estimates were valid and nationally representative due to the application of the sampling weights. Comparison of indicators between countries was possible due to the use of standardized questionnaires.

Conclusion

In summary, our findings demonstrated how socio-economic and demographic factors could affect HIV testing uptake among women of reproductive age in four Southeast Asian countries. Since there are multidimensional factors that facilitate or impede HIV testing uptake, multisectoral collaboration of related sectors and organizations is necessary to uplift the socioeconomic status of women such as creating more economic and education opportunities.

Our study emphasized evidence that high knowledge of HIV and lack of discriminatory attitude towards PLHIV increase HIV testing among women. Therefore, it is important to take actions not only to improve comprehensive knowledge of HIV and the advantages of HIV testing but also to reduce discrimination to prevent transmission of HIV and access to treatment for women. Health education programs for HIV should reach youth who did not attain secondary and higher education where sexual and reproductive health education programs are generally provided. Peer-led or community-led health education approach can help to increase knowledge of HIV and reduce discriminatory attitudes towards PLHIV.

In addition to effective implementation of PMTCT services and decentralization of HIV testing services, it is critical to take actions for making HIV testing services available and accessible to women in rural areas. Furthermore, there is a need to empower women regarding autonomy in gender/sexual relation to make their own decision for safer sex and getting tested for HIV. Strategies to fill the gaps of HIV testing uptake should be context-specific depending on the nature of epidemic, organizational structure of health service delivery, available resources, and collaborations with related stakeholders, and importantly with community participation. A combination of these approaches can contribute to achieving the UNAIDS 95-95-95 targets by 2025 and ending AIDS epidemic by 2030.

CHAPTER 5

Conclusion

Countries are scaling up their HIV testing services to increase the coverage of HIV testing according to the nature of the HIV epidemic and available resources for health – human resources, financial resources, and infrastructure in the individual's country. Heterosexual transmission of HIV is still driving the HIV epidemic in Myanmar and other Southeast Asian countries. Women and girls are at risk of acquiring HIV infections from their male partners and can spread HIV infections to their children vertically. Awareness of HIV status is vital for women themselves and their children, partners, and families to get the HIV prevention and care continuum. Therefore, getting tested for HIV is critical for women.

In summary, our study highlighted the disparity in lifetime HIV testing uptake among women by their socioeconomic and demographic characteristics and their comprehensive knowledge of HIV in Myanmar, Cambodia, the Philippines, and Timor-Leste. HIV testing rates varied significantly between countries, and different factors predicted the HIV testing uptake of women in each country. Never married, no or primary education, poorest quintile of wealth index, working in agriculture, rural residency, and lack of comprehensive knowledge of HIV were negatively associated with lifetime HIV testing uptake among women in all selected Southeast Asian countries. Our study identified gaps in HIV testing uptake during ANC in Myanmar. Living in rural areas, being in the poorest wealth quintiles, having no comprehensive knowledge of HIV, having less than 4 ANC visits, and not receiving information about HIV impeded HIV testing uptake as part of ANC in Myanmar. HIV testing uptake was significantly different by the marital status in Myanmar.

In this study, we conducted complete case analyses assuming missing at random. Multiple imputation method would be next step to handle the missing data – generate 5 imputed data sets by filling in the missing values, run the multivariable logistic regression models with each of the imputed data sets, combine and average the results of the analyses from the 5 imputed data sets to get the estimates and standard errors. As we discussed in each study, there were shortcomings: lack of temporality, possible social desirability bias in reporting history of STIs, and cautious interpretation of the reported associations. Our study was comprehensive and nationally representative and used high-quality and reliable data sets.

Our study provided evidence that comprehensive knowledge of HIV was modest and consistently predicted both lifetime HIV testing uptake and HIV testing uptake during ANC visits. Thus, it is fundamental to promote health education campaigns for HIV. The health education campaigns for HIV should target women with low education, out-of-school women, and adolescent girls. The health messages should comprise comprehensive knowledge of HIV and mother-to-child transmission of HIV, advantages of HIV testing and PMTCT services, and address local misconceptions about HIV transmission and discrimination towards PLHIV. Simple informative health messages should be provided using local languages and disseminated effectively in a sustainable manner.

There is a need to increase the availability and accessibility of HIV testing services to rural communities through the decentralization of HIV testing services, use of trained lay health providers and local volunteers in HIV testing services and raising awareness of HIV knowledge. HIV self-testing with information for confirmatory testing of HIV and linkage to prevention and treatment for HIV should be made available to the general population as an option. Women who are not reached by the existing HIV testing services or who are reluctant to visit healthcare

facilities can test for HIV in private. Additionally, there should also be a financial assistance mechanism for women living in poverty to increase the accessibility of HIV testing and ANC services.

HIV testing services should be effectively integrated into other related healthcare services such as adolescent and reproductive health services, and maternal and child health services. It should be tailored to all sub-populations, especially youth. The interventions should be community-led or peer-led to have sustainable progress towards increasing HIV testing coverage in women. A multisectoral approach is also needed to create more educational and employment opportunities for women. The responses to HIV/AIDS epidemic need to be context-specific. A combination of these behavioral and structural interventions can contribute to staying on track for achieving HIV testing coverage in women by 2025 and leading an end of the AIDS epidemic by 2030.

APPENDIX

Appendix 1. Variables of interest and their definitions and coding

Variables of interest	Definition (questions in the survey)	Remarks/ recoding
Outcome variables		
Lifetime HIV testing uptake	I don't want to know the results, but have you ever been tested for HIV? (yes/no)	Missing values on receiving HIV test are coded as not tested, according to the guide to DHS statistics (Croft, 2018).
HIV testing as part of antenatal care	I don't want to know the results, but were you tested for HIV as part of your antenatal care? (yes/no)	Missing values on receiving HIV test are coded as not tested, according to the guide to DHS statistics (Croft, 2018).
Explanatory variables		
Socioeconomic and demographic characteristics		
Marital status	Current marital status	It was categorized into never in union, formerly in union, currently in union
Age	Age in years (completed)	It was grouped into 3 categories: 15-19, 20-24, 25-29, 30-39, 40-49 years.
Residence	Place of residence	Rural/Urban
Education level	Highest level of education	It was categorized into no education or primary, secondary, higher.
Occupation	What is your occupation? That is what kind of work do you mainly do?	Types of occupation were grouped into not working, agricultural, manual, non-manual, professional.
Wealth index	Wealth index in quintiles	As described in (Croft, 2018).
Exposure to mass media	Do you read/listen/watch a newspapers or magazines/the radio/ television, at least once a week, less than once a week or not at all?	At least once a week exposed to any media ais considered as regular exposure to that form of media.

		It was coded as yes if women consumed any form of media at least once a week; otherwise, no.
HIV related knowledge, attitudes toward PLHIV, and behaviors		
Comprehensive knowledge about HIV	1. Can people reduce their chance of getting HIV by having just one uninfected sex partner who has no other sex partners? 2. Can people reduce their chance of getting HIV by using condom every time they have sex? 3. Can people get HIV from mosquito bites? 4. Can people get HIV by sharing food with a person who has HIV? 5. Is it possible for a healthy-looking person to have HIV?	Comprehensive knowledge of HIV (yes/no) is a composite measure as described in (Croft, 2018). The respondents who know that consistent use of condoms during sexual intercourse and having just one uninfected faithful partner can reduce the chances of getting HIV: AND know that a healthy-looking person can have HIV; AND reject the two most common local misconceptions about transmission or prevention of HIV are defined as having comprehensive knowledge of HIV. Missing values and "don't know" responses were regarded as lack of knowledge.
Knowledge of prevention of mother-to-child transmission	Can HIV be transmitted from a mother to her baby: a) During pregnancy? b) During delivery? c) By breastfeeding? Are there any special drugs that a doctor or a nurse can give to a woman with HIV to reduce the risk of transmission to the baby?	It is a composite measure (yes/no). Knowing that HIV can be transmitted from mother to child during pregnancy, during delivery, and by breastfeeding; AND knowing that the risk of mother-to-child transmission can be reduced by the mother taking special drugs were coded as having knowledge.
Discriminatory attitude toward PLHIV	Would you buy fresh vegetables from a shopkeeper or vendor if you knew that this person had HIV?	Respondents who said "no" to the question were coded as having the discriminatory attitude (yes); otherwise, no. "Don't know/Not sure/Depends" and missing were

		coded as not having discriminatory attitude (no). Note: Women who have never heard of AIDS were assumed not having discriminatory attitudes towards PLHIV.
Awareness of HIV testing services	Do you know a place where people can go to get an HIV test?	Respondents who said "yes" to that question or "yes" to the question, have you ever been tested for HIV, were coded as yes; otherwise, no.
Age at first sexual intercourse	How old were you when you had sexual intercourse for the very first time?	It was coded as never had sex, <18, 18-20, 20+ years. The inconsistent response was filled in with age at first cohabitant.
Total lifetime number of sex partners	In total, with how many different people have you had sexual intercourse in your lifetime?	It was coded as 1, 2, 3+. Don't know response was coded as missing. (Note: this variable was not available in MDHS dataset)
History of an STI or symptoms of an STI	1. Now I would like to ask you some questions about your health in the last 12 months. During the last 12 months, have you had a disease which you got through sexual contact? 2. Sometimes women experience a bad-smelling abnormal discharge. During the last 12 months, have you had a bad-smelling abnormal discharge? 3. Sometimes women have a genital sore or ulcer. During the last 12 months, have you had a genital sore or ulcer?	Respondents who said "yes" to at least one of these questions will coded as having self-reported STI or symptoms of an STI in the last 12 months. Don't know and missing were coded as "no" assuming not having STIs. Note: Women who have never had sex were assumed not having STIs. (Note: this variable was not available in NDHS dataset)
ANC information		

Having ANC < 4 months of pregnancy	How many months pregnant were you when you first received antenatal care for this pregnancy?	Respondents who had their ANC visits within the first trimester of pregnancy were coded as yes; otherwise, no.
Having at least 4 ANC visits	How many times did you receive antenatal care during this pregnancy?	Having at least 4 ANC visits was coded as yes; otherwise, no.
Counseling on HIV during antenatal care	During any of the antenatal visits for your last birth, were you given any information about: a) Babies getting HIV from their mother? b) Things that you can do to prevent getting HIV? c) Getting tested for HIV?	Counseling was defined that someone talking with the respondents about all three of the following topics: a) babies getting HIV from their mother, b) preventing the virus, and c) getting tested for HIV (Croft, 2018). "Yes" to all three topics will be coded as received counseling.
Women's empowerment		
Disagreement over all of the reasons for wife beating	In your opinion, is a husband justified in hitting or beating his wife in the following situations: a) If she goes out without telling him? b) If she neglects the children? c) If she argues with him? d) If she refuses to have sex with him? e) If she burns the food?	Respondents who said "no" to all of the five questions were coded as yes; otherwise, no.
Negotiation for safer sex	Attitude towards negotiating safer sexual relations with husband. 1. Agrees that a wife is justified to ask husband to use condom if husband has an STI. 2. Agrees that a wife is justified in refusing to have sex with her husband if she knows that he has sex with other women.	A wife can negotiate safer sex if the respondent says "yes" to one of the two questions (Misha, Medley, Hong, Gu, & Robey, 2009).

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