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Factors associated with HIV testing among young men who have sex with men in Myanmar: a cross-sectional study

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Abstract

Introduction: In Myanmar, men who have sex with men (MSM) experience high risk of HIV infection. However, access to HIV testing and prevention services remains a challenge among this marginalized population. The objective of this study was to estimate population prevalence and correlates of prior HIV testing among young MSM (YMSM) and informs the development of HIV testing and intervention programmes that respond to the specific needs of this population.

Methods: Five hundred and eighty-five YMSM aged 18 to 24 years were recruited using respondent-driven sampling (RDS) in a cross-sectional survey conducted in six townships of Myanmar. RDS-adjusted population estimates were calculated to estimate prevalence of HIV testing; RDS-weighted logistic regression was used to examine correlates of HIV testing in the past 6 months and in a lifetime.

Results: There were 12 participants who reported receiving a HIV-positive test; of those, five were tested in the past 6 months. The RDS-weighted prevalence estimates of lifetime (any prior) HIV testing was 60.6% (95% CI: 53.3% to 66.4%) and of recent (≤ 6 months) HIV testing was 50.1% (95% CI: 44.1% to 55.5%). In multivariable analysis, sexual identity was associated with lifetime but not recent HIV testing. Lifetime and recent HIV testing were associated with having three or more male sexual partners in the past 12 months (adjusted ORs (aORs) = 2.28, 95% CIs: 1.21 to 4.32 and 2.69, 95% CI: 1.59 to 4.56), having good HIV-related knowledge (aORs = 1.96, 95% CIs: 1.11 to 3.44 and 1.77, 95% CI: 1.08 to 2.89), reporting high HIV testing self-efficacy (aORs = 13.5, 95% CIs: 6.0 to 30.1 and 9.81, 95% CI: 4.27 to 22.6) and having access to and use of non-HIV health-related services in the past 12 months (aORs = 13.2, 95% CIs: 6.85 to 25.6 and 7.15, 95% CI: 4.08 to 12.5) respectively.

Conclusions: HIV testing coverage among YMSM aged 18 to 24 years old in Myanmar is still suboptimal. Integrated HIV testing and prevention services in existing health service provision systems with tailored HIV information and education programmes targeting YMSM to improve HIV-related knowledge and self-efficacy may help to promote regular HIV testing behaviour and contribute to sustainable control of the HIV epidemic among this marginalized population in Myanmar.

Keywords: HIV testing; young people; men who have sex with men; respondent-driven sampling; Myanmar

1 | INTRODUCTION

Globally, gay men and other men who have sex with men (MSM) are among the key populations disproportionately affected by HIV/AIDS [1–3]. Published data have shown that young MSM (YMSM) are highly vulnerable to HIV [4,5]. Stigma, discrimination and limited access to sexual and reproductive health services have been cited as key determinants of the HIV epidemic among this population in low-, middle- and high-income countries [6–8]. Availability of and access to HIV testing among MSM, as with other key populations, represents a global challenge. The magnitude of the problem, however, is much more prevalent in low- and middle-income countries (LMICs) due to a combination of structural factors

such as criminalization, social exclusion and inadequate resources allocated to HIV prevention [9–11].

Young people are vulnerable to HIV infections; however, due to lack of access to HIV prevention information, lack of and/or limited availability of youth-friendly HIV services, HIV testing coverage among adolescent and young people is significantly lower than that among adult populations. Survey data in sub-Saharan African countries in the 2005 to 2010 period showed that only 10% men and 15% women aged 15 to 24 years were aware of their HIV status [12]. Studies among youth in different settings have shown that younger age was independently associated with never being tested for HIV [13–15]. Young key populations (people who inject drug (PWIDs), female sex worker (FSWs), MSM) face additional

barriers in accessing HIV-related services due to social stigma, discrimination and criminalization. Fear of consequences associated with disclosure of behaviour and HIV status make many young people from key populations reluctant to attend HIV services. As a result, the MSM population remains hidden populations from HIV intervention programmes [16]. Therefore, young people of key populations are less likely to have access to and use of HIV services compared to their peers in the general population. Existing evidence suggested that young FSWs, PWIDs and MSM were also less likely to have ever tested for HIV or have tested less frequently compared to their peers of older age [17–19]. These studies finding indicated that a sustained focus on HIV research, policy and intervention for adolescent and young key populations is required if the goal of ending the global HIV epidemic is to be achieved [20].

Global studies on factors associated with HIV testing among MSM have shown that poor HIV testing uptake associated with a number of individual factors including low HIV-related knowledge, low HIV risk perception, low perceived behavioural control, fear of positive test result and its consequences, perceived discrimination and internalized homophobia [21]. However, the majority of studies were conducted in high-resource, developed countries such as Australia [22], United Kingdom [23], Hong Kong [24], Italy [25] and USA [26–30], and other studies were conducted in upper middle-income countries[1] including Mexico [31], South Africa [32,33] and China [34–36]. Data from low- or lower middle-income countries are sparse. In addition, studies on peer-led interventions to improve HIV testing among MSM [37] also revealed that intervention studies among MSM were mostly conducted in high-resource settings and the authors concluded that more high-quality studies are needed to assess effects of interventions in low-resource settings. The data from these studies suggested that there is a knowledge gap, and research among MSM in different cultures is needed to develop culturally sensitive programmes that address barriers in access to HIV services among MSM populations particularly young MSM to ensure successful response to the global epidemic [38].

Myanmar is a lower middle-income country which has a concentrated HIV epidemic with a low prevalence of 0.4% among the general population. The majority of new infections occur among key populations including FSWs, PWIDs and MSM. The estimated national HIV prevalence among MSM was 11.6% but highly variable across cities/regions; for example, data from the integrated biological and behavioural (IBBS) survey among MSM in five cities in Myanmar showed that HIV prevalence among MSM ranging from 6% in Pyay to 27% in Yangon [39]. The proportion of MSM newly diagnosed with HIV continues to increase, with YMSM experiencing HIV at a rate five times higher than that of their counterparts in the general population [40]. A recent study suggests MSM in Myanmar are engaging in sexual risk behaviours similar in magnitude and practices to MSM in high-income countries [41]. Although Myanmar's National Strategic Plan on HIV/AIDS 2011 to 2015 has prioritized HIV prevention interventions targeting key populations, access to HIV testing and prevention services remains a challenge for MSM. This is particularly a challenge for YMSM due to the criminalization of MSM and lack of social, health and education services responding to their unique needs [42–44].

In order to address this challenge, Link Up, a global consortium led by the International HIV/AIDS Alliance, implemented a combined community-based peer education and clinic-based service improvement intervention to address the sexual and reproductive health and rights of YMSM in Myanmar. The intervention commenced in October 2014, and an evaluation was conducted 6 months after implementation by Burnet Institute in collaboration with Population Council. Details of the Link Up intervention and evaluation have been reported elsewhere [45]. Briefly, the intervention included two components: (i) peer education and outreach and (ii) clinic-based services. Trained peer educators conducted outreach activities providing individual and group education and counselling on health promotion, HIV and sexually transmitted infections (STIs), gender, sexuality and gender-based violence and made referrals for HIV counselling and testing (HCT), STIs screening and treatment and psychological support. Peer educators also referred clients to appropriate services and followed up with clients when needed. At clinics, operated by Marie Stopes International (MSI), integrated MSM-friendly sexual and reproductive health services were provided. These services included, but were not limited to, HIV/STI counselling, testing and treatment with psychosocial and harm reduction support.

This analysis, using data from the evaluation study, examines the prevalence and correlates of HIV testing among YMSM and provides recommendations for targeted interventions to improve access to and uptake of HIV testing among YMSM in Myanmar.

2 | METHODS

2.1 | Study population

The evaluation study of the Link Up intervention was conducted in six townships of Myanmar: Pathein, Mawlamyine, Bago, Kalay, Magwe and Thanlyin. These selected study sites were comparable in terms of: (i) population size (about 250,000); (ii) size of government hospital (about 100 beds); (iii) presence of a sexual reproductive health clinic and/or a drop-in centre and (iv) presence of a large outreach HIV prevention programme for key populations operated by MSI. The study population consisted of YMSM, aged 18 to 24 years, who self-reported having had sexual intercourse with other men in the past 6 months, and who lived in or around the study site during the study period.

2.2 | Data collection

For the evaluation study, a sample size of 572 was required across the six study sites. This was based on an estimated HIV testing coverage of 48% among MSM before the intervention, an expected increase of 15 percentage points after intervention, a design effect of 1.4 and an expected 10% non-response rate.

Study participants were recruited between April and early June 2015 using respondent-driven sampling (RDS). This sampling method was selected due to the hidden and marginalized nature of the population under observation [46]. Seed participants were identified and recruited with the assistance of community outreach workers from a local community-based organization working with MSM in study sites - the Myanmar

Business Coalition on AIDS (MBCA). Initially, four seed participants from each township were selected based on self-reported sexual identities, connection to MSM networks and peers, regardless of their HIV status. Seeds were given three recruitment coupons each and asked to recruit study participants from their MSM peer networks, where subsequent recruits were then asked to recruit three other peers using recruitment coupons. Coupons were valid for 2 weeks from the day they were distributed to recruiters and recruitment continued until the sample size was reached.

The study questionnaire was adapted from a validated one previously used in an MSM sexual health study in Kenya [47]. The questionnaire was translated from English into Myanmar language and was validated by Burnet researchers who are Myanmar nationals and fluent in both English and Myanmar language with the assistance of a native English-speaking research manager. After the translation, a meeting among investigators was held to review English and Myanmar versions of the questionnaire to ensure clarity and consistency between the two versions. The questionnaire was revised and finalized after field testing in mock interviews with local MSM.

Questionnaires were administered at data collection sites, which were carefully selected by local outreach workers and MSM to ensure privacy. Face-to-face interviews were conducted in Myanmar language by trained data collectors who were members of the MSM community. Data were collected and stored electronically using Mobile Data Studio (MDS) software version 7.0 (CreativityCorp Pty Ltd., Perth, Australia).

During the data collection, due to the slowing in recruitment rate, nine extra seeds were added making a final number of 33 seeds by the end of the study. In addition, 31 participants who successfully recruited three others were given two additional coupons to boost the recruitment process. A total of 1455 coupons were distributed and 830 (57%) valid coupons were returned by potential participants. Potential participants with valid coupons were screened for eligibility by members of the data collection team. MSM who were older than 24 or younger than 18 (82 subjects) and who had not had sexual intercourse with another man in the past 6 months (163 subjects) were excluded. Following screening, participants were provided with information about the evaluation study and asked to give their consent to participate. A total of 585 participants who met all inclusion criteria and gave written informed consent were enrolled into the study, completed interviews and included in this analysis.

The greatest length of recruitment waves was 9 and the average number of recruitment waves per seed was 4.1. Forty-nine percent (16/33) of the seeds recruited 81% (477/585) of the total sample, one seed did not recruit any participants and the maximum number of recruits from a single seed was 55. Participants were given approximately US$4 for participating in the study (primary compensation) and an additional US$1 for each person they successfully recruited into the study (secondary compensation). This level of incentive was deemed to be appropriate, given the average income in Myanmar (minimum daily wage of approximately US$3), to compensate participants for their time and efforts to participate in the study without negative impacts on the validity of data they provide.

2.3 | Study measures

Questionnaires obtained *socio-demographic* information including age, highest level of education completed, ethnicity, religion, marital status and occupation.

Sexual identity was measured by participants' responses to the question "How would you describe your sexual identity? Or what word would you use to describe your sexual identity?" There were three sexual identities including: (i) *Tha-nge* or "young boy" in Myanmar language, who are mostly non-gay identified often insertive partners, not effeminate and generally engage sexual relationships with the other two types of MSM; (ii) *Apone* or "non gay-identified" are mostly not effeminate, and tend to be receptive partners; (iii) *Apwint* or "gay-identified" broadly transgender women who are biologically born as male but openly dress and act like women and often tend to be the receptive partner.

Personal network size was identified using the following questions "How many MSM do you think live in or around this township?," "How many other MSM do you know by name who live in or around this township AND you know how to contact them?," "How many of them have you seen or met in the last one month?," "Of those, how many do you think are 18 years of age and older?" and "Among those acquaintances, how many would you consider to recruit into this study?" Personal network size was determined by participants' responses to the last question.

History of HIV testing was assessed via the following questions "Have you ever been counselled for and received an HIV test at a health facility or volunteer counselling and testing (VCT) centre?" and "When did you have your most recent HIV test?." Those reporting prior HIV counselling/testing were asked for the name of the facility from which they received their most recent HIV test. Those with no HIV testing history were asked for the reasons they have not gone for testing.

Sexual risk behaviours were assessed through self-reported number of sexual partners in the past 12 months; unprotected (condomless) anal or vaginal sex with male/female partners and having sex with other men/women for money (selling sex) in the past 30 days.

HIV-related knowledge was measured by the following questions "Can people protect themselves from HIV by abstaining from sexual intercourse?," "Can people protect themselves from HIV by using condom correctly every time they have sex?," "Can a person get HIV from mosquito bites?," "Can people protect themselves from HIV by having one uninfected faithful sex partner?," "Can a person get HIV from unprotected anal sex?" and "Can a person get HIV by getting an injection from a needle that was already used by someone else?" Participants who answered all of the above questions correctly were categorized as having good HIV knowledge.

Access to HIV education and use of health services were measured based on self-reported visits and access to non-HIV health-related services at clinics or drop-in centres in the past 12 months and having contact with a peer educator in the past 12 months.

History of violence and sexual abuse were assessed through three separate questions asking how many times study participants experienced verbal, physical or sexual abuses in the past 12 months (e.g. "In the past 12 months, how many times have you had verbal insults directed at you because someone

believed you have sex with other men?"). Participants who reported at least one time being a victim of verbal or physical abuse because of their sexual orientation were categorized as having experienced violence. Participants who reported at least one time being sexually assaulted or raped were categorized as having experienced sexual abuse ("In the past 12 months, how many times did anyone force you to have sex with them by sexually assaulting or raping you?").

Psychosocial factors included reported HIV testing self-efficacy and disclosure of sexual behaviour to others (e.g. parents, siblings, relatives, female sexual partners, MSM and friends who are not a sexual partner). Self-efficacy was assessed via respondent's Likert scale responses to the statements: "I feel confident that I could locate a place where I can get tested for HIV" and "I feel confident that I could get tested for HIV." Participants who agreed or strongly agreed to both of these statements were considered to have high self-efficacy. Disclosure of sexual behaviour to others was assessed via the question "Did you reveal to others that you have sex with other men?."

Other measurements include reported frequency of *alcohol consumption* "How often do you have a drink containing alcohol?"; *history of drug use* (e.g. "Some people have tried injecting drugs using a syringe or needle. Have you injected drugs in the last 12 months?") and *self-reported STI symptoms in the past 12 months* (any STI symptoms including discharge from penis, discharge from anus, genital ulcer on penis, anal ulcer or sore, ulcer in the throat and burning pain on urination).

2.4 | Statistical analysis

Data from all recruited seeds (n = 33) and all waves of recruitment (in and out-of-equilibrium data) were included in the final RDS estimates. RDS-weighted descriptive analyses using RDS estimator I were undertaken to present characteristics of the study population. RDS weights were generated based on recruiters and self-reported network size using Stata's user written commands for analysis of RDS surveys with 95% confidence intervals obtained from bootstrapped standard errors to reflect dependence in the sampling process [48]. For RDS-weighted analyses, assessments of convergence for all analysis variables were performed taking into account respondent's network size to ensure that key underlying assumptions of RDS were met [46]. Equilibrium point (required referral length until convergence) for key outcomes of interest "Ever tested for HIV" and "Tested for HIV in the past 6 months" was four.

Earlier RDS research has suggested to exclude seeds and several published studies have discarded seeds from analysis [49,50]. However, simulation studies have demonstrated the robustness of RDS estimators against the inclusion of seeds data and have showed that the removal of out-of-equilibrium data may introduce greater bias [51,52]. There were 12 participants including one seed who reported being HIV positive. Except for the HIV-positive seed, the 11 other positive participants were recruited from nine different HIV-negative seeds. Given the small number of HIV-positive participants, the random recruitment of participants irrespective of HIV status and to keep the sampling structure and recruitment matrix intact [53], all of these positive participants were included in the final analyses. Sensitivity analyses were conducted to assess the impact of seeds and self-reported HIV-positive participants on final RDS estimates for key outcomes of interest.

For regression analysis with RDS data, it is recommended that when results derived from unweighted and weighted analyses are similar, use of weighting procedure in regression models is not necessary [54,55]. In our analysis, there were marked differences in the results of unweighted and weighted analyses. As such, bivariate and multivariable regression results reported here were estimated using individualized RDS weighting with robust standard errors to adjust for the lack of independence in observations of an RDS sample. Covariates were selected into multivariable models if individually associated with HIV testing in bivariate analyses at $p \leq 0.1$. Statistical significance was assessed at the 5% level.

All statistical analyses were performed using Stata version 13.1 (STATA Corp, College Station, TX, USA).

2.5 | Ethical considerations

All participants received a detailed explanation of the study and were asked to provide written informed consent prior to enrolment. The study was approved by the Department of Medical Research Ethics Review Committee (Yangon, Myanmar), the Population Council Institutional Review Board (New York, USA) and The Alfred Hospital Human Research Ethics Committee (Melbourne, Australia).

3 | RESULTS

The majority of participants self-identified as being Myanmar ethnicity (90.9%), Buddhist (91.4%) and had completed middle school or higher (78.9%; Table 1). Nearly three quarter of YMSM (70.9%) considered themselves as *Tha-nge* (non gay-identified, insertive partner). The median number of male partners in the past 12 months was 4 (IQR: 2 to 8), and 29.2% of YMSM reported having had unprotected sex in the past 30 days. Nineteen percent (18.9%) reported being stigmatized because of their sexual orientation, and 11.9% had been a victim of sexual abuse in the past 12 months.

RDS-weighted estimations show that 60.6% (95% CI: 53.3% to 66.4%) of YMSM had ever tested for HIV in their lifetime and 50.1% (95% CI: 44.1% to 55.5%) had their latest test in the past 6 months (Table 2). Fifty-four percent (53.9%, 95% CI: 46.0% to 60.4%) had accessed non-HIV health-related services and 47.2% (95% CI: 41% to 52.9%) had contact with a peer educator at least once in the past 12 months. A third of YMSM (36.6%, 95% CI: 31.7% to 41.6%) had good HIV-related knowledge and 19.9% (95% CI: 16.1% to 24.2%) reported having STI symptoms in the past 12 months. Sensitivity analyses suggest that the exclusion of seeds (n = 33) from RDS-weighted estimates for key outcomes of interest resulted in slightly different point estimates with very much overlapping, but wider, 95% confidence intervals: 58.2% (95% CI: 51.3% to 65.4%) for "Ever tested for HIV" and 50.5% (95% CI: 44.4% to 57.5%) for "Tested for HIV in the past 6 months." Similar results were found when the 12 HIV-positive participants were dropped from the RDS analysis.

The majority (80%) of study participants who had been tested for HIV in their lifetime received their most recent HCT services from NGO-operated health facilities (MSI clinic,

Table 1. Characteristics of YMSM (aged 18 to 24 years[a]) from six townships in Myanmar

Variables	RDS-unadjusted[b]		RDS-adjusted[c]	
	n/N	%	%	95% CI
Socio-demographics				
Education, highest level completed				
Primary or lower	54/583	9.2	10.5	7.13 to 14.0
Middle or high school	412/583	70.7	68.4	63.1 to 73.4
University or higher	117/583	20.1	21.1	16.6 to 26.1
Ethnicity				
Myanmar	526/576	91.3	90.9	87.4 to 94.0
Others (Mon, Shan, Chin, Kayin)	50/576	8.7	9.1	6.0 to 12.6
Religion				
Buddhist	536/585	91.6	91.4	88.1 to 94.3
Muslim	21/585	3.6	3.6	1.7 to 6.0
Other (Christian, Hindu, no religion)	28/585	4.8	5.0	2.9 to 7.5
Marital status				
Single	486/581	83.7	85.2	81.6 to 88.6
Committed to a man as married	70/581	12.0	10.2	7.5 to 13.3
Currently/formally married to a woman	25/581	4.3	4.6	2.9 to 6.4
Occupation				
Current professional employment	199/584	34.1	28.1	23.0 to 33.0
Current non-professional employment	250/584	42.8	48.5	42.4 to 54.3
Unemployed	135/584	23.1	23.4	18.5 to 28.4
Sexual identity				
Apone (hidden, receptive)	79/585	13.5	9.9	6.7 to 13.6
Apwint (open, receptive)	169/585	28.9	19.1	14.4 to 24.1
Tha-nge (masculine, insertive)	337/585	57.6	70.9	64.4 to 77.6
Sexual risk behaviour				
Number of male sexual partners in the last 12 months[d], median (IQR)	4 (2 to 8)	-	-	-
Having sex with other men/women for money in last 30 days	96/585	16.4	15.7	12.1 to 19.7
Having any unprotected vaginal/anal intercourse in the last 30 days	175/585	29.9	29.2	24.9 to 34.1
Alcohol consumption				
Never	208/585	35.6	32.0	27.0 to 37.3
≤4 times per month	313/585	53.5	57.0	52.4 to 61.9
≥2 times per week	64/585	10.9	11.0	7.7 to 14.4
Illicit drug use (lifetime)				
Have ever used (any) drug	149/585	25.5	25.3	20.3 to 31.0
Have used Marijuana	45/585	7.7	9.0	6.1 to 12.1
Have used Amphetamine	27/585	4.6	4.9	2.9 to 7.3
Have used Heroin/Cocaine	12/585	2.1	2.5	1.1 to 4.3
Injecting drug in the past 12 months (among those have ever used any drug)	10/149	6.7	7.4	2.3 to 14.0
History of violence and sexual abuse because of sexual orientation				
Experienced violence in the last 12 months	119/585	20.3	18.9	14.9 to 22.9
Experienced sexual abuse in the last 12 months	69/585	11.8	11.9	8.8 to 15.4
Psychosocial factors				
Disclosed sexual orientation to others[e]	405/585	69.2	67.5	62.2 to 71.8
Reported high self-efficacy	486/580	83.8	80.7	76.4 to 84.9

YMSM, young men who have sex with men; RDS, respondent-driven sampling.

[a]Age distribution of the sample (n) was 74, 128, 91, 70, 80, 74 and 68 for participant's age from 18 to 24 years respectively.

[b]RDS-unadjusted sample estimates. Percentages reported are of the total sample except otherwise noted.

[c]RDS-adjusted population estimates using STATA commands for analysis of respondent-driven sampling with 95% CI obtained applying bootstrapping approach. Percentages reported are of the total sample except otherwise noted.

[d]Including regular, non-regular sex partners and paying male clients (who paid money in exchange for sexual acts).

[e]Others including parents/sibling, MSM or female friends who is not a sexual partner, female sexual partners.

Table 2. Characteristics of YMSM aged 18 to 24 years from six townships in Myanmar as related to health and HIV services

Variables	RDS-unadjusted[a]		RDS-adjusted[b]	
	n/N	%	%	95% CI
Access to and use of health-related education or service programme				
Have visit and received non-HIV health-related services from a clinic or a drop-in centre in the last 12 months	369/585	63.1	53.9	46.0 to 60.4
Have contact with peer educator in the last 12 months	309/584	52.9	47.2	41.0 to 52.9
HIV testing history				
Ever tested for HIV	410/585	70.1	60.6	53.3 to 66.4
Tested for HIV in last 6 months	332/585	56.8	50.1	44.1 to 55.5
HIV-related knowledge				
Have good HIV-related knowledge	217/572	37.9	36.6	31.7 to 41.6
Reported STI prevalence				
Self-reported having STIs symptoms in the last 12 months	106/585	18.1	19.9	16.1 to 24.2

YMSM, young men who have sex with men; RDS, respondent-driven sampling.
[a]RDS-unadjusted sample estimates.
[b]RDS-adjusted population estimates using STATA commands for analysis of respondent-driven sampling with 95% CI obtained applying bootstrapping approach.

Table 3. Point of service utilization and perceived barriers to HIV testing among YMSM (aged 18 to 24 years) from six townships in Myanmar

Variables	n	%[a]
Place of most recent HIV counselling/testing		
Gvt hospital	35	8.5
National AIDS Programme	11	2.7
MSI clinic	129	31.5
PSI TOP DIC	178	43.4
Private clinic	33	8.0
Other (local CBO/NGO)	24	5.9
Reasons for not having HIV test		
Afraid of learning HIV status	34	21.0
Knows/trusts self	95	58.6
Knows/trust partners	11	6.8
No money for test	4	2.5
Do not know a place to get test	24	14.8
Feel healthy/not sick	34	21.0

YMSM, young men who have sex with men.
[a]RDS-unadjusted sample estimates, denominators are numbers of respondents who reported lifetime HIV testing (N = 410) and who never been tested for HIV and provided reasons for not having an HIV test (N = 162).

PSI drop-in centre and local community-based organizations; Table 3). The most frequently listed reason for not having an HIV test was "know/trust self" (58.6%) followed by "afraid of learning HIV status" or "feeling healthy/not sick" (21.0%) and "do not know a place to get test" (14.8%).

RDS-weighted bivariate analysis shows that education, religion, unprotected (condomless) sexual intercourse, drug use, experience of violence and sexual abuse and self-reported STI symptoms were not significantly associated with history of HIV testing (Table 4).

In RDS-weighted multivariable analyses (Table 4), when adjusted for other covariates in the model, selling sex to others in the past 30 days, alcohol consumption, disclosure of sexual behaviour to others and having contact with a peer educator in the past 12 months were no longer found to be associated with HIV testing. Sexual identity (*Apwint* gay-identified MSM) was associated with lifetime, but not recent, HIV testing while having three or more male partners in the past 12 months and having good HIV-related knowledge were independently associated and showed higher odds of having a lifetime as well as a recent HIV test. Visits to, and having received, non-HIV health-related services from health clinics or drop-in centres in the past 12 months, and reporting high HIV testing self-efficacy were strongly associated with prior HIV testing. The odds of having HIV tested in a lifetime for participants who reported high self-efficacy and who had access to, and use of, non-HIV health-related services was 13 times that of their counterparts who reported low self-efficacy and had no access to services (aORs: 13.5 and 13.2, 95% CIs: 6.0 to 30.1 and 6.85 to 25.6 respectively). Similarly, the odds of having a recent HIV test were 10 times higher for participants who reported high self-efficacy and seven times higher for participants who reported having access to non-HIV health-related services.

4 | DISCUSSION

Findings of this study showed that HIV testing among YMSM in Myanmar is still suboptimal. Facilitators of HIV testing among this population included having three or more male sexual partners, good HIV-related knowledge, reported high self-efficacy and use of health services. Low perceived risk of HIV infections, fear of positive test results and not knowing a

Table 4. Factors associated with prior HIV testing among young MSM in Myanmar (bivariate and multivariate logistic regression using individualized weight for dependent variable with robust standard errors adjusting for clustered sampling), N = 546

Independent variables	Ever tested for HIV		Tested for HIV in the past 6 months	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[a]	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[c]
Demographic characteristics				
Education				
Primary or lower (ref)	1.0	-	1.0	-
Middle or high school	0.98 (0.49 to 1.98)	-	0.97 (0.51 to 1.85)	-
University or graduate	0.89 (0.41 to 1.96)	-	0.83 (0.40 to 1.71)	-
Ethnicity				
Myanmar (ref)	1.0	1.0	1.0	1.0
Other	3.93 (1.49 to 10.4)[d]	4.79 (0.80 to 28.7)	2.24 (1.11 to 4.53)[d]	1.76 (0.58 to 5.37)
Religion				
Buddhist (ref)	1.0	-	1.0	-
Other	1.48 (0.67 to 3.29)	-	0.99 (0.50 to 1.93)	-
Marital status				
Single (ref)	1.0	1.0	1.0	1.0
Committed to a men as married	2.78 (1.34 to 5.77)[d]	2.68 (0.78 to 9.18)	2.02 (1.13 to 3.64)[d]	1.78 (0.77 to 4.11)
Currently/formally married to a woman	1.49 (0.56 to 3.94)	2.31 (0.52 to 10.2)	0.72 (0.31 to 1.65)	1.14 (0.29 to 4.39)
Occupation				
Unemployed (ref)	1.0	1.0	1.0	1.0
Professional	2.76 (1.56 to 4.87)[d]	1.37 (0.59 to 3.15)	1.89 (1.15 to 3.11)[d]	1.07 (0.54 to 2.15)
Non-professional	1.08 (0.67 to 1.74)	1.55 (0.71 to 3.35)	1.14 (0.71 to 1.81)	1.44 (0.76 to 2.74)
Sexual identity				
Tha-nge (non gay-identified, insertive) (ref)	1.0	1.0	1.0	1.0
Apwint (gay-identified, receptive)	8.25 (4.53 to 15.0)[d]	**3.11 (1.21 to 8.04)[d]**	3.71 (2.38 to 5.77)[d]	1.22 (0.59 to 2.51)
Apone (non gay-identified, receptive)	3.93 (1.85 to 8.33)[d]	1.96 (0.89 to 4.34)	3.16 (1.70 to 5.90)[d]	1.96 (0.92 to 4.20)
Sexual risk behaviours				
Number of male sexual partner in the past 12 months[a]				
1 to 2 (ref)	1.0	1.0	1.0	1.0
≥3	2.09 (1.38 to 3.17)[d]	**2.28 (1.21 to 4.32)[d]**	2.63 (1.77 to 3.93)[d]	**2.69 (1.59 to 4.56)[d]**
Having sex with other men/women for money in past 30 days				
Yes	1.55 (0.86 to 2.80)[e]	0.79 (0.34 to 1.82)	1.55 (0.93 to 2.60)[e]	1.03 (0.52 to 2.07)
No (ref)	1.0	1.0	1.0	1.0
Having any unprotected vaginal/anal sex acts in the past 30 days				
Yes	1.25 (0.80 to 1.94)	-	1.13 (0.76 to 1.69)	-
No (ref)	1.0	-	1.0	-
Substance use				
Drinking alcohol				
≥2 times per week	0.36 (0.19 to 0.69)[d]	0.78 (0.33 to 1.82)	0.32 (0.17 to 0.61)[d]	0.58 (0.25 to 1.38)
≤4 times per month	0.74 (0.47 to 1.16)	1.36 (0.65 to 2.84)	0.66 (0.44 to 0.99)[d]	0.85 (0.48 to 1.53)
Never (ref)	1.0	1.0	1.0	1.0
Using drug[b] in past 12 months				
Yes	1.01 (0.64 to 1.59)	-	0.78 (0.51 to 1.19)	-
No (ref)	1.0	-	1.0	-
History of violence and sexual abuse because of sexual orientation				
Experienced violence in the past 12 months				
Yes	1.44 (0.85 to 2.45)	-	1.31 (0.83 to 2.09)	-
No (ref)	1.0	-	1.0	-
Experienced sexual abuse in the past 12 months				
Yes	1.06 (0.56 to 1.97)	-	1.37 (0.77 to 2.47)	-
No (ref)	1.0	-	1.0	-

Table 4. (*Continued*)

Independent variables	Ever tested for HIV		Tested for HIV in the past 6 months	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[a]	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[c]
Psychosocial factors				
Disclose sexual orientation to others				
Yes	1.64 (1.07 to 2.49)[d]	0.84 (0.45 to 1.60)	1.72 (1.15 to 2.56)[d]	1.04 (0.61 to 1.78)
No (ref)	1.0	1.0	1.0	1.0
Reported high self-efficacy (Feeling confident to locate a place and confident to get tested for HIV)				
Yes	21.6 (11.6 to 40.5)[d]	**13.5 (6.0 to 30.1)**[d]	25.3 (11.2 to 57.2)[d]	**9.81 (4.27 to 22.6)**[d]
No (ref)	1.0	1.0	1.0	1.0
Access to HIV education and use of health service programme				
Had visit and received non-HIV heath related services from a clinic or a drop-in centre in the past 12 months				
Yes	29.5 (17.0 to 51.1)[d]	**13.2 (6.85 to 25.6)**[d]	16.2 (10.2 to 25.7)[d]	**7.15 (4.08 to 12.5)**[d]
No (ref)	1.0	1.0	1.0	1.0
Had contact with peer educator in the past 12 months				
Yes	7.43 (4.68 to 11.8)[d]	1.53 (0.77 to 3.03)	5.68 (3.83 to 8.43)[d]	1.42 (0.82 to 2.46)
No (ref)	1.0	1.0	1.0	1.0
Have good HIV-related knowledge				
Yes	1.97 (1.28 to 3.03)[d]	**1.96 (1.11 to 3.44)**[d]	2.08 (1.40 to 3.09)[d]	**1.77 (1.08 to 2.89)**[d]
No (ref)	1.0	1.0	1.0	1.0
Reported Having STI symptoms in the past 12 months				
Yes	1.06 (0.61 to 1.86)	-	1.15 (0.70 to 1.90)	-
No (ref)	1.0	-	1.0	-

Bold values indicate factors significantly associated with prior HIV testing in multivariate analysis.
MSM, men who have sex with men.
[a]Including regular, non-regular and commercial sex partners
[b]Including illicit drug use and injecting drug
[c]Multivariate model includes only variables that were associated with outcomes of interest in bivariate analysis at level of $p \leq 0.1$
[d]$p < 0.05$.
[e]$p \leq 0.1$.

testing venue were identified as the main barriers in access to and use of HIV testing services.

This analysis determined HIV testing prevalence and identified correlates of HIV testing among YMSM aged 18 to 24 years in Myanmar. We found that the proportion of YMSM in Myanmar who have ever tested for HIV is higher than that of the overall MSM population in Myanmar who have received an HIV test and know the result as reported from IBBS survey in 2015 (49.6%) [39]. The coverage of HIV testing among YMSM in our study is similar to that reported for the overall MSM population aged 18 years and older in Indonesia (58%), but lower than that reported for other member countries of the Association of South East Asian Nations (ASEAN) including Vietnam (65%), Malaysia (66%), Singapore (77%), Thailand (79%) and a pooled category of those residing in Brunei, Cambodia, Laos and Myanmar (81%) [56]. It is, however, worth noting that this study applied different sampling (web-based recruitment) and data collection methods (anonymous online survey with no incentives), which may account for the differences in findings.

We estimated only half of the YMSM population in our study had recently tested for HIV, a lower figure compared to the proportion of MSM population aged 18 to 49 years who have tested for HIV and received their results in the past 12 months, reported from an RDS survey in four townships of Yangon, Mandalay, Pathein and Monywa in 2010 (62%, 95% CI: 55% to 70%) [57]. With evidence from research conducted in LMICs consistently indicating that YMSM are much less likely to access HIV testing as compared to older MSM [58–61], greater efforts are urgently needed to increase HIV testing coverage among this targeted population.

Our study results identified a number of demographics and psychosocial factors individually associated with prior HIV testing among YMSM in Myanmar. These factors include sexual identity and HIV testing self-efficacy. This finding corresponds with earlier evidence that self-reported sexual identity, particularly being a gay-identified MSM was positively associated with lifetime HIV testing [31], and that a stronger subjective norm towards HIV testing was associated with a higher odds of recent HIV testing while higher levels of internalized homophobia and depression appear to be restrictive factors [31,58]. We, however, did not find evidence supporting the association between being gay-identified MSM (having perceived sexual identity as female) and having HIV tested in the past 6 months as reported in the other study [62]. Previous studies have shown that homophobia and other psychological factors such as perceived behavioural control and self-efficacy play an important role in access to and use of HIV testing services

among MSM aged ≥15 years in general [21] as well as YMSM in particular [63]. However, the differences in the impacts of these psychological factors on HIV testing among YMSM with different sexual identities remain unknown. This knowledge gap requires further research targeting YMSM to improve HIV testing coverage among this marginalized population.

Unlike other studies, which reported that transactional sex and unprotected (condomless) sexual intercourse were associated with prior HIV testing among MSM [64,65], no such relationships were found in our study. Also, our multivariable analysis showed that alcohol consumption and drug use were not significantly associated with HIV testing, contrary to the finding of an RDS study among 243 YMSM aged 15 to 24 years in Chiang Mai, Thailand [66]. However, we found that increasing number of male sex partners was associated with higher odds of having tested for HIV, a finding similar to that of other studies conducted among MSM in Cameroon, China and other Asian countries [61,67,68]. It is likely that HIV testing behaviour reflects perceived risk of HIV infection among MSM; ones who have multiple male sexual partners may perceive themselves at high risk, while others who have never tested may not perceive themselves or their partners as "risky" [35,69]. Another possible explanation is that sense of responsibility to protect partners from HIV infection may lead to frequent HIV testing among MSM who are in a relationship and engaged in risky behaviour [70]. Findings of our study suggest that the number of sex partners may play an important role in determining HIV testing behaviour and a tailored HIV intervention programme that includes risk reduction messages might encourage frequent testing and increase HIV testing coverage among YMSM in Myanmar.

In this study, having contact with a peer educator in the past 12 months, when adjusted for other covariates in the multivariable regression model, was not associated with HIV testing in the past 6 months and in a lifetime. This finding corresponds to findings from a national web-based survey among 2077 MSM in Vietnam [71], but does not align with findings from an RDS study among 1402 MSM in Mozambique in which the authors reported that having contact with peer educators in the past 12 months was positively associated with recent HIV testing [72]. Given the important role of peer educators in reaching out to marginalized, hard-to-reach key populations, our study finding warrants further research to ensure the effectiveness and efficiency of peer education activities within a broader harm reduction programme targeting the YMSM population in Myanmar.

We found that having good HIV-related knowledge and particularly, having access to and use of health-related services was strongly associated with prior HIV testing among YMSM in Myanmar. This finding corroborates with earlier evidence, from studies conducted in other LMICs, that MSM who have access to HIV education and service programmes were more likely to have tested for HIV in a lifetime [19,73] and in the past 6 months [62], and that having good knowledge on HIV transmission, prevention and treatment was positively associated with HIV testing practice [59,72,74]. However, this should be interpreted with care given that the direction of this association is unknown. It is also possible that participants had greater HIV knowledge, greater HIV testing self-efficacy and accessed health services because of the HCT services they received.

In our study, among YMSM who reported prior HCT services, 80% received their services from NGO-operated facilities, while only 11% reported a government hospital or the National AIDS Programme as the point of service delivery. Even though we did not ask participants about the rationale for their choice of service providers, it may be possible that MSM highly regard the quality of NGO services including the confidentiality, the "exclusivity" of services provided to them with non-discriminatory attitudes of healthcare providers as MSM in other previous studies have often referred to NGO-operated STI/HIV clinics as "our clinic" versus "government clinic" [60,75]. Regarding reasons for not having an HIV test, we found that "knows/trusts self" was the most frequently given reasons for not having an HIV test, followed by "feel healthy/not sick," "afraid of learning HIV status" and "do not know a place to get test." As knowing/trusting self and feeling healthy/not sick may reflect the level of perceived risk of HIV infection among YMSM, our results further confirm findings of previous studies that the leading reasons for not being tested for HIV among MSM were perceived low risk of HIV infection, fear of positive diagnosis and its associated consequences and not knowing where to go for a test [35,56,76]. Our study adds to the existing literature recommending that, in low prevalence and concentrated HIV epidemic settings where social-structural factors present major barriers in access to and use of HIV testing services among key populations including MSM and transgender people, the implementation of community-based NGO run HIV clinics providing services in response to their needs with support of peer outreach would play a pivotal role in fostering social inclusion and service access among these hard-to-reach populations [77,78].

The first 90 of the UNAIDS 90-90-90 target requires that 90% of people living with HIV/AIDS are diagnosed and know their HIV status [79]. In order to achieve this objective, countries with a concentrated HIV epidemic need to expand their models of service provision to reach most-at-risk populations with innovative approaches to deliver HIV and health-related services [80]. Research has shown that community-based HIV testing and self-testing, together with HIV youth-friendly services integrated within healthcare systems may help to promote routine HIV testing among young people of key populations [81,82]. In Myanmar, similar approaches may help to strengthen the country's efforts in increasing coverage of HIV testing services among YMSM. It is likely that both system and individual factors have roles to play in determining HIV testing coverage among key populations particularly MSM in a cultural context where society and general public is not open to or even condemn homosexuality. Our study findings suggested that effective HIV interventions among this population will need to address both system and individual factors simultaneously, a lesson learned not only for Myanmar but other countries in the region with similar HIV epidemic and socio-economic and cultural contexts.

We recognize several limitations, which must be accounted for when interpreting the results of this study. First, our data is self-reported thus may suffer from recall and social desirability biases [83] leading to under-reported risky sexual behaviours and substance use which may explain the non-significant relationship between risk factors (such as unprotected sexual intercourses) and HIV testing found in our study. In addition, caution should be taken when interpreting

the results of our study particularly for factor variables with relatively large standard errors. Second, with a relatively large number of seeds and an average of four recruitment waves per seed, one may suspect that our data is subjected to seed bias. However, with no problematic homophily values for all RDS analysis variables and the use of bootstrapped standard errors to adjust for seed dependence in sampling process, we believe that the risk of seed bias has largely been mitigated in our study. Third, we did not collect information on internalized homophobia, a factor likely to be associated with HIV testing among MSM in context where same sex practices are highly stigmatized [7,84]; thus, we could not examine the influence of this important psychosocial factor on HIV testing practice among YMSM in Myanmar. This information gap should be addressed in future studies. Given the RDS recruitment method with a cross-sectional study design, our study findings may have limited generalizability, as we do not know if our study participants are truly representative of YMSM in Myanmar. In addition, we are also unable to determine the cause-effect relationships between associated factors and HIV testing practice among this population. Furthermore, as the Link Up interventions continued after our data collection, the estimates presented in this manuscript are subject to change. As such, future research with longitudinal data will help to better understand unique facilitators and barriers in accessing HIV testing and prevention services experienced by these vulnerable YMSM.

5 | CONCLUSIONS

This study highlights the need and provides valuable data for the development of appropriate HIV testing and prevention programmes that address specific needs of YMSM in Myanmar. We found that HIV testing among MSM aged 18 to 24 years in this country is still suboptimal particularly for a population that is engaging in risky sexual behaviours. Tailored HIV information and education programmes targeting YMSM that aim to change their risk perception, enhance HIV-related knowledge, develop and improve self-efficacy may help to increase HIV testing coverage. HIV prevention and testing services, embedded in broader healthcare services provided at NGO run health facilities, are needed to promote regular HIV testing behaviour, facilitate timely linkage to engage more YMSM in the HIV treatment and care cascade and, contribute to sustainable control of the HIV epidemic among YMSM in Myanmar.

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COMPETING INTERESTS

The authors declare no conflict of interest. The donor had no involvement in study design, study implementation or the writing and submission of this manuscript.

AUTHORS' CONTRIBUTIONS

SL, PPA, AKP, NP, PAA, WT, AB and MDP conceptualized the study and data analysis plan. MDP, SL and PAA performed data analysis. MDP drafted the manuscript. PPA, AKP, NP, PAA, WT, AB and SL reviewed and commented on initial and final drafts of the manuscript. All authors read and approved the final manuscript.

Note

[1] According to World Bank Country data. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups.

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