



MONASH University

Understanding HIV testing behaviours and engagement in HIV prevention among men who have sex with men and transgender women in Myanmar

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A thesis submitted for the degree of Doctor of Philosophy at Monash University, Department of
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Abstract

Globally, men who have sex with men (MSM) and transgender women (TW) are disproportionately burdened by HIV. In Asia, the high burden of HIV among MSM and TW occurs against a background of low HIV prevalence among adults of reproductive age – typically less than 1% - with several countries in the region reporting estimated HIV prevalence exceeding 10% and evidence of expanding HIV epidemics. In Myanmar, current estimates suggest that 11.6% of MSM and TW are living with HIV nationally, while prevalence exceeding 25% has been estimated among MSM and TW in major urban settings.

HIV testing has assumed a central place in contemporary HIV prevention through its role in reducing the impact of undiagnosed HIV, facilitating early treatment initiation leading to viral suppression, and for promoting post-diagnosis reductions in risk behaviours. HIV testing also provides important preventive benefits by creating service engagement opportunities to promote risk reduction counselling and health promotion. Despite considerable scale up of Myanmar's national response to HIV, testing rates among MSM and TW remain sub-optimal and undermines Myanmar's progress towards reaching national HIV prevention targets that are aligned with global goals to eliminate HIV.

This thesis adopted a mixed methods approach to better understand current HIV testing behaviours and levels of engagement in HIV prevention among MSM and TW and identify factors that shape and influence this engagement. Studies in this thesis explored self-reported and actual testing behaviours, barriers to testing and prevention, and the potential for novel approaches to enhance HIV testing uptake. This thesis also described the development and implementation of an electronic data management system implemented within two community-based HIV testing clinics targeting MSM and TW, as a platform to directly observe HIV testing behaviours and outcomes among clients attending the service.

My research identified high proportions of MSM and TW self-reporting regular HIV testing which was not observed in the direct measurement of repeated HIV testing behaviours derived

from the electronic data management system data. The discrepancy between these two studies pointed to barriers to enacting aspirational testing routines and the importance of collecting and managing observational data on HIV testing to appropriately inform and evaluate HIV prevention strategies. Sub-optimal HIV testing frequency was observed against a background of high levels of reported sexual risk behaviours across multiple datasets. Factors such as stigma and discrimination from family, community and service providers, the need to conceal sexual and gender identity, and perceived threats to confidentiality and privacy were identified as barriers to HIV testing and engagement in HIV prevention among MSM and TW. Among service-engaged MSM and TW, high HIV incidence and the association between HIV positivity and reporting no testing history confirms the prioritisation of MSM and TW for HIV control efforts and the need to improve HIV testing engagement. Novel approaches to service delivery – including peer-delivered HIV testing and the integration of online-based health promotion – were identified as strategies that may help circumvent some of the barriers identified and improve uptake and retention of MSM and TW in HIV testing and prevention in Myanmar.

The ongoing political and social evolution of Myanmar and the changing landscape of HIV prevention and care services provides important opportunities to enhance the local HIV response. The findings in this thesis have clear programmatic applications and highlight the need to: reinvigorate primary prevention efforts through condom promotion to mitigate risk of sexual transmission; expand peer-based HIV prevention services which can cater appropriately to different MSM and TW subgroups, and; consider the integration of digital technology in HIV prevention. These activities should be situated within efforts to strengthen the enabling environment, reduce the impact of stigma and discrimination on HIV prevention engagement and improve HIV epidemiological data collection to better monitor the impact of service delivery improvements on HIV burden among MSM and TW.

General Declaration

I hereby declare that this submission is my own work and to the best of my knowledge it contains no material which has been accepted for the award of any other degree or diploma and at university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes three original papers published in peer reviewed journals and two unpublished publications. The conception, development and writing up of all the paper in this thesis were the principal responsibility of myself, the candidate, working within the Department of Epidemiology and Preventive Medicine under the supervision of Professor Mark Stoové, Dr Alisa Pedrana and Mr Chad Hughes. A number of publications are co-authored reflecting the collaborative nature of public health research and acknowledges the input for these relevant research teams. I have reformatted submitted and published papers in order to generate a consistent presentation within the thesis.

In the case of Chapters two to six, my contribution to the work involved the following:

Thesis Chapter	Publication title	Publication Status	Nature and extent of candidate's contribution	Co-authors names and nature and % of contribution (* Monash student)
Two	Characteristics of men who have sex with men and transgender women in Myanmar who test frequently for HIV	Published	60%; data analysis, results interpretation, manuscript preparation and review	ZM Oo, ZW Thein, B Draper, PP Aung, C Ryan, M Thant (15% collectively): data collection, project management, review of manuscript; C Hughes (10%): study design, data collection, review of manuscript; M Stoové (15%): Study design, data analysis, contribution to manuscript development
Three	HIV incidence and factors associated with testing positive for HIV among men who have sex with men and transgender women in Myanmar: data from community-based HIV testing services	Submitted	50%; study design and management, data collection and analysis, results interpretation, manuscript preparation and review	M Traeger (10%): data cleaning and analysis, review of manuscript; ZM Oo, TT Tun, NN Oo, H Maung (15% collectively): data collection, project management, review of manuscript; C Hughes (5%): Study design, data collection, review of manuscript; A Pedrana (5%): data analysis, contribution to manuscript development; M Stoové (15%): Study design, data analysis, contribution to manuscript development
Four	"We are not gays...don't tell me those things": Engaging 'hidden' men who have sex with men and transgender women	Published	55%; data analysis, results interpretation, manuscript preparation and review	E Clouse, AL Wirtz (10% respectively), KH Thu, S Naing, SD Baral, C Beyrer (10% collectively): study design, data collection, data analysis, manuscript review; M Stoové (15%):

	in HIV prevention in Myanmar			data analysis, manuscript development and review
Five	Acceptability of peer-delivered HIV testing and counselling among men who have sex with men and transgender women in Myanmar	Published	60%; data analysis, results interpretation, manuscript preparation and review	ZM Oo, ZW Thein, B Draper, PP Aung, C Ryan (10% collectively): data collection, project management, review of manuscript; C Hughes (10%): study design, data collection, review of manuscript; A Pedrana (5%): data analysis, contribution to manuscript development; M Stoové (15%): Study design, data analysis, contribution to manuscript development
Six	Using digital communication technology to increase HIV testing among men who have sex with men and transgender women: A systematic review and meta-analysis	Submitted	60%; study design and management, data collection and analysis, manuscript preparation and review	K Ryan* (10%): data extraction, manuscript review; M Lim, A Pedrana, M Stoové (10% respectively): study design, data analysis, manuscript preparation and review

Research outcomes during candidature

A list of publications and oral presentations during the PhD candidature is presented below. Those related to work contained within this thesis and included as a chapter (*) or in the appendix (^) are noted by the specified symbol.

Peer-reviewed publications

***Veronese V**, Clouse E, Wirtz AL, Thu KH, Naing S, Baral SD, Beyrer C, Stoové M. “We are not gays... don’t tell me those things”: engaging ‘hidden’ men who have sex with men and transgender women in HIV prevention in Myanmar. BMC Public Health. 2019; 19(1):63.

***Veronese V**, Oo ZM, Thein ZW, Aung PP, Draper BL, Hughes C, Thant M., Stoové M. Acceptability of peer-delivered HIV testing and counselling among men who have sex with men and transgender women in Myanmar. AIDS Behav, 2018. 22:p. 2426 – 2434

***Veronese V**, Oo ZM, Thein ZW, Aung PP, Draper BL, Hughes C, Thant M., Stoové M. Characteristics of men who have sex with men and transgender women who test frequently for HIV in Myanmar. J Glob Health Rep 2018;2(e2018040).

^Wirtz, AL, Clouse E, **Veronese V**, Thu KH, Naing S, Baral SD, Beyrer C. New HIV testing technologies in the context of a concentrated epidemic and evolving HIV prevention: qualitative research on HIV self-testing among men who have sex with men and transgender women in Yangon, Myanmar. J Int AIDS Soc, 2017. 20(1): p. 21796.

Draper BL, Oo ZM, Thein ZW, Aung PP, **Veronese V**, Ryan C, Thant M., Hughes C., Stoové M. Willingness to use HIV pre-exposure prophylaxis among gay men, other men who have sex with men and transgender women in Myanmar. J Int AIDS Soc, 2017. 20(1): p. 21885.

Bowring AL, **Veronese V**, Doyle JS, Stoové M., Hellard, M.E. HIV and sexual risk among men who have sex with men and women in asia: a systematic review and meta-analysis. AIDS Behav, 2016. 20(10): p. 2243-65.

Wade AJ, **Veronese V**, Hellard ME, Doyle JS. A systematic review of community based hepatitis C treatment. BMC Infect Dis, 2016. 16: p. 202.

Shahid S, Majeed MF, Awaan AB, Mirza H, Sarfraz N, **Veronese V**. Expanding access to HIV testing and counseling and exploring vulnerabilities among spouses of HIV-positive men who inject drugs in Pakistan. Curr Opin HIV AIDS, 2016. 11 Suppl 1: p. S6-12.

Submitted manuscripts in press

***Veronese V**, Traeger M, Oo ZM, Tun TT, Oo NN, Maung H, Hughes C, Pedrana A, Stoové M. HIV incidence and factors associated with testing positive for HIV among men who have sex with men and transgender women in Myanmar: data from community-based HIV testing services. Accepted by JIAS

***Veronese V**, Ryan KE, Lim MJ, Pedrana A, Stoové M. Using digital communication technology to increase HIV testing among men who have sex with men and transgender women: A systematic review and meta-analysis. Accepted by JMIR

Other research outputs

Thein ZW, Draper BL, Aung PP, **Veronese V**, Ryan C, Thant, M, Hughes C, Stoové M. HIV pre-exposure prophylaxis preparedness among men who have sex with men in Myanmar: A survey of service-engaged MSM in Yangon and Mandalay, Burnet Institute 2015, Melbourne Australia

Oral Presentations (presenting author underlined)

Veronese V, Oo ZM, Thein ZW, Draper BL, Aung PP, Ryan C, Thant M, Hughes C, Stoové M. More than Just Friends? Exploring High Acceptability of Peer HIV Testing among men who have sex with men in Myanmar. *Australasian HIV & AIDS Conference*; November 2016, Adelaide, Australia

Shahid S, Majeed MF, Awaan AB, Mirza H, Sarfraz N, **Veronese V**. Home-based HIV testing and counselling in Pakistan: Improving detection of HIV among female spouses of PWID. 12th *International Congress on AIDS in Asia Pacific*; March 2016, Dhaka, Bangladesh

Poster Presentations

Veronese V, Traeger M, Oo ZM, Tun TT, Oo NN, Maung H, Hughes C, Pedrana A, Stoové M. HIV Epidemiology Among Men Who Have Sex with Men and Transgender Women in Myanmar: Data from Community-Based Surveillance. *STI & HIV 2019 World Congress (Joint Meeting of the 23rd ISSTD and 20th IUSTI)*; July 2019 (forthcoming), Vancouver, Canada

Lin KS, Than KK, Fowkes FJL, Simpson JA, Oo ZM, Draper BL, **Veronese V**, Stoové M. Is condom use different across three sexual identities of men who have sex with men from Myanmar? 9th *International AIDS Society Conference on HIV Science*; July 2017, Paris, France

Veronese V, Oo ZM, Thein ZW, Draper BL, Aung PP, Ryan C, Thant M, Hughes C, Stoové M. Seek, test and re-test: Characteristics of high frequency HIV testers among service-engaged men who have sex with men in Myanmar. *Australasian HIV & AIDS Conference*; Adelaide, Australia 2016.

Oo ZM, **Veronese V**. Characteristics of high frequency HIV testers within a population of men who have sex with men reached by an outreach program in Myanmar. *8th Asia Pacific Conference on Reproductive and Sexual Health and Rights*, February 2016, Nay Pyi Taw, Myanmar

Acronyms and abbreviations

AHI	Acute HIV infection
AIDS	Acquired immune deficiency syndrome
ANC	Antenatal clinic
aOR	Adjusted odds ratios
ART	Anti-retroviral therapy
BSS	HIV behavioural surveillance survey
DIC	Drop-in centre
FGD	Focus group discussion
FSW	Female sex workers
HIV	Human immunodeficiency virus
HSS	HIV sentinel surveillance
IBSS	Integrated bio-behavioural surveillance survey
IDI	In-depth interview
LMIC	Lower-middle income countries
MoH	Ministry of Health
MSM	Men who have sex with men
NAP	National AIDS Program
NGO	Non-governmental organisation
NSP	National Strategic Plan
OR	Odds ratio
PMTCT	Prevention of mother to child transmission of HIV
PrEP	Pre-exposure prophylaxis
PWID	People who inject drugs
RPOC	Rapid point of care
STI	Sexually transmitted infection
TasP	Treatment as prevention
TW	Transgender women
RDS	Respondent-driven sampling

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One of the very best things about my PhD was the opportunity to be surrounded daily by a bunch of people who are as interesting as they are clever. To my PhD pals past and present, I’ve really enjoyed the innumerable hours of amusing conversation had over cake, coffee or beer but it’s the friendship and moral support that I’m particularly grateful for.

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1. Introduction

1.1 HIV among MSM and TW in Asia

1.1.1 *HIV in Asia*

The Asian¹ HIV epidemic is concentrated among key populations at higher risk of HIV, driven chiefly by condomless sex in the context of commercial sex work or male-to-male sex and the sharing of contaminated injecting equipment by people who inject drugs (PWID) (8). High HIV prevalence relative to adults of reproductive age has been observed among PWID, female sex workers (FSW) and men who have sex with men (MSM) and transgender women (TW) in most Asian countries (6). Previous concerns that sexual transmission of HIV between key populations and their sexual partners would result in a generalised epidemic have not been realised; although female, non-commercial sex partners of key populations are substantially affected by HIV, it is suggested that the onward transmission of HIV has been limited by low levels of self-reported sexual risk behaviours in this group (9).

Since the first documented case of HIV in Asia in the mid-1980s, over 11 million people have been infected and more than five million people are currently living with HIV (5). Most recent estimates suggest the Asian HIV epidemic has now stabilised and is showing signs of decline, with an estimated 14% decrease in new infections between 2010 and 2017 (5). This has occurred

¹ Includes countries within Asia and the Pacific, in line with regional definition used by UNAIDS and referred to as 'Asia' for brevity (Afghanistan, Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Democratic People's Republic of Korea, Federated States of Micronesia, Fiji, India, Indonesia, Japan, Kiribati, Lao People's Democratic Republic, Malaysia, Maldives, Marshall Islands, Mongolia, Myanmar, Nauru, Nepal, New Zealand, Pakistan, Palau, Papua New Guinea, Philippines, Republic of Korea, Singapore, Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Viet Nam)

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in the context of a doubling of domestic financing levels for national HIV responses in the past decade, both in absolute terms, as well as proportionally relative to international donor funding (namely the Global Fund for TB, AIDS and Malaria – hereafter, the Global Fund - and PEPFAR), which has declined over recent years across the region (6).

The response to HIV in Asia at the start of the epidemic was slowed by political denial and limited attention (10). Since then, most countries have made significant progress, moving from ad-hoc to more mature responses to HIV that are informed by cohesive national strategic responses; however, the speed of this evolution has varied considerably across countries (8, 10). Strong political commitment - used to drive agenda setting, funding and allocation of resources in tandem with strong community mobilisation, has played an instrumental role in some of the region's more successful approaches to HIV. This includes Thailand and Cambodia where bold prevention measures – such as the 100% condom use policy implemented in all commercial sex venues – and wide-scale community mobilisation successfully moderated growing epidemics (11, 12). Similarly, Vietnam's more recent illustration of political leadership, civil society participation and community involvement, among other factors, has seen the early adoption of innovative prevention measures such as HIV self-testing and a national program for HIV pre-exposure prophylaxis (PrEP) and declining national prevalence (13, 14).

1.1.2 Epidemiology of HIV among MSM and TW in Asia

MSM and TW are recognised as a priority population for HIV control in the region given their disproportionate burden of HIV. Estimates suggest that MSM in Asia are 18 times more likely to acquire HIV compared to other adults of reproductive age (15) and account for 29% of all new infections (6). New infections among TW were estimated to account for 2% of all new infections in Asia in 2017 (6). While Asia-specific estimates are not available, TW in low and middle income countries (LMIC) are estimated to be 50 times more likely to acquire HIV compared to other adults of reproductive age (16). There are major gaps in understanding regarding the specific burden of HIV among TW populations due to limited data that disaggregates risk among TW from MSM, and limited representation of TW in HIV surveillance systems (16).

There is a high degree of heterogeneity in the HIV epidemic among MSM and TW within the region. Some countries report HIV prevalence estimates greater than 10% (Figure 1) and increasing numbers of new infections over recent years (6, 17-21), while others estimate levels of HIV that are low and similar to the general population (6).

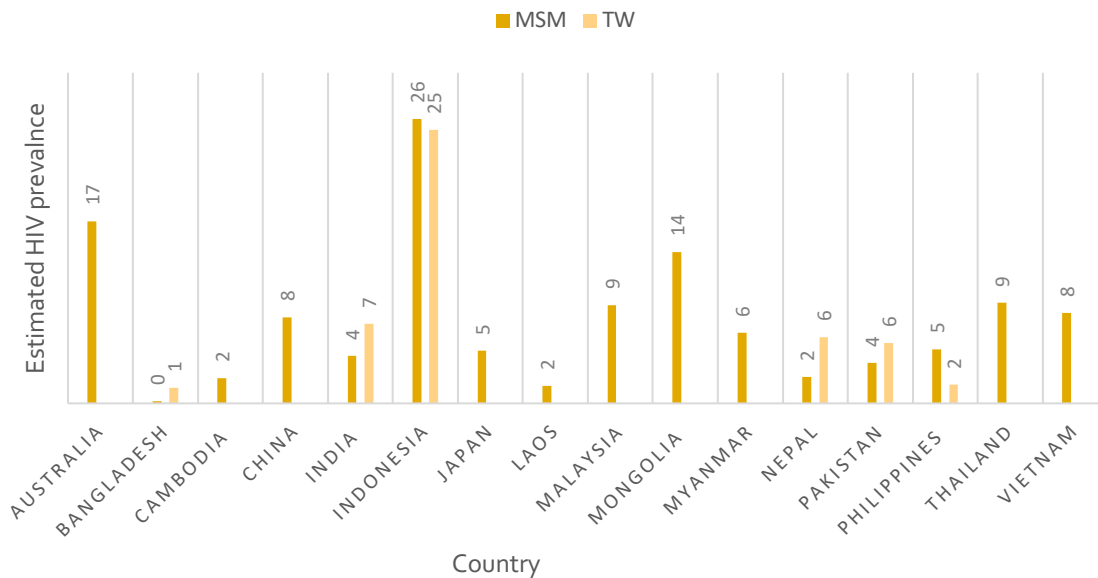


Figure 1: Estimated HIV prevalence from latest available national surveillance among MSM and TW across Asia (2011 – 2015). (Source: 2, 9, 13, 19, 20)

There is also variation within countries, with higher concentrations of HIV typically seen among MSM and TW residing in urban locations, relative to both rural and national estimates (6, 22, 23), suggesting context-specific factors that increase vulnerability in urban environments. For MSM and TW, cities may provide greater opportunities for connection with other MSM and TW, facilitated through cruising sites, emerging use of geo-located dating apps used to find sex partners and/or greater sense of freedom of sexual expression and anonymity (24). Specific drivers of HIV infection among MSM and TW will be further discussed in Section 1.4.

1.2 HIV among MSM and TW in Myanmar

1.2.1 *HIV in Myanmar*

The first diagnoses of HIV in Myanmar occurred in the mid-1980s among PWID (25). By 1989, it was estimated that over 70% of PWID in the capital city of Yangon were living with HIV, influenced by Myanmar's wide-scale cultivation of opium and proximity to key drug trade and trafficking routes in Asia (8, 25, 26). Sentinel surveillance data from antenatal clinics (ANC) in 1999 was used for the first time to estimate national HIV prevalence of 3.5%, indicative of a generalised HIV epidemic, yet this was strongly contested by national authorities at the time (27, 28).

1.2.2 *HIV surveillance in Myanmar*

National HIV prevalence estimates in Myanmar are modelled using data collected through a second generation surveillance system in accordance with WHO guidelines (29). This system comprises HIV and AIDS case and mortality reporting, STI surveillance, HIV sentinel surveillance (HSS), behavioural surveillance or integrated bio-behavioural surveillance surveys (BSS or IBBS) and at-risk population size estimates.

HSS is the main source of regular HIV epidemiological data and has been conducted annually since 1992 through the National AIDS Programme (NAP) within the Ministry of Health and Sports (MoH) (1). HSS captures data on new HIV diagnoses among FSWs, PWID, pregnant women at ANC, blood donors, new military recruits and male STI patients. HSS efforts have been scaled up over time in Myanmar; by 2012, HSS sites were located in 35 townships, compared to nine in 1992. HSS data for key populations is provided by targeted intervention sites, which are most commonly non-governmental organisation (NGO)-led HIV services specifically targeting key populations. MSM were first included in the HSS system in 2007 through the addition of two MSM-specific targeted intervention sites, which was expanded to four sites in 2012 (1). Figure 2 presents HIV estimates from HSS data for all populations since

2001 until latest available data. Despite annual collection, publicly available HSS data is incomplete and has not been released since 2014. The first BSS to target key populations was conducted in 2007 among PWID and FSW, respectively. More recently, combined IBBS has been conducted among PWID (2014), FSW (2015) and MSM and TW (2009, 2015).

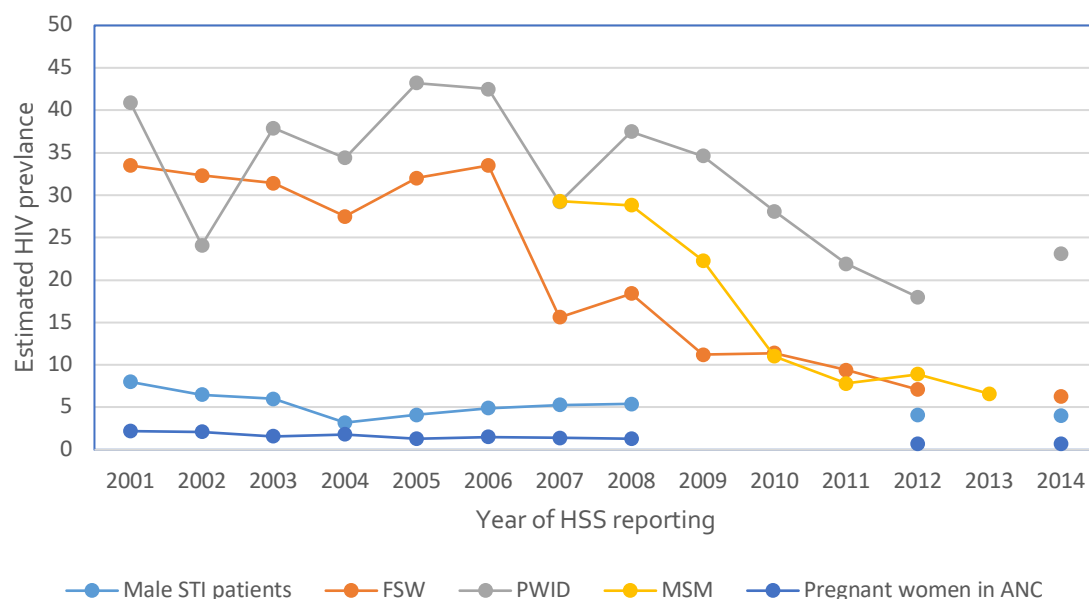


Figure 2: HIV sentinel surveillance data on key populations conducted since 2001 (Source: (1-4))

1.2.3 Epidemiology of HIV among MSM and TW in Myanmar

HIV prevalence is currently estimated to be less than one percent in adults of reproductive age (30) and the number of new infections have steadily declined, from an estimated peak of 29,000 in 2000 to 11,000 in 2017 (5). Figure 3 illustrates the concentrated HIV epidemic in Myanmar and the declining prevalence estimates from HSS among key populations. HSS estimates also point to a decline in HIV among MSM, with prevalence estimated at 6.6% in 2014, compared to 29.3% in 2007.

However, estimates produced through IBBS suggest higher levels of national HIV prevalence among key groups compared to HSS data; estimated from 2015 IBBS data, national HIV prevalence was 28.7%, among PWID, 14.6% among FSW and 11.6% among MSM and TW. IBBS

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estimates of sub-national prevalence have also suggested higher concentrations of HIV among MSM and TW in the major cities of Yangon and Mandalay (Figure 3).

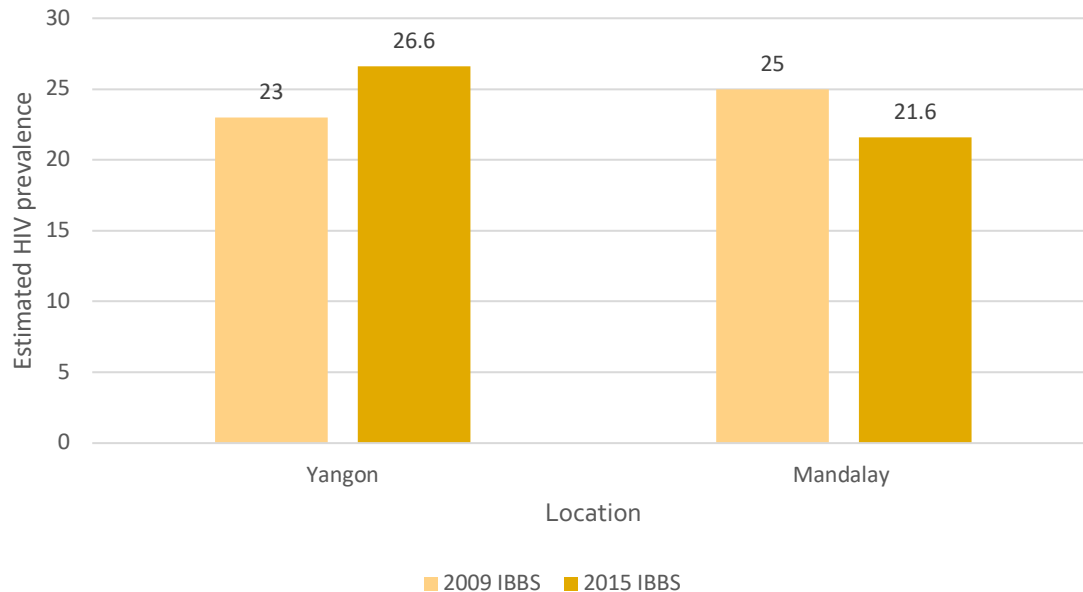


Figure 3: HIV estimates among MSM and TW in 2009 and 2014 IBBS (Source: (4, 7))

These higher sub-national estimates are consistent with regional trends described in Section 1.1.2 and similarly suggest location-specific factors within major cities in Myanmar that influence HIV vulnerability for MSM and TW.

While declines in the prevalence of HIV in key populations may be an accurate reflection of HIV epidemiology in Myanmar as a result of HIV-related mortality and reductions in incidence, trends in HSS data (and their discrepancy from IBBS estimates) may also be affected by methodological factors including: addition of new sentinel surveillance sites, sampling bias associated with the characteristics of people presenting to sites, and variations in sampling approaches. For example, a 2013 review of the surveillance system noted that HSS sites unable to achieve target sample sizes through consecutive sampling of eligible participants attending the service were asked to engage peer outreach workers to purposively recruit participants from the community and encourage them to attend the site for testing (1). In addition, HSS data

is derived from clients attending service sites that focus on delivering HIV testing and prevention. As people living with diagnosed HIV are unlikely to attend these services, HSS data is therefore more likely to reflect prevalence of undiagnosed HIV than overall HIV prevalence. The IBBS implemented in 2009 and 2015 employed respondent-driven sampling (RDS) to recruit participants, a methodology designed to reduce sampling bias by reaching networks of harder to reach populations (31) and includes both known-positive and status unknown participants, and is potentially more likely to reflect true HIV population prevalence among key populations.

1.3 Sexual and gender identity in Asia

1.3.1 *Sexual and gender identity labels in Asia*

Contemporary HIV prevention, including activities that recognise and respond to factors associated with HIV risk and service engagement, highlights the importance of tailoring interventions to address local context and needs. For HIV prevention among MSM in Asia, this includes appropriately characterising, defining and understanding male sexuality and how this interacts with HIV vulnerability. A systematic review of data from LMICs estimated that around 12% of men in South and South East Asia have engaged lifetime sex with another man (32), twice as high as estimates from Western settings (33). Unlike Western conceptions that separate gender and sexual identity, these two concepts are often regarded as inherently interlinked in Asian culture and expectations around sexual orientation are largely dictated by prevailing gender norms rather than sexual practices. In Asia, sex between men is not limited to those who self-identify as homosexual. For men, their gender or ‘masculinity’ is asserted through gender- normative behaviours such as marriage and reproduction (34). In this way, ‘masculinity’ is regarded as synonymous with heterosexuality and can be maintained even when engaging in same-sex behaviours.

Across the region, a range of indigenous labels which connote local understandings of gender and sexual identity are used (35). Classifications commonly include terms to describe feminine-

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presenting MSM (such as *bóng lậ* in Vietnam (36) and *kothis* in India (37)) and masculine-presenting MSM who keep their same-sex behaviours largely hidden (such as *bóng kín* in Vietnam (36) and *Panthi* in India (38)). Additional labels exist for transgender women, which typically reference individuals with a male assignation at birth who identify as female and are sexually oriented towards men (such as *katheoy* in Thailand, or *waria* in Indonesia). This is largely consistent with Western interpretations of transgender women, except that in the West, transgender is used to refer to a gender identity, whereas in Asia being transgender typically references both gender and sexual identity (34). Sexual and gender identity is thought to be an important determinant of engagement in HIV testing and other prevention services in Asia and has implications for program design and delivery; this will be further discussed below.

1.3.2 Sexual and gender identity labels in Myanmar

Common typologies of MSM and TW seen in Asia are also represented in Myanmar, where three main categories have historically been used describe typical sub-groups (39-42). *Apwint* are described as individuals with male assignation at birth who identify as female are locally regarded as ‘open’ and may be otherwise be identified as transgender. *Apone*, otherwise known as *hider* or ‘hidden’, are masculine-presenting men who are sexually attracted to other men but whose sexual orientation is largely concealed. Individuals that might be classified as “open” and “hidiers” are thought to exist on opposite ends of the same spectrum of shared inner effeminacy – locally described as *nwé*. While *opens* may publically express *nwé*, *hidiers* attempt to conceal it, typically by adopting heteronormative and masculine appearance, behaviour and characteristics (39). Lastly, *thane* are masculine-presenting men who identify as heterosexual and have incidental sex with other men while maintaining primary relationships with female partners. *Thane* are seen within Myanmar as usually engaging in sex with *apwint* (often commercially) or *apone*.

These labels have historically been loosely defined alongside preferences for sexual positioning, with *apwint* and *apone* typically associated with receptive sex, while insertive sex is typically reported by *thane* (2, 43). However, there is a fluidity of sexual and gender identification and

expression in Myanmar and public expression of one's sexual and gender identity is often context- or situation- specific, allowing individuals to move in and out of various subject positions (44, 45). Additionally, social pressure to marry and maintain gender expectations leads many MSM and TW to conceal sexual and gender identity and may lead some to engage in heterosexual relationships (41). Estimates of between six (43) and 24% (1) of MSM participating in research report being married to women, including 20% of newly diagnosed MSM captured in sentinel surveillance surveys (2). A recent study found as many as 45% of MSM reported recent vaginal sex (46), presumably many in the context of marriage given social and cultural norms governing sex outside of marriage for women (47).

MSM and TW labels exist in a culture that values gender conformity and heteronormativity. The belief that sexual or gender-non conformity is a consequence of bad karma remains widely held (48), and contributes to significant stigma and discrimination towards sexual minorities or those whose behaviours are seen as culturally or morally transgressive - this will be further discussed in Section 1.4.4. In many Asian settings, TW carry roles of social, cultural or spiritual significance. TW in Myanmar are believed to have a connection to the spiritual world that may grant them exception to cultural and moral mores that prioritise heteronormative behaviours. *Nat kawdaw* or 'spirit wives' are TW perceived to have the ability to access both the human and supernatural worlds. The adoption of female gender presentation is regarded as an inherent part of *nat kawdaws* ability to communicate with the spiritual world and is therefore largely accepted (49).

However, the use and interpretation of these historical terms used to describe MSM and TW subgroups are changing. Western loanwords such as 'gay' and 'homo' are appearing in Myanmar discourse and dialogue – a likely reflection of increasing exposure to Western media, international organisations and a burgeoning civil society movement supporting rights for sexual minorities (39, 50). Some have noted that the use of these loanwords are limited to more privileged (typically English-literate), urban-residing groups, or those connected to international NGOs (44).

1.4 Factors associated with HIV risk among MSM and TW

1.4.1 *Sexual risk behaviours*

While more contemporary notions of sexual risk and HIV need to take account of PrEP (see Section 1.5.3) and anti-retroviral therapy (ART)-induced viral suppression (see Section 1.5.2), generally, condomless anal sex with a HIV-positive partner has been considered the key driver of HIV transmission among MSM and TW. This risk is facilitated by the increased efficiency of anal sex to transmit HIV; estimates of transmission risk through condomless receptive anal sex is 138 per 10,000 exposures compared to 4 per 10,000 for vaginal sex (51, 52). Reported consistent use of condoms during anal sex over the past six months has ranged from 26 – 76% among MSM and TW in six Asian countries (53). Differences in reported condom use by casual or regular sex partner type have been noted, with typically higher levels of reported condom use with casual compared to regular partners (54, 55). Acute STIs may also increase the probability of HIV infection in the context of condomless sex through increased biological susceptibility to HIV and increased HIV infectiousness (56-58). Numerous studies from the region have identified presence of STIs as a predictor of HIV sero-conversion among MSM and TW populations (59-66). While scarce, data on STI prevalence in Myanmar among MSM and TW provides an indicator for increased HIV susceptibility as a proxy indicator for condomless sex. The estimated syphilis prevalence among MSM and TW from most recent HSS (2012) was 3.3% (69) and a recent study found that 16% of MSM and TW self-reported an STI diagnosis in the past 12 months (41). Evidence from the region suggests that vulnerability to HIV and STIs may be heightened among MSM who engage in commercial sex work (67); as many as one in four MSM and TW in Yangon reported selling sex in the latest IBBS (7).

In Myanmar, approximately 80% of respondents in the latest IBBS reported condom use at last sex, which was more commonly reported with casual partners than regular partners (82% reported condom use at last sex with casual partner compared to 69% with regular partners) (7). Consistent use of condoms over the past month was also reported more often with casual compared to regular partners (64% and 53% respectively), as noted by others (43, 68, 69), and is

consistent with regional data. A recent study also noted evidence of MSM in Myanmar engaging in sero-adaptive behaviours to mitigate HIV risk, including sero-sorting and sero-positioning reported by 22% and 1.7% of HIV-negative MSM, respectively (70). Low HIV testing frequency and testing coverage in Myanmar (see Section 1.7.2) raises concerns regarding the prevention impact of sero-adaptive behaviours in Myanmar given that the effectiveness of these strategies relies on accurate knowledge of HIV status.

HIV risk also appears to vary by sexual and gender identity in Myanmar. In a 2013 study of MSM and TW in four locations, *apwint* participants reported a higher mean number of sex partners in the past month compared to *thange* (29 and nine, respectively) and also reported lower rates of consistent condom than *thange* participants (43). While no data reports comparative levels of receptive sex, it is generally held that receptive sexual positioning is more commonly assumed by *apone* and *apwint* (30, 42). The latest IBBS estimated higher HIV prevalence among *apone* (39%) and *apwint* (19%), compared to *thange* (5%) (7). These differences in HIV prevalence estimates may be attributable to a range of factors, such as the noted differences in sexual risk behaviours described above, including preferences for receptive anal sex positioning (61, 71). These differences may also relate to the probability of HIV exposure within sexual networks or reflect different experiences of structural barriers, including stigma and discrimination, that can limit access to HIV prevention and engagement in preventive behaviours (see Section 1.4.3 and 1.4.4).

1.4.2 *Undiagnosed HIV*

Undiagnosed HIV in the context of sexual risk behaviours is believed to be a key contributor of new infections among MSM (72). Estimates suggest that undiagnosed HIV may contribute between 59% - 82% of new infections among MSM cohorts in high-income settings (73-75). Moreover, the acute stages of HIV infection associated with sero-conversion and higher levels of viremia - but before HIV antibodies can typically be detected by standard testing algorithms (76) - may also play a role in ongoing HIV transmission (66). The disproportionate role of undiagnosed HIV (relative to diagnosed and treated, and diagnosed and untreated) in driving

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onward transmissions among MSM in high-income settings has led many to highlight frequent testing as a key strategy for reducing HIV incidence (72-75).

Less is known about the specific contribution of undiagnosed HIV to transmission in LMIC, or in Asia more specifically. Given that the coverage of ART is generally lower in LMIC compared to high-income settings, the relative proportion of undiagnosed HIV to overall HIV transmissions among MSM in LMIC may not be as high as those described above. However, given ongoing sexual risk behaviours and low coverage and frequency of HIV testing (see Section 1.6.2), undiagnosed HIV is likely to be an important contributor to HIV transmission in Asia. The role of undiagnosed HIV may also be potentiated by highly connected sexual networks, and the extent of infrequent HIV testing, infrequent condom use and HIV prevalence within sexual networks. MSM and TW commonly report multiple casual sex partners in Asia (77-80), including concurrent casual and regular sexual partnerships (81, 82), which may enhance HIV transmission where undiagnosed HIV is present and where sexual networks are highly clustered. Additionally, in countries like Myanmar, where the illegality and stigmatisation of sex between men mean fewer and less diversity in locations to meet sex partners, the role of undiagnosed HIV in transmission within sexual networks may be enhanced (83).

1.4.3 *Limited treatment access and uptake*

Sustained HIV viremia among people with diagnosed and untreated HIV remains a key driver of HIV transmission in LMIC (6) and scaling up ART access for MSM is estimated to avert between 14 – 25% of new HIV infections among MSM in LMIC settings (84). A review of data from Asia suggests limited success in engaging and retaining MSM in the HIV care cascade (85), and suboptimal retention of TW in ART services (86).

In most settings, clinical staging and CD4 testing is required for initiation of ART and generally requires additional visits, often to facilities other than where individuals have been diagnosed. This, alongside logistics and laboratory capacity can result in long waiting time for results, and

additional steps after staging to link to ART care. These factors can delay treatment initiation and contribute to poor retention in the HIV care cascade (87), and can compound additional barriers faced by key populations to accessing HIV services, such as those described in Section 1.4.4 below. For the benefits of ART to be realised, the structural barriers that can impact the retention of MSM and TW in HIV treatment and other services must be addressed.

1.4.4 Psychosocial barriers and prohibitive environments

Structural barriers commonly faced by MSM and TW in Asia include stigma and discrimination, limited availability of competent and sensitive HIV testing and prevention services, low levels of HIV prevention knowledge and hostile social and legal environments (11, 86, 88, 89). These structural barriers inhibit MSM and TW's engagement in HIV prevention while enhancing HIV vulnerability and risk.

Punitive laws that criminalise homosexual sex remain a feature of numerous legal frameworks across Asia (90). As many as 19 of the 48 countries comprising the Asia Pacific region impose some level of criminalisation against consensual male-to-male sex, while also applying other criminal provisions – such as indecency offenses – disproportionately towards sexual minorities (91). These legal restrictions are typically a relic of penal codes introduced during colonisation and maintained by political and religious conservatism regarding same-sex behaviours and orientation (92). While enforcement of these laws in many countries is rare, the criminalisation of homosexual sex may be used as a basis for extortion or harassment of sexual minorities (93) and creates an environment that legitimises prejudice and marginalisation of MSM and TW.

Socio-cultural views which regard homosexual sex as transgressive or inappropriate contribute to the marginalisation of MSM and TW groups and may enhance vulnerability to HIV through stigma and discrimination, concealment of sexual identity and limited engagement in HIV prevention services, including HIV testing (discussed further in Section 1.6.2). A relationship between prejudicial attitudes, criminalisation of homosexual behaviour, or legislation that

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enshrines discriminatory practices and limited access to HIV prevention services, has been reported in nearly every region of the world (88, 94-97).

Stigma and discrimination, as well as familial and gendered expectations, contribute to many MSM and TW concealing their sexual or gender identity, particularly in health settings. Across Asia, non-disclosure of sexual identity has been associated with lower uptake of testing for HIV (98, 99) and STIs (100) and a reluctance to attend MSM-targeted HIV prevention services due to privacy concerns or because they do not identify as the intended target group for such services (101, 102). Additionally, non-disclosure of sexual behaviours may hinder the provision of relevant and tailored sexual health information, including recommendations for HIV testing frequency and assessments of eligibility for biomedical HIV prevention options, such as PrEP (103). Additional concerns about stigma and discrimination on the basis of a perceived association with HIV may also lead to lower rates of HIV testing (88), and delayed (104) or infrequent testing behaviours (88, 105).

Transgender women experience unique forms of stigma and discrimination, including higher levels of reported sexual abuse or assault (79, 80) and discrimination from family, friends or community members compared to MSM (23). Stigma and discrimination of TW can also lead to employment and economic marginalisation, which potentially contributes to an increased likelihood of TW's engagement in sex work (35). For some, participation in sex work is also perceived as an opportunity for gender affirmation not otherwise available to TW in Asia (106). Sex work, however, increases the risk of TW experiencing gender-based violence (80) and increases risk of STIs and HIV (80, 107) .

In Myanmar, consensual homosexual sex remains criminalised under Section 377 of the Penal Code and is punishable by up to ten years' imprisonment (42). There are few reports of individuals being prosecuted under this article but some claim the law is used by authorities to extort bribes, intimidate sexual minorities and disrupt outreach HIV prevention activities (41, 45). The broad interpretation of other statutory acts, including those colloquially known as "in the shadows" laws, are reported applied indiscriminately to sexual minorities deemed by police to be suspicious or undesirable (41). MSM and TW in Myanmar have reported experiencing

stigma and discrimination in employment and education settings (45), police harassment (7), arbitrary detention or physical and sexual abuse by police or other law officials (45), and forced sex (108). While Myanmar's legal framework does include certain components designed to protect sexual minorities – including equal employment opportunities and guarantees of privacy and security – limited awareness of these laws, disregard of the laws by police and judicial bodies, and sexual minorities' sense of distrust towards authorities prevents broad enactment of these protections, and likely results in the underreporting of offenses against MSM and TW (45).

1.5 HIV Prevention among MSM and TW

In 2014, UNAIDS launched targets to guide the global response to HIV towards the end of AIDS. Known as the 90-90-90 targets, these goals aim to achieve 90% of people living with HIV knowing their status, 90% of people with diagnosed HIV initiated on treatment, and 90% of people on treatment achieving viral suppression by 2020 (109); attainment of these targets is estimated to result in the virtual elimination of HIV by 2030 (defined as a 90% reduction in incidence compared to 2010 levels). Ultimately, these targets are underpinned by the strategic use of ART and the acceleration of people living with HIV to achieve viral suppression and prevent onward transmission of HIV – known as Treatment as Prevention (TasP; see Section 1.5.2).

The 90-90-90 goals have been adopted at regional and country-levels and also by within-country jurisdictional governments. In Asia, a concerted effort has been made towards achieving these elimination goals, with estimated improvements made between 2015 and 2015 (see Figure 4)

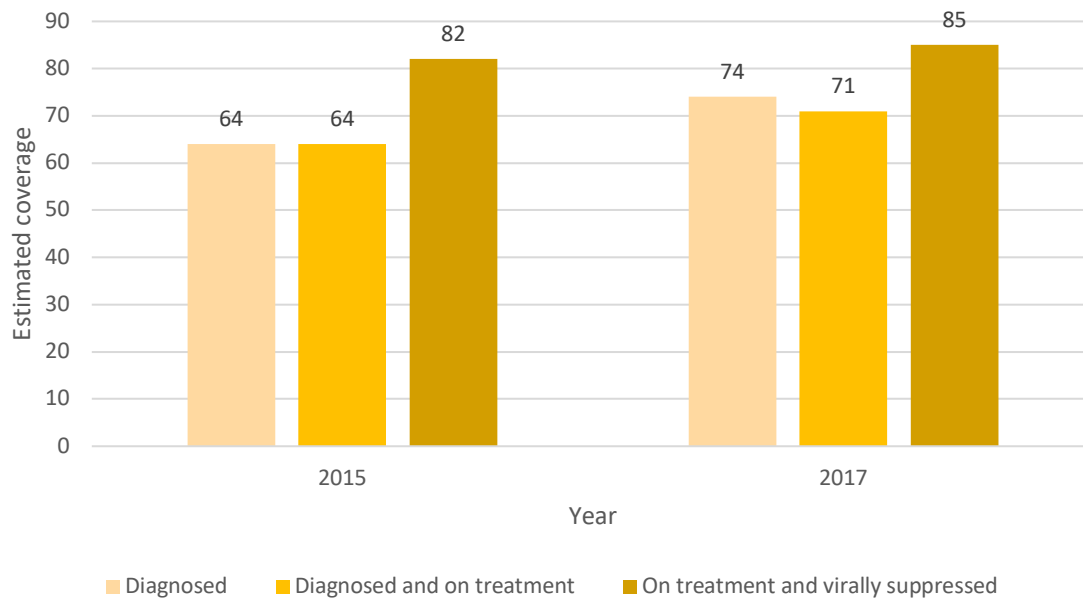


Figure 4: Progress towards the 90-90-90 goals in Asia (2015 compared to 2017) (Source: (5, 6))

However, while HIV care cascade targets dominate the current prevention discourse, the modelling that underpins the 90-90-90 targets is predicated on a concomitant scale up of primary prevention activities and health systems strengthening efforts. This, combined with countries where meaningful incidence reductions have yet to emerge despite considerable improvements in HIV cascade indicators, has led some to call for a renewed emphasis on strategies to promote primary HIV prevention (110) and a re-emphasis on primary prevention within a combination prevention approach (111).

Combination prevention refers to the implementation of a suite of evidence-based and synergistic behavioural, biomedical and structural interventions tailored to the local context and that respond to the documented local drivers of HIV infections and to the needs and vulnerabilities of key populations (112). Current guidelines for service provision among MSM and TW highlight the importance of addressing structural barriers for key populations to enhance their access to HIV testing and treatment (113).

For MSM and TW, combination prevention entails access to condoms and lubricant, HIV-related health promotion and HIV testing, situated within broader structural interventions to

reduce stigma and discrimination and other barriers to health service access. Contemporary approaches to HIV prevention for MSM and TW now also include the strategic use of ART to prevent HIV acquisition in HIV-negative individuals – or PrEP (see Section 1.5.3). However, in LMICs where health systems and resources continue to contribute to incomplete HIV treatment coverage and where clinical and service environments preclude the scale-up of PrEP, primary prevention of HIV through behaviour change and risk reduction strategies remain the key approach to averting new infections (114).

1.5.1 *Primary prevention*

Unprotected anal sex remains the primary risk for HIV acquisition among MSM and TW; reducing this risk through the condom promotion and distribution is a key primary prevention measure. Behavioural interventions that target sexual risk taking or promote protective behaviours, such as consistent condoms use and regular engagement in HIV and STI testing, have been a central component of HIV prevention for MSM and TW. Behavioural approaches to HIV prevention may focus on the individual or social group and include strategies such as individual counselling and education or skills-building sessions, peer community outreach and health promotion, social marketing campaigns, or social or behavioural support (115-117), with the ultimate goal of behaviour change that results in diminished HIV risk.

Many systematic reviews have synthesised existing evidence on HIV behavioural interventions targeting MSM and TW (115, 118-120). Collectively, estimated increases as a result of behavioural interventions in reported levels of consistent condom use among MSM and TW have ranged from 27% - 41% (115, 119-121). Others note positive impacts on reductions in the number of sexual partners as a result of behavioural interventions that provide HIV information through group discussion, peers or counsellors, or involved interpersonal skills training (115, 121). Reports of larger behavioural intervention impact among non-gay identifying MSM suggest that behavioural interventions may be particularly effective among harder-to-reach subgroups of MSM (115). A recent review looked specifically at behavioural interventions targeting MSM and TW in South-East Asia, finding that most interventions used peer education

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and outreach, which was typically supported by condom distribution activities and the provision of HIV prevention and testing services from fixed-site drop in centres (DICs) (122). All included studies were able to demonstrate positive outcomes across a range of behavioural targets including condom use at last sex, consistent use of condoms and reduced number of sexual partners. While evidence points to the positive impact of these interventions on risk reduction behaviour change, how long these changes last or the impact of these changes on population-level HIV transmission is unclear (119, 123, 124).

1.5.2 *Treatment as Prevention (TasP)*

The assumed role of treatment and viral suppression on reducing HIV transmission risk emerged in the 1990s through the prevention of mother to child transmission of HIV (PMTCT) after it was observed that ART given to pregnant women reduced the likelihood of transmission to their children (125). This observation was the precursor to trials designed to provide definitive evidence of the effectiveness of early treatment and viral suppression on reducing HIV transmission. The HPTN052 study was the first to find that early initiation of treatment leading to viral suppression reduced the risk of HIV transmission. Results from this study showed a 96% reduction in incident infections in sero-discordant heterosexual couples commenced immediately on ART, compared to couples where ART commencement was delayed until a decline in CD4 count or onset of HIV-related symptoms (126). Two subsequent studies confirmed the strong prevention impact of viral suppression in male same-sex couples; the PARTNER study (127) and the Opposites Attract study (128), both which reported no HIV transmissions in male sero-discordant couples across 1238 and 588.4 couple-years of follow-up, respectively. On the strength of this evidence, TasP has become a key paradigm of HIV prevention, reflected by the focus on viral suppression as the endpoint objective in the UNAIDS 90-90-90 targets, the revision of global guidance recommending immediate treatment initiation for people living with HIV (PLHIV) regardless of clinical staging or CD4 count (129), and the emergence of the global Undetectable=Untransmittable (U=U) movement (130).

However, the emphasis on TasP as the overwhelming focus of HIV prevention policy targeting MSM and other key populations has been questioned (85). The delayed identification of PLHIV and suboptimal or delayed linkage and retention in care are issues that both undermine the effectiveness of TasP and disproportionately affect MSM and TW ((86); see Section 1.5.2). These factors underscore the importance of an integrated combination prevention approach to HIV and the role of political, social and structural interventions in optimising the effectiveness of TasP and primary prevention for MSM and TW (85, 110). Moreover, while the evidence concerning TasP is strong, the modelling that underpins the 90-90-90 includes simultaneous scale-up of harm reduction/primary prevention, which may not currently reflect real life situations. Regional modelling studies confirm the impact of immediate treatment initiation among MSM and TW, but assumes high level coverage of clean syringes for PWID (131), or increases in reported condom use (132). As discussed, the significant barriers faced by MSM and TW may limit access to primary prevention services and undermines the estimated impact of TasP.

1.5.3 *Pre-exposure prophylaxis (PrEP)*

The effectiveness of PrEP for preventing HIV acquisition among MSM has been identified in numerous studies (133-136), with results highlighting a dose-dependent relationship and the importance of adherence. The iPrEX trial found a 44% reduction in HIV transmission among MSM and TW prescribed once-daily PrEP, while effectiveness reached 90% among participants with indicators of highest adherence (133). The iPrEX OLE study found greatest preventive benefit of PrEP associated with adherence that was equivalent to four or more pills taken per week resulting in 100% protection from HIV acquisition (135). A significant prevention impact was also demonstrated in the PROUD study open label trial in England, which demonstrated an 88% reduction in HIV incidence in MSM prescribed daily PrEP and confirmed real-world applicability (134). The IPERGAY study also demonstrated that event-based PrEP dosing among MSM – taking PrEP before and after risk events – is also highly effective in preventing HIV (136).

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On the basis of the strong trial evidence, WHO called for expanded access to PrEP for MSM in 2014. In 2015, WHO updated recommendations to include a recommendation for making PrEP available to all key populations where incidence is greater than 3 per 100 person- years, as part of combination HIV prevention approach (137). While there are a number of countries with policies supportive of PrEP in Asia, this has not necessarily translated to national provision (with the exception of Thailand and Vietnam) and availability of PrEP beyond small-scale demonstration projects is limited (138, 139). The extent of self-importation and off-label use of PrEP in Asia is also not documented.

However, there is evidence for demand of PrEP, with numerous studies reporting high levels of willingness to use PrEP among MSM and TW in Asia (140-142), even in contexts of low PrEP awareness (141, 143, 144). Identified barriers to PrEP in the region include costs (71, 144), concern regarding potential side effects (142, 145) and concerns about stigma and discrimination (141, 143). A sub-analysis of the original iPrEX study identified lower time spent with protective concentrations of PrEP among TW, suggesting potential barriers to adherence compared to MSM participants (146). TW may experience unique and specific barriers to PrEP, such as limited trans-inclusive marketing of PrEP and concerns about interactions of PrEP with gender-affirming hormone therapy (146, 147).

While there may be significant demand and willingness to use PrEP among MSM and TW in Asia, several implementation challenges may affect its future HIV prevention impact in Asia (148), including questions about the ethics of providing PrEP in countries with low coverage of ART for PLHIV (149) and limited health systems infrastructure to ensure regular monitoring of people on PrEP.

1.6 HIV testing

1.6.1 *The role of testing in global HIV prevention*

Given the focus on early diagnosis and treatment initiation of PLHIV reflected in global frameworks such as 90-90-90 and TasP approaches discussed in Section 1.5, HIV testing has assumed a central place in the HIV prevention response. Globally, there has been an upward trend in the numbers of individuals testing for HIV in most parts of the world (5), however data measuring testing coverage and frequency is limited.

Regular HIV testing has also become a key part of the HIV prevention response among MSM and TW, prioritised for its role in reducing the impact of undiagnosed HIV. Appropriate testing models with strong referral pathways and integration with treatment services also underpin the role of testing services to reduce HIV incidence among MSM through reductions in the levels of viremia in sexual networks (150-153). A focus on appropriate pre- and post-test counselling within testing service models also helps prevent onward HIV transmission through the facilitation of post-diagnosis behaviour change. Reductions in sexual risk taking among MSM following diagnosis have been noted extensively (154), including reported declines in number of sexual partners (155, 156) and condomless anal sex (157, 158). Evidence of risk-reduction behaviour through reductions of concurrent sexual partnerships and condomless sex with casual partners has also been found among recently-diagnosed MSM in Asia (159).

1.6.2 *Testing behaviours and barriers among MSM and TW in Asia*

In Asia, improvements in the proportion of PLHIV who know their status have been made, increasing from an estimated 64% in 2015 to 74% in 2017 (6). While there are no specific estimates for the proportion of MSM and TW living with HIV who are diagnosed, country-level estimates (where they exist) provide widely disparate estimates but typically point to sub-optimal coverage of HIV testing across the region (19, 160) and ongoing barriers faced by MSM and TW to testing uptake.

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Documented barriers to testing typically span structural factors – such as location and availability and appropriateness of services - and individual and psychosocial factors - such as perceptions of HIV risk, levels of HIV knowledge, fear of diagnosis and status disclosure and stigma and discrimination (90, 161-163). In addition to these barriers, MSM and TW in Asia may face specific barriers related to sexual and gender identity and expression. As discussed in Section 1.3.1, sex between men in many parts of Asia is not limited to those who identify as gay or are exclusively sexually oriented towards other men. Numerous studies have reported lower levels of testing among men who are non-gay identifying (99, 164), report female sex partners (99), or conceal their sexual identity (98, 99, 160). For TW, lack of specific TW-services may further limit HIV testing behaviours. Across Asia, services for TW are typically combined with MSM, however TW may not feel welcome at MSM-specific services nor wish to be identified as ‘men’ (35, 165).

Low levels of HIV knowledge and perceptions of risk may influence MSM and TW’s likelihood to seek HIV testing (166-168). Data from the Asian Internet MSM Sex Survey identified that low risk perception was the most common reason for not being testing (160). However, incongruence between risk perception and risk behaviour has been noted. For example, in Pakistan, only 23% of TW self-described themselves as at risk of HIV infection, despite only 9% reporting consistent use of condoms with sexual partners in the past year (78).

1.6.3 Approaches to overcoming barriers to HIV testing among MSM and TW

Community-based and peer-led HIV testing and prevention services have emerged as a key strategy to overcoming some of the barriers experienced by MSM and TW described above. Peer-led services have become a fundamental part of the HIV response in Asia, with the involvement of peers designed to reduce perceptions of stigma and discrimination in health-seeking contexts and increase comfort around disclosure of sexual practices for MSM and TW (8). Rooted in social learning theory, peer-based approaches attempt to promote positive behaviour change through modelling and changing perceived norms within a social network

(169-172). Peer involvement in HIV testing may include general promotion and demand creation through community outreach and education, or direct involvement in the HIV testing and/or counselling process (113, 173). WHO guidelines for task shifting has provided broad support for the greater involvement of peers in the actual delivery of HIV testing (174). Peer involvement in HIV testing has been facilitated by the increased availability of rapid point-of-care (RPOC) testing, which enables HIV testing to be conducted in non-clinical settings by non-clinical or laboratory-trained staff. RPOC testing is thought to reduce reported barriers to testing through an immediate result delivery, which also reduces loss to follow up associated with multiple service appointments to receive test results. In Asia, examples of RPOC testing in community-based, peer-led settings have been shown to increase testing uptake and linkage to care among MSM (13, 175, 176).

HIV self-testing is another identified strategy to overcome barriers to testing among MSM. HIV self-testing may be a cost-effective (177) and useful strategy to engage naïve testers in LMICs (178). HIV self-testing also offers advantages related to greater geographic reach and testing coverage beyond areas serviced by fixed site testing services and has the potential to increase testing frequency without the inconvenience of having to attend a health service (179).

Acceptability of HIV self-testing among MSM is reportedly high (180), and although the majority of evidence to date is from high-income settings, a growing number of studies have been conducted in Asia, finding HIV self-testing as an acceptable option for MSM and TW in Myanmar(181), Cambodia (182), China (183) and Vietnam (13).

An emerging approach to increasing demand for HIV testing services and modalities is the use of online platforms for health promotion (184). In Asia, high levels of mobile network coverage and use of smart phones offers opportunities for health promotion among MSM (185). Geo-social networking applications (“apps”) are increasingly used in high frequency by MSM in the region to meet potential sex partners (186). The association of higher risk sexual behaviours among MSM who use these apps (187-189) suggests that using digital technology as a platform for HIV-related health promotion may provide an opportunity to target MSM in environments of risk. Recent systematic reviews have identified that HIV prevention interventions delivered

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through online digital technology are effective in reducing sexual risk taking and promoting HIV testing among MSM (190, 191). The success of peer-involved models of HIV testing and prevention programs has led to the exploration of peer involvement in online health promotion to MSM, including through apps used to meet sex partners (192-194). Early findings suggest that online health promotion delivered by peers may increase rates of HIV testing (195), increase engagement in HIV prevention services (193) and increase HIV-related knowledge (196) among MSM.

In Myanmar, the rapid scale-up and increased coverage of internet and mobile phone networks and services has raised interest in the potential for mobile phone and internet-based technologies to reach MSM and TW with HIV prevention programs. In 2017, UNAIDS noted that decreasing internet censorship and expanding ownership of mobile and web-based technologies created an opportunity to use such technologies to enhance reach and engagement of MSM and TW in HIV prevention, testing and treatment (197). There are a growing number of online-based HIV prevention interventions being trialled in Myanmar. For example, in 2017 an online outreach strategy was developed by a community-based NGO which resulted in a four-fold reported increase in the number of individual MSM and TW clients testing for HIV and a 19% increase in case detection compared to traditional outreach strategies (198).

1.7 Responding to HIV among MSM and TW in Myanmar

1.7.1 *Evolution of the HIV strategic response in Myanmar*

The national response to HIV in Myanmar has evolved considerably over the last two decades, partly as a consequence of the changing socio-political landscape. In 1999, Myanmar's health system was ranked 190th out of 191 nations and HIV, despite being considered a national health crisis, was largely ignored by the controlling military junta (27, 199). This lack of political attention and weak national health infrastructure resulted in a response that was limited in

scope, poorly funded and failed to acknowledge the specific needs of key populations or factors that contributed to HIV transmission (200).

Increasing cooperation among UN agencies saw more coordinated efforts to tackling HIV and increased HIV funding, culminating in the establishment of the first Joint United Nations Program on AIDS (UNAIDS) in 2002 (200). UNAIDS coordinated the HIV prevention response and provided oversight to the United Nations Expanded Working Group on HIV/AIDS – a coalition of government actors, donors and NGOs who developed the First National Strategic Plan for HIV in Myanmar (2003 – 2005), marking the beginning of a multi-sectoral response to HIV. This national plan was backed by government and identified strategic priorities for HIV control, focusing mainly on people who sell and purchase sex and people who inject drugs (201). The Fund for HIV in Myanmar – created to finance the Joint Program - provided approximately one third of the funding for the national response by 2005 (200).

Implementation of HIV prevention activities during the early stages of the national response was impeded by high levels of administrative control, restricting reach and coverage of activities and slowing progress towards national targets (200). Various international NGOs began providing HIV prevention activities to MSM starting around 1997 (202). Approximately 22,000 MSM had been reached with health education by 2005 (203); however, up to this point, a lack of political commitment and limited understanding (or denial) about the size of the population or the magnitude of the burden of HIV among MSM and TW prevented more comprehensive efforts (201, 202, 204).

MSM were first identified as a priority population for HIV control in the Second National Strategic Plan (2006 – 2010) (3) and were targeted for mass health education information, peer education and behaviour change promotion, condom and lubricant distribution programs and HIV testing and STI testing and treatment. The Second National Strategic Plan aimed to reach 62,000 MSM with these prevention activities by 2010; by 2012, an estimated 76,000 were reached by any HIV intervention, representing one third of the estimated population (205). During this time, HIV testing for key populations was limited to government-provided services, while a limited number of NGOs provided basic HIV prevention services such as condoms and health

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education to MSM (202, 206). Under the Third National Strategic Plan (2011 – 2015) (4), the first targets for HIV reduction among MSM were set, aiming for a 50% reduction in the number of new infections by 2015 compared to 2010, as well as a significant increase in HIV prevention service coverage.

Funding the national HIV response has been largely covered by the Global Fund, who have provided around half of the total funding and committed more than 300 million USD to date (207). This funding has historically bypassed government and instead been disbursed to implementing partners through international and local NGOs, promoting parallel approaches to health delivery and potentially diminishing opportunities for overall health system strengthening. However, from 2018, funds from the Global Fund are being distributed through the MoH, enabling greater government control and oversight of funding and creating an environment for greater health systems coordination (207).

Alongside this increased financial control, the current and Forth National Strategic Plan (2016-2020) outlines plans for greater leadership and management of national ART provision by the government (30). ART was first made available through an NGO-provided program in 2003 that delivered free treatment in ten primary care settings across Myanmar (208). In 2005, a national ART program, led by the Ministry of Health and the National Tuberculosis Program, was initiated in six centres under Myanmar's Integrated HIV Care program. Decentralisation of ART provision services began in 2012 to reduce the workload of ART centres and expand access to treatment outside of major public services, including greater availability through NGO providers at the township level (206). By the end of 2016 there were 82 public sector ART initiation sites as well as 187 decentralised sites providing ART or ART maintenance (30, 209).

Current national guidelines in Myanmar follow WHO's recommendations for the immediate initiation of ART following an HIV diagnosis; adoption of this policy in 2017 increased the estimated number of PLHIV requiring treatment by 100,000 (210, 211). Levels of estimated treatment coverage has since doubled, reaching 66% of PLHIV in 2017 (6).

1.7.2 *Implementation and scale-up of HIV testing and prevention activities in Myanmar*

The current National Strategic Plan (2016 – 2020) (30) includes specific diagnosis and treatment targets aligned with the UN's 90-90-90 goals and is focused on scaling up HIV prevention efforts among key populations, aiming to reach 90% of MSM and TW with HIV prevention programs by 2020. This National Strategic Plan also aims to have 90% of MSM and TW reporting condom use at last sex and 90% of MSM and TW receiving a HIV test in the past year. Scale up of HIV testing and prevention programs will be prioritised in areas of greatest need, determined by estimated HIV burden and size of population at risk

NGOs currently continue to play a key service delivery role by delivering comprehensive HIV prevention services through outreach and fixed site services and providing HIV case management to link PLHIV to care in Myanmar in high burden areas. However, under the current Plan, public sector services will play a greater role in the leadership and delivery of combination prevention in medium and low burden areas. Ultimately, the aim is to achieve substantial improvement in HIV testing coverage by expanding outreach testing and mobile and fixed site clinical services, and supporting provider-initiated HIV testing and integration in other health settings. The current National Strategic Plan also calls for demand for HIV testing and combination prevention to be generated through peer outreach and social and mass media health promotion.

Substantial scale up of HIV testing will be required to realise national HIV control targets in Myanmar. Latest IBBS estimates show that 52% of MSM and TW reported testing in the past year (ranging from 37 – 63% across studies sites), most commonly at NGO services (7). Higher levels of recent testing have been reported by other studies (68, 212), however these studies have predominantly recruited MSM and TW through NGO networks which may bias the sample towards those already engaged in HIV prevention. Conversely, a 2013 study that recruited participants in five locations through RDS found that 46% of MSM and TW reported ever visiting a DIC, and 41% had ever attended a health talk on HIV and condom use (43).

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These data suggest the reach of prevention and testing programs is falling well short of the 90% targets outlined above.

There are a number of challenges to scaling up HIV prevention and testing services in Myanmar and achieving high coverage among MSM and TW populations. First, as has been discussed above, sexual and gender identity is thought to be an important determinant of HIV testing behaviours in Myanmar. Non-identifying MSM in Myanmar have reported being less likely to access HIV testing services due to concerns for privacy (42), while also expressing a willingness to adopt HIV self-testing which was seen to offer greater confidentiality compared to facility based testing (181); these findings suggest that services will need to be cognisant of the preference and needs of different sexual identities. While the current National Strategic Plan acknowledges the variegated levels of HIV risk and vulnerability among MSM and TW sub-populations, the extent to which this has been incorporated into current service delivery efforts is unclear.

Second, while the current National Strategic Plan is supportive of novel HIV program strategies in Myanmar, meaningful progress towards their implementation and scale-up has yet to occur. A recent trial of HIV self-testing was conducted in Myanmar among 577 MSM and TW in Yangon, with the majority of participants reporting that HIV self-testing was easy to use, the instructions and operations easy to understand, and that they would test more often if HIV self-testing were available (213). These findings aligned with previous qualitative research that identified a high level of acceptance for HIV self-testing among MSM and TW in Yangon, despite their concerns about potential psychosocial impacts of unsupervised diagnosis and incorrect use (181). Yet, there is currently no regulatory or policy support for HIV self-testing in Myanmar. Similarly, the current National Strategic Plan is also supportive of PrEP as a new approach to HIV prevention and identifies the need for a national policy regarding PrEP, however no demonstration trials have been conducted to date. There is evidence of MSM and TW's willingness to use PrEP in Myanmar; a 2017 study among 434 HIV negative MSM and TW identified that 62% were willing to use PrEP with willingness associated with greater self-perceived risk of HIV and reporting recent multiple sex partners (68). However, given that PrEP

is status-dependant, the suboptimal levels of HIV testing described above, as well as the incomplete coverage of ART, will likely undermine the potential impact of PrEP in Myanmar.

Last, while behavioural interventions are a key focus of the current National Strategic Plan, there is limited evidence about their general effectiveness or which specific approaches might be more effective in Myanmar. Only one study to date has explored the role of a comprehensive HIV prevention program on sexual risk and health seeking behaviours among MSM and TW. The intervention combined community-based peer education and health promotion on HIV and STIs, condoms and lubricant distribution and referrals to HIV and STI testing and treatment facilities. Serial cross-sectional surveys among participants in intervention townships found no significant changes in health seeking or sexual risk behaviours, or levels of HIV knowledge. The authors noted that the lack of impact may be attributed to the limited coverage and exposure to the intervention, or the short time frame between surveys (six months) (69).

1.8 Thesis rationale

MSM and TW in Myanmar are disproportionately impacted by HIV and have been identified as a priority population for national HIV control measures. In the context of high HIV prevalence among MSM and TW (particularly in the major cities of Yangon and Mandalay), evidence of ongoing sexual risk factors, including high reported number of casual sex partners, low levels of reported condom use and diagnoses of other STIs, suggests an ongoing future burden of HIV among MSM and TW. This burden also occurs within a context of continued stigma and discrimination and limited service coverage which impedes access to HIV services and prevents many MSM and TW from adopting preventive behaviours.

Suboptimal coverage and frequency of HIV testing point to the need to better understand specific barriers to engagement in HIV testing and prevention to identify and inform new approaches to service delivery. Myanmar has recently undergone a rapid period of change and

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development following the transition to a civil, democratically-elected government. The increase in funding and attention from international NGOs, burgeoning civil society and increasing sophistication and coordination of the national response to HIV provide important opportunities for innovative and expanded HIV prevention interventions.

However, MSM and TW are still a relatively understudied population in Myanmar. Greater understanding of MSM and TW's experiences and barriers to testing, and preferences for service models are required to design and implement HIV prevention services that speak to their specific characteristics and needs. This thesis seeks to better understand and characterise current HIV testing behaviours and levels of engagement in HIV prevention among MSM and TW in Myanmar. This research hopes to guide practitioners and policy makers in Myanmar in providing pragmatic services that address identified needs and helps to reduce future HIV burden experienced by MSM and TW.

1.8.1 Research aims

This thesis aims to enhance understanding of HIV testing behaviours among MSM and TW in Myanmar and explore barriers and facilitators to improved engagement in HIV testing and prevention services. The thesis objectives are:

1. Describe current HIV testing practices among MSM and TW in Myanmar;
2. Quantify HIV burden among service-attending MSM and TW;
3. Identify barriers and facilitators to HIV testing and engagement with prevention; and
4. Explore potential novel approaches to enhance HIV testing uptake.

1.9 Methods

Most of the data used for this PhD was collected through the Burnet Institute Myanmar's HIV prevention program for MSM and TW. This program was funded by the Global Fund and

delivered a comprehensive suite of HIV prevention activities to MSM and TW clients through fixed-site and community-based outreach activities in five districts in Myanmar between 2009 and 2017. Trained peer volunteers conducted health promotion, condom distribution and created demand for HIV and STI testing services in known MSM and TW-hotspot locations. Fixed-site DICs offered basic sexual health screening and primary health services for MSM and TW, with these service provided by both clinical and trained peer staff managed by Myanmar Business Coalition on AIDS (MBCA). In 2015, DICs began providing on-site RPOC testing conducted by trained nurses with peers involved in pre- and post-test counselling. On-site testing replaced the previous systems of referrals to public testing facilities and aimed to reduce barriers by offering testing in an MSM and TW-friendly environment and to reduce loss to follow up associated with off-site referral and needing to return to testing facilities to receive test results.

1.9.1 PReP acceptability survey

In 2014, the Burnet Institute conducted research in Myanmar to determine preparedness, levels of understanding and acceptability of MSM and TW for the uptake of PrEP as a new HIV prevention strategy. A cross sectional study was conducted in Yangon and Mandalay, recruiting a convenience sample of 520 MSM and TW in November – December 2014 through the HIV prevention program outreach activities.

Peer educators were trained in research methodology and recruited participants using snowball and time-venue-based sampling in known MSM and TW- hotspots. Participants were provided with non-identifying study cards that listed the times and venues for survey completion. Up to three additional cards were given to facilitate recruitment among participants' social networks. Eligibility was defined as those with male assignation at birth who self-identified as MSM or TW and were aged 18 years or over. Quantitative, interviewer-administered surveys were used to explore current HIV risk practices, and barriers and facilitators to HIV testing, treatment and other prevention strategies, and also asked about knowledge, attitudes and willingness to use PrEP. Data from this survey was used in studies described in Chapters 2 and 5.

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1.9.2 *Sentinel surveillance system*

In 2016, as part of the ongoing improvement of the Burnet Institute Myanmar's HIV prevention program described above, an HIV testing electronic data management system (eDMS) was developed and implemented to improve and modernise service delivery and replace paper-based systems used for donor reporting. This system aimed to strengthen reporting practices by enabling a broader range of HIV testing outcomes to be measured, especially those related to frequency of MSM and TW service engagement, facilitated by unique client identifiers that enable the prospective linkage of clients' testing episodes. The eDMS was trialled in the Yangon and Mandalay DIC sites, chosen for their high caseload and high local HIV prevalence. While the eDMS was introduced in the context of service delivery and ongoing program strengthening, the system also enabled the DICs to act as HIV sentinel surveillance sites and the data captured by the system was able to generate a more comprehensive epidemiological picture of HIV incidence and associations with HIV testing behaviours and outcomes among clients.

The eDMS was developed on a Microsoft Access-based patient management database and fields were modelled on previously used paper-based DICs forms and updated to include additional best-practice indicators related to sources of HIV risk. DIC staff accessed the eDMS via handheld tablets, which were linked to a central server. Client data was entered during pre- and post- HIV test counselling by peer DIC staff. At the end of the trial period (August 2016 – November 2017), de-identified records of clients who had male assignation at birth, were aged 18 years or above, and who attended the DIC for HIV testing were extracted from the system for analysis. Data from this study is presented in Chapter 3.

1.9.3 *Qualitative research*

In 2015, qualitative research was conducted in Yangon by Johns Hopkins University to inform a broader implementation study on innovative approaches to enhance retention of MSM and TW in the HIV continuum of care. This formative phase sought to identify current facilitators and

barriers related to HIV testing and treatment, and acceptability of various study interventions and delivery approaches.

In-depth key informant interviews were held with MSM and TW community members (n=25) and five focus group discussions were held with MSM and TW community leaders and services providers in Yangon (n=35). All study participants were drawn from the greater Yangon area and recruited through word-of-mouth. In-depth key informant interviews and focus group discussions were conducted by trained members from three local community-based organisations using semi-structured interview guides.

A secondary analysis was undertaken on this qualitative data to specifically investigate how experiences and perceptions of barriers to HIV testing and prevention varied across the different sexual and gender identities in Myanmar. This comparison was done in order to highlight the challenges of engaging non-disclosing MSM. Data from this study is presented in Chapter 4.

1.10 Thesis outline

This thesis by publication comprises seven chapters, of which five present published or submitted work. The following provides an overview of chapters two to seven. The thesis objective/s corresponding to the chapter is parenthesised.

Chapter Two

This chapter describes patterns of self-reported HIV testing behaviours among MSM and TW in Yangon and Mandalay and explores factors associated with reporting high frequency HIV testing. This paper has been published in *Journal of Global Health Reports* (objective 1)

Chapter Three

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This chapter uses data from the eDMS described previously to characterise observed patterns of HIV testing and testing outcomes among MSM and TW attending two community-based HIV testing clinics in Yangon and Mandalay. Factors associated with testing HIV positive at first test during the observation period are described and HIV incidence is estimated among those with two or more tests. This paper has been accepted for publication in *The Journal of the International AIDS Society* (objective 1 & 3)

Chapter Four

This chapter explores the specific challenges to engaging 'hidden' MSM in HIV testing and other prevention services in Myanmar. This study is a secondary analysis of the qualitative data collected during formative research led by Johns Hopkins University. This paper has been published in *BMC Public Health* (objective 3).

Chapter Five

This chapter explores the acceptability of peer-delivered HIV testing and its relationship with sexual risk and socio-demographic characteristics among MSM and TW in Yangon and Mandalay. The study is a secondary analysis of quantitative data collected by the PrEP acceptability survey. This paper has been published in *AIDS and Behaviour* (objective 3 & 4).

Chapter Six

This chapter describes a systematic review and meta-analysis of the effectiveness of digital communication technology platforms to improve HIV testing uptake among MSM and TW. This paper has been accepted for publication in *Journal of Medical Internet Research* (objective 4).

Chapter Seven

This chapter is an integrated discussion that presents a thematic overview of the findings of this thesis and discusses the implications for HIV prevention programming targeting MSM and TW in Myanmar.

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2 Self-reported testing behaviours among MSM and TW in Myanmar

The literature presented in Chapter 1 highlights the importance of regular engagement in HIV testing to mitigate the role of undiagnosed HIV in ongoing transmission, and facilitate prompt linkages to treatment and care, and engagement in risk reduction counselling for HIV-negative individuals. Increasing uptake of HIV testing among MSM and TW is a key priority of Myanmar's current national response, yet national estimates point to sub-optimal coverage of HIV testing. However, there is limited evidence available that characterises testing frequency among MSM and TW in Myanmar or identifies socio-demographic or behavioural correlates of HIV testing to inform priorities for targeted outreach or health promotion.

The manuscript in this chapter describes self-reported testing behaviours of MSM and TW recruited in community outreach settings in Yangon and Mandalay and socio-demographic and sexual risk behaviours associated with levels of reported engagement with HIV testing. This research identified a high proportion of self-reported engagement in frequent HIV testing among the MSM and TW recruited to the study and identified variables associated with frequent testing behaviours.

The research presented in this chapter was published as:

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Characteristics of men who have sex with men and transgender women in Myanmar who test frequently for HIV

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2.1 Abstract

HIV prevalence among men who have sex with men (MSM) and transgender women (TW) in Myanmar is increasing and less than half report having a HIV test in the past 12 months. The promotion of regular testing among this group has been identified as a key priority of the national HIV response, yet there remains limited information on HIV testing patterns and frequency among MSM and TW.

A cross-sectional quantitative survey was conducted among self-identifying MSM and TW in November 2015 recruited from known hot-spot locations in Yangon and Mandalay to characterise the self-reported HIV testing frequencies among MSM and TW and explore factors associated with high frequency HIV testing.

Among 353 HIV negative or unknown MSM and TW, more than half were identified as high frequency testers based on their regular HIV testing routine and date of last HIV test and was significantly associated with reporting recent sex with regular male partners and location of last HIV test.

Our findings contrast with national data suggesting sub-optimal testing uptake and support HIV testing delivered through community-based, tailored HIV testing services and the role of such models in establishing and maintaining regular HIV testing behaviours among MSM and TW in Myanmar.

2.2 Background

Men who have sex with men (MSM) and transgender women (TW) in Asia are more than 18 times more likely to acquire HIV compared to the general population (15). Despite a general decline in HIV prevalence in the region, new and re-emerging epidemics have been observed

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among MSM and TW in some Asian countries, including the Philippines, Thailand and Myanmar (17, 30, 214). In Myanmar, HIV prevalence among MSM and TW nationally is estimated at 11.6% with higher concentrations in the major urban areas of Yangon (27%) and Mandalay (22%) (30).

Regular HIV testing and timely diagnoses are important components of global HIV prevention and AIDS elimination strategies (109) and are prominent within the Myanmar HIV National Strategic Plan (30). Early detection of HIV facilitates timely access to HIV treatment and viral suppression, reducing the probability of forward transmission (215), and also affords opportunities for risk reduction practices (154). Undiagnosed HIV is identified as a key driver of HIV transmission in many countries, (216, 217); in the context of ongoing sexual risk behaviours among MSM and TW (43), delayed diagnoses of HIV are also likely to be a key factor in ongoing transmissions in Myanmar.

However, recent self-reported data indicates that less than half of all MSM and TW in Myanmar have tested for HIV in the past 12 months, while estimated coverage of HIV prevention programmes among MSM and TW is around 50% (30). Access to HIV testing and prevention services is limited by considerable stigma and discrimination experienced by MSM and TW in Myanmar (88, 97, 163). Sex between men remains criminalised, and alongside certain cultural and religious mores, this criminalisation contributes to an environment in which sexual minorities experience ongoing harassment and decreased access to HIV services (42, 218).

Regular and routine HIV testing among MSM and TW is crucial to meaningfully impact the HIV epidemic and has been identified as a key component of Myanmar's national response to HIV. While national guidelines for HIV testing are currently being developed in Myanmar, HIV testing services currently encourage a three-monthly HIV testing schedule for MSM and TW clients who report high-risk behaviours (219). Only one study in Myanmar to date has reported on recent HIV testing, finding that around one third of MSM and TW reported having an HIV test in the past three months (220). There remains limited information on HIV testing patterns and frequency among MSM and TW in Myanmar to help inform local HIV strategies.

This study explores the self-reported histories of HIV testing among MSM and TW recruited through outreach activities in Yangon and Mandalay. To help inform strategies to enhance frequent HIV testing behaviours, we aimed to: 1) characterise the self-reported HIV testing frequency among MSM and TW; and 2) explore factors associated with MSM and TW reporting high frequency HIV testing.

2.3 Methods

Recruitment

The methods for this study have been described in detail elsewhere (221). Briefly, a cross-sectional survey was administered among self-identifying MSM and TW in Yangon and Mandalay between November and December 2014. Participants were recruited by peer educators from the Myanmar Business Coalition on AIDS (MBCA), a non-governmental organisation (NGO) providing community-based HIV education and prevention services across Myanmar, who received training in research methodology. These peer researchers recruited MSM and TW using snowball and time-venue-based sampling in known MSM and TW 'hotspots'. Participants were provided with non-identifying study cards that provided information on when and where they could participate in surveys and up to three additional cards were given if participants indicated they knew peers who would be interested and eligible for participation. Eligibility criteria for survey participation included being biologically male, aged 18 and over, reporting anal sex with a male partner in the past 12 months, being willing and able to provide informed consent and no previous participation in the study.

Data collection

Surveys were peer-researcher administered in the local language using secure, electronic tablets. Surveys explored factors related to socio-demographic characteristics, sexual risk behaviours, HIV prevention practices, knowledge, attitudes and use of HIV/STI risk reduction strategies and self-perceived HIV risk among MSM and TW. Variables included in this analyses

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were: location of recruitment (Yangon, Mandalay), age, gender identity (male, TW), highest level of education (primary, middle, high school, tertiary), median monthly income, male sex partners during past three months (casual only, regular only, both casual and regular), location of last test (government hospital or clinic, private hospital or clinic, international/non-government organisation (i/NGO)), primary reason for undertaking last HIV test (concern/interest in knowing status, part of regular testing pattern, suggestion from sexual partner or friend, symptoms of HIV, other) and self-perceived likelihood of future HIV acquisition (very unlikely, unlikely, neutral, likely, very likely). Barriers to HIV testing were assessed using Likert scales responses (strongly disagree, disagree, neutral, agree, strongly agree) to statements about being worried about stigma when attending a HIV testing clinic, being afraid of disclosing HIV test results to others, not being able to afford HIV testing costs, not having the time to test for HIV, finding it generally difficult to access HIV testing services, and having to wait a long time to test for HIV. Proportions of participants reporting specific barriers to were determined by dichotomising level of agreement (strongly agree/agree versus neutral/disagree/strongly disagree).

Analysis

Our outcome of interest was high frequency testing behaviour, defined as reporting typically testing for HIV every three months and reporting receiving a HIV test within the past six months. We created a dichotomous (yes, no), composite variable to classify HIV undiagnosed MSM and TW as high frequency testers using the following variables: usual frequency of HIV testing (\geq three months, every 3-6 months, every 6 – 12 months, every 12 – 24 months, >24 months) and; time since last HIV test (past month, 1 – 6 months, 7 – 12 months, 1–2 years ago, >2 years/never).

Descriptive statistics were used to characterise high frequency testers across socio-demographics, sexual risk behaviours, and self-reported barriers to testing and perceived HIV risk. Analysis was restricted to participants who were HIV-negative or status unknown and who provided data on HIV status and the two testing variables used to make the composite outcome variable; Pearson's chi-square was used to assess any significant differences between

HIV undiagnosed participants included and excluded in the analysis on the basis of missing data across socio-demographic variables. Univariable and multivariable logistic regression identified variables significantly associated with high frequency testing; variables significant in univariable analyses ($p < 0.1$) were retained in the multivariable model. Analyses were conducted using Stata (Version 13, Stata Corp., College Station, TX, USA). Statistical significance in multivariable model was set at $p < 0.05$.

Ethics

Ethics approval was granted by the Department of Medical Research Ethics Review Committee, Myanmar and Alfred Hospital Human Research Ethics Committee, Melbourne, Australia (Project number 445/14).

2.4 Results

In total, 520 MSM and TW participants were recruited in Yangon ($n=227$) and Mandalay ($n=293$). Participants with a known HIV positive status ($n=66$), or with missing data on HIV status ($n=10$) or the two HIV testing variables used to classify high frequency testing behaviour ($n=91$) were excluded from analyses. Participants whose data was excluded on the basis of missing data HIV testing variables were significantly more likely to be older, report lower income and educational attainment ($p < 0.05$) compared to included participants (data not shown).

Among the remaining 353 HIV-negative and undiagnosed participants, just over half were recruited from Mandalay, were aged under 25 years and educated to tertiary or high school level. One in five participants identified as TW, while the rest identified as male gender. The median monthly income was 150,000 MMK (USD \$109; IQR 100,000 – 200,000 MMK).

Over one third of participants reported both regular and casual sex partners in the past three months, while 34% and 28% reported exclusively casual and regular sex partners, respectively. The most commonly reported barriers to HIV testing included not having enough time to test

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and fear of letting people know their HIV test results. Half of all participants considered it likely/very likely they would acquire HIV in the future.

The majority of participants identified *concern or interest to know HIV status* as a primary reason for last HIV test, while a quarter reported their last test as part of their regular testing practices. Most participants reported receiving their last HIV test at an NGO or iNGO service. Two thirds of participants reported typically testing for HIV approximately every three months and nearly 80% reported receiving an HIV test in the past six months (Table 1).

In total, 56% (n=197) of our sample were classified as high frequency testers on the basis of their typical testing frequency and time since their last test. In univariable analyses, high frequency testing was significantly associated with identifying as male compared to TW (OR: 1.9; 95% CI: 1.1 – 3.3), reporting sex with regular male partners only in the past three months compared to sex with casual partners (OR: 2.3; 95% CI: 1.3 - 4.1) and receiving their last HIV test at an NGO/iNGO service compared to a government hospital or clinic (OR: 3.9; 95% CI: 1.4 – 11.2). At the multivariable level, after adjusting for age, reporting only regular sexual partners in the past three months (aOR: 2.3; 95% CI: 1.3 – 4.2), and receiving a last HIV test at an NGO/iNGO service (aOR: 3.5; 95% CI: 1.2 – 10.7) remained significantly associated with high frequency testing (Table 2).

2.5 Conclusion

Nearly two thirds of MSM and TW were identified as high frequency testers based on their self-reported three-monthly testing routines and having had an HIV test in the past six months; this finding contrasts with the suboptimal rates of self-reported HIV testing among this group nationally (30). High frequency testing was significantly associated with reporting only regular sex partners and location of last HIV test. Recent evidence demonstrating lower risk of HIV infection among frequent testers - a suspected association of risk reduction counselling provided as testing events - and the reduced risk of onward HIV transmission through the

detection of acute HIV among Asian MSM (153, 222) underscores the potential role of frequent HIV testing in controlling the HIV epidemic, beyond that simply associated with early HIV diagnosis. In light of previous reports of suboptimal HIV testing rates in Myanmar, and scant data on the patterns of HIV testing among MSM and TW, these findings of factors associated with frequent testing further local understandings of testing behaviours and can inform future HIV health promotion strategies and targeting of health promotion messages and testing services.

Our sample was recruited in the context of an existing community-based, non-governmental HIV prevention program that provided HIV prevention services, including testing referrals and health education on the importance of regular testing to MSM and TW. i/NGO HIV prevention programs in Myanmar routinely advise MSM and TW engaging in high-risk behaviour to undertake three-monthly HIV testing (69, 219). In this study, sixty percent of MSM and TW reported a typical three-monthly testing pattern and the majority reported testing within the past six months. While HIV testing frequencies among MSM at a country-level are still reported as inadequate (30), testing patterns reported in our study are similar those reported by MSM and TW engaged with other non-governmental, peer-involved, community-based programmes in Myanmar (69). Together, these findings suggest a high degree of responsiveness among MSM and TW to HIV testing health promotion messages provided by community organisations. This view is further supported by our finding that MSM and TW who reported receiving their most recent test at an i/NGO service were nearly four times more likely to be classified as high frequency testers compared to those who tested at a government service.

Myanmar has seen a rapid expansion of i/NGO-provided HIV testing and prevention services over the last decade, driven by increases in donor funding and occurring alongside the decentralisation of HIV testing services (223). These services are typically tailored to the specific needs of priority populations and increasingly utilise peers in key service delivery roles, reflecting global guidance and normative practice around HIV service provision for key populations (113, 173). Our findings speak to the importance of MSM and TW- friendly services, particularly in a country where homosexual behaviour remains criminalised and sexual

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minorities face ongoing harassment and discrimination (41, 42). Widely regarded in Myanmar as safe environments where sexual minorities can speak freely about same-sex behaviours (42), i/NGO HIV services that include peers in key service delivery roles offer an important foundation for HIV prevention services and counselling that are appropriately aligned with actual risk behaviours.

The association between high frequency testing and location of last test may also reflect MSM and TW's perceptions or past experiences of HIV testing within government services. Studies suggest that these services are seen as discriminatory towards sexual minorities and are typically avoided by MSM and TW in Myanmar due to fear of stigma and discrimination from staff (42, 69). It is somewhat concerning that the new National Strategic Plan in Myanmar supports the transfer of HIV treatment services from i/NGO providers back to the public sector (30). Despite the disproportionate representation of MSM and TW among PLHIV in Myanmar, a recent review of patients enrolled in HIV treatment at two large public hospitals in Yangon found that less than 1% reported male-to-male sexual contact as a risk factor for infection (224). This figure indicates either an underreporting of sexual risk behaviours or the limited utilisation of these centres by MSM and TW. As HIV policy in Myanmar continues to emphasise a 'test and treat' prevention and care strategies, the benefits accrued from frequent HIV testing may be undermined if HIV treatment services are not perceived as friendly, safe and supportive services by those at highest risk of HIV infection.

In this study, participants reporting only regular partners were more likely to be high frequency testers compared to those with only casual partners. Recent evidence suggests that MSM and TW in Myanmar are engaging in sero-adaptive behaviours (70), and our finding could illustrate the emergence of negotiated safety as a risk reduction strategy. In our sample condomless sex with regular partners was more commonly reported than with casual partners (221) and in light of the result presented in this paper, condomless sex within a regular partner may have been predicated on regular HIV testing. However, there is a limited understanding about how different sexual partnerships and assessments of risk may motivate testing behaviours among MSM and TW in Myanmar or regionally. Apart from one study which found that a sense of

responsibility towards regular sexual partners was associated with regular testing among Chinese MSM (167), much of the available research on facilitators of regular testing comes from high-income settings and largely suggests HIV testing which is motivated by engagement in risk behaviours, such as multiple casual partnerships or engaging in condomless sex (225, 226). The discrepancy in testing motivations among MSM in these high-income settings with the findings of this study reinforce the importance of context-specific understanding of risk assessment among MSM and TW when shaping health promotion messages and priorities. How different sexual partnerships interact with MSM and TW's health seeking behaviours in Myanmar warrants further exploration.

Our findings should be considered with the following limitations. MSM and TW in study were recruited by peer-researchers in an outreach environment reached by a community-based HIV prevention service that provided health promotion on the importance of HIV testing and referrals to testing services. Additionally, our sample was recruited from the two largest urban areas in Myanmar with greater access to HIV prevention programmes and were also relatively well educated and remunerated (227) and their testing behaviours may not reflect MSM and TW who are economically and socially-disadvantaged or reside outside of urban areas; this is further supported by the significant differences noted among included and excluded participants who were less educated, less well-remunerated and older in age compared to included participants.

We demonstrated a rate of HIV testing that was substantially higher than the national average and findings may not reflect the broader MSM community and those residing in more isolated areas with less access to HIV services. Our description of high frequency testing behaviour relies on self-reported measures and we acknowledge the possible contribution of responder-bias, particularly given the involvement of peer outreach workers as data collectors. There is no reliable objective data on HIV testing frequencies among MSM and TW in Myanmar. Our use of the composite variable, comprising usual testing routine and time since last HIV test, was designed to help strengthen the validity of this outcome.

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This study found evidence of high rates of HIV testing uptake and frequency among MSM and TW in Myanmar, despite low HIV testing rates reported nationally. High frequency testing behaviours were associated with receiving a last test at an i/NGO service and reporting only regular sexual partners. Our findings underscore the utility of community-based i/NGO services in establishing and maintaining regular engagement of MSM and TW in HIV prevention and support the expansion of health promotion messaging and strategies beyond the engagement of naïve MSM and TW testers, to the establishment and maintenance of routine HIV testing.

2.6 Acknowledgments

ZMO, ZWT, PPA, CR, MT, CH and MS all contributed to the development of the data collection tools, training of peer educators to recruit participants, oversight of recruitment, data collection, and interpretation of results. VV, BLD and MS led the data cleaning and analysis process. VV and ZMO led the writing of the manuscript. All authors have read and approved the final manuscript. The authors gratefully acknowledge the work of the peer researchers from MBCA who were involved in this study as well as the participants who generously provided their time and information. This study was supported by internal programme funding from the Burnet Institute. The Burnet Institute receives support from the Victorian Operational Infrastructure Support Program. This work forms part of the PhD of VV, who is supported by an NHMRC Postgraduate scholarship through Monash University. We declare no competing interests.

SELF REPORTED TESTING BEHAVIOURS

Table 1: Socio-demographic characteristics, sexual behaviour and HIV testing patterns among MSM and TW in Myanmar

	n (%) (n=353)
Location	
Yangon	151 (42.8)
Mandalay	202 (57.2)
Age	
Median (IQR)	23 years (20 – 28 years)
<25	197 (56.0)
25-29	93 (26.4)
30>	62 (17.6)
Self-reported gender	
Male	284 (80.7)
TW	68 (19.3)
Highest level of education achieved	
Tertiary level	110 (31.3)
High school	133 (37.8)
Middle school	86 (24.4)
Primary school or below	23 (6.5)
Monthly income	
Median monthly amount in MMK (IQR)	150,000 (100,000 - 200,000)
Above median (>150,000 MMK)	125 (35.7)
Below median (<150,000 MMK)	225 (63.7)
Sexual partners in past three months	
Both regular and casual partners	127 (37.6)
Regular partner(s) only	96 (28.4)
Casual partner(s) only	115 (34.0)
Self-reported likelihood of acquiring HIV in the future	
Likely/ very likely	170 (50.2)
Very unlikely/ Unlikely/ Neutral	169 (49.9)
PERCEIVED BARRIERS TO HIV TESTING	
I worry about stigma if seen attending a HIV testing clinic	
Agree	78 (23.8)
Disagree	250 (76.2)
I am afraid of letting people know my HIV test result	
Agree	120 (36.5)
Disagree	209 (63.5)
I cannot afford the costs associated with HIV testing	
Agree	87 (26.5)
Disagree	241 (73.5)
I don't have time to test for HIV	

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Agree	158 (48.0)
Disagree	171 (52.0)
I find it difficult to access services HIV testing services	
Agree	116 (35.3)
Disagree	213 (64.7)
I have to wait a long time to test for HIV	
Agree	88 (26.8)
Disagree	241 (73.2)
HIV TESTING BEHAVIOURS	
Reason for undertaking last HIV test*	
Concern/ interest to know status	321 (90.3)
Part of regular testing pattern	94 (26.3)
Suggestion from sexual partner or friend	63 (17.8)
Symptoms of HIV	11 (3.1)
Other	26 (7.9)
Location of last HIV test	
NGO/iNGO	312 (88.4)
Government hospital or clinic	18 (5.1)
Private hospital or clinic	16 (4.5)
How often do you typically attend for an HIV test?	
At least every three months	213 (60.3)
At least every six months	76 (21.5)
Every 6 – 12 months	18 (5.1)
Every 1 – 2 years	27 (6.5)
More than 24 months since my last test	19 (5.4)
Time since last HIV test	
In the past six months	279 (79.7)
Six months – 2 years	52 (14.9)
Over 2 years/ never tested	19 (5.4)
High Frequency testing status	
Yes	197 (55.8)
No	156 (44.2)

Table 2: Socio-demographic, sexual behaviours and other associations with high frequency testing status

	High frequency testers (n=197) n (%)	Factors associated with high frequency testing OR (95% CI)	aOR (95% CI)
Location			
Yangon	89 (58.9)	1.2 (0.8 – 1.9)	
Mandalay	108 (53.5)	1	
Age			
Median age in years (IQR)	23 (20 – 28)		
<25	116 (58.9)	1.1 (0.6 – 2.0)	1.1 (0.6 – 2.2)
25-29	46 (49.5)	0.8 (0.4 – 1.4)	0.8 (0.4 – 1.7)
30>	35 (56.5)	1	1
Self-reported gender			
TW	46 (67.7)	1.9 (1.1 – 3.3)*	1.8 (1.0 – 3.3)
Male	150 (52.8)	1	1
Highest level of education achieved			
Tertiary level	63 (57.3)	1.0 (0.4 – 2.6)	
High school	77 (57.9)	1.1 (0.4 – 2.6)	
Middle school	44 (51.2)	0.8 (0.3 – 2.0)	
Primary school or below	13 (56.5)	1	
Monthly income			
Median monthly amount in MMK (IQR)	150,000 (100,000 - 200,000)		
Above median (>150,000 MMK)	77 (61.6)	1.4 (0.9 – 2.2)	
Below median (<150,000 MMK)	119 (52.9)	1	
Sexual partners in past three months			
Both regular and casual partners	70 (55.1)	1.4 (0.7 – 2.4)	1.4 (0.8 – 2.5)
Regular partner(s) only	64 (66.7)	2.3 (1.3 – 4.1)**	2.3 (1.3 – 4.2)**
Casual partner(s) only	53 (49.1)	1	1
Location of last HIV test			
NGO/iNGO service	187 (59.9)	3.9 (1.4 – 11.2)*	3.5 (1.2 – 10.7)*
Private hospital or clinic	5 (31.3)	1.2 (0.3 – 5.1)	1.1 (0.2 – 5.3)
Government hospital/ clinic	5 (27.8)	1	1
Self-reported likelihood of acquiring HIV in the future			
Likely/ very likely	96 (56.5)	1.1 (0.7 – 1.6)	
Very unlikely/ Unlikely/ Neutral	93 (55.0)	1	

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PERCEIVED BARRIERS TO HIV TESTING			
I worry about stigma if seen attending a HIV testing clinic			
Agree	44 (56.4)	1.0 (0.6 – 1.7)	
Disagree	140 (56.0)	1	
I am afraid of letting people know my HIV test result			
Agree	70 (58.3)	1.2 (0.7 – 1.8)	
Disagree	114 (54.6)	1	
I cannot afford the costs associated with HIV testing			
Agree	47 (54.0)	0.9 (0.5 – 1.5)	
Disagree	137 (56.9)	1	
I don't have time to test for HIV			
Agree	90 (60.0)	1.1 (0.7 – 1.7)	
Disagree	94 (55.0)	1	
I have to wait a long time to test for HIV			
Agree	52 (59.1)	1.2 (0.7 – 2.0)	
Disagree	132 (54.8)		

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3 Observed testing behaviours and estimates of HIV incidence among service-engaged MSM and TW in Myanmar

The data presented in Chapter 2 revealed a high proportion of MSM and TW self-reporting frequent testing behaviours. However, such data is subject to reporting biases and, when repeated through serial cross-sectional studies, susceptible to recruitment bias. Despite this high level of reported engagement with HIV prevention services, program data collected through HIV testing services is rarely used to assess levels and outcomes of service uptake among key populations. As reported in Chapter 1 (Section 1.7.1), international donors have been key funders of HIV programs, and program data collected by their implementing partners is primarily for the purpose of donor reports and usually only presents aggregate service-level data on activities (e.g., monthly number of HIV tests conducted and proportion of HIV tests that were positive). However, with improved data collection and data integration systems, program data from HIV testing sites has the potential to more accurately and reliably characterise HIV testing behaviours and diagnoses and inform public health efforts.

The manuscript presented in this chapter utilises data collected through an electronic data management system implemented in two community-based testing clinics. This system used a unique ID that enabled prospective tracking of clients attending the service. This data provided the first HIV incidence estimates for any key population group in Myanmar and describes directly observed HIV testing frequencies and associations with HIV diagnoses. HIV incidence was high relative to regional estimates, and limited engagement in repeat testing and associations between HIV diagnoses and sexual identity, age, and HIV testing history suggest incomplete coverage of primary prevention programs and the role of undiagnosed HIV in ongoing transmission.

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High incidence and factors associated with testing positive among men who have sex with men and transgender women in Myanmar: data from community-based HIV testing services

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3.1 Abstract

In Myanmar, men who have sex with men (MSM) and transgender women (TW) are disproportionately affected by HIV, despite national HIV program scale-up. However, limited HIV surveillance capacity prevents monitoring of epidemic trends and program impact. This study aimed to estimate HIV prevalence and incidence and explore associated sexual risk behaviours among MSM and TW clients attending HIV testing clinics in Myanmar.

An electronic data management system (eDMS) was implemented in two community-based, MSM and TW-tailored HIV testing clinics in Myanmar in August 2015. Unique client identifiers enabled prospective monitoring of service engagement, testing frequency and outcomes. We estimated HIV incidence and rate of HIV diagnosis at baseline testing visit among clients over a 15 month period. Correlates of HIV diagnoses were identified using multivariable logistic regression.

2794 MSM and TW were tested for HIV. At their baseline test, 38% of clients reported any previous testing and 93% reported being sexually active over the previous three months, with 74% reporting sex with casual male partners and 28% reporting consistent condom use with casual partners. 291 clients tested positive for HIV for the first time at baseline (10·4%; 95%CI: 9·3–11·6). Twelve incident cases were detected among 279 clients receiving ≥ 2 tests (incidence = 10·1 per 100 person-years; 95%CI: 5·73–17·8). HIV diagnosis at baseline was significantly associated with being TW or a non-openly disclosing MSM, age 26–39 years, and reporting no testing history.

High HIV incidence and new diagnoses being associated with reporting no testing history points to undiagnosed HIV driving transmissions in Myanmar. Repeat testing was uncommon. HIV programs in Myanmar must focus on promoting frequent HIV testing alongside adequate coverage of education and primary prevention interventions among MSM and TW.

3.2 Introduction

Evidence of emergent HIV epidemics and prevalence estimates greater than 10% point to a disproportionate burden of HIV among men who have sex with men (MSM) and transgender women (TW) in Asia (15, 123, 214). This includes Myanmar, where estimated HIV prevalence among MSM and TW is 11% (results not disaggregated by sexual or gender identity), with prevalence estimates in the major cities of Yangon (27%) and Mandalay (22%) among the highest observed in the region (7, 30). In line with UNAIDS HIV elimination targets, a key part of Myanmar's national response to HIV is health systems improvement to advance progress towards 90-90-90 targets (30). However, sub-optimal coverage and frequency of testing among key populations, including MSM and TW, remains a key challenge to HIV prevention in Myanmar and undermines a 'test and treat' approach (30, 228).

Sexual minorities continue to experience stigma and discrimination in Myanmar. Homosexual sex remains criminalised under Myanmar's penal code, and while enforcement of this law appears rare, it acts to legitimise the intimidation or harassment of sexual minorities, contributing to stigma and discrimination as key barriers to HIV testing, treatment and care for MSM and TW (42, 229). These experiences also contribute to many MSM and TW concealing their sexual orientation, particularly in health service contexts (42, 230). However, recent scale-up of HIV programs, particularly decentralised HIV testing services run by local and international non-government organisations (NGOs), has allowed for new models of community-based and peer-staffed HIV services. These services are now a common feature of Myanmar's HIV response and aim to promote greater engagement of key populations by circumventing known psycho-social barriers to testing (69, 230, 231) in line with Myanmar's National Strategic Plan on HIV (30).

HIV epidemiological data in Myanmar is limited largely to infrequent integrated bio-behavioural surveys (232). While routinely collected HIV service-level data can provide a platform for sustainable epidemiological data collection (233), there is currently no standard electronic data capture system within government clinics and no central integration of HIV testing and diagnosis data from NGO services. Limited recent estimates of HIV prevalence and

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an absence of data to monitor HIV incidence among MSM and TW hampers efforts to understand the impact of HIV programmatic responses in Myanmar.

In 2016, we developed and implemented an electronic data management system (eDMS) at two community-based HIV testing clinics targeting MSM and TW in Yangon and Mandalay with the aim of strengthening data collection and reporting practices, and enabling the monitoring of HIV trends in a service delivery context. Using this data, we describe socio-demographic characteristics, sexual behaviours and HIV testing behaviours and outcomes among clients, identify factors associated with HIV positivity, and calculate HIV incidence among clients returning to test at the services.

3.3 Methods

Settings

The eDMS was implemented within two MSM and TW- focused community-based drop-in centres (DICs) in Yangon and Mandalay, the two largest urban areas in Myanmar with large, documented MSM and TW populations, relative to other areas (IBBS REF). The DICs were managed by a local NGO Myanmar Business Coalition on AIDS (MBCA) and designed to attract MSM and TW in particular through the provision of discrete, non-conspicuous HIV prevention services (231). Rapid point-of-care (RPOC) HIV testing was introduced into the DICs in March 2015, replacing the previous system of off-site referrals. Health promotion and referred access to primary health care and STI services was freely available to clients, while incentives in the form of travel costs (2000 Myanmar Kyat, approximately equivalent to USD 2) were provided to promote uptake of HIV testing. HIV testing was conducted by trained nurses, and supported by trained MSM and TW peer educators who are responsible for pre- and post-HIV test counselling.

Data collection

The eDMS was designed to replace previous paper-based reporting systems used to record client visits and testing outcomes at the DICs and was piloted in Yangon and Mandalay over a 15-month period (August 2016 – November 2017). At their first presentation to the DIC during this period, clients were registered into the system using a unique numeric identifier (UID) to enable prospective data linkage of testing episodes. Client contact information (name, residential township, phone number) and basic demographic details (age, male or female/transgender gender identity, highest level of education attained) were captured. Consistent with indigenous Myanmar labels of sexuality and gender expression among MSM and TW, clients were categorised through self-identification as either: *apone* (men who typically do not disclose same-sex sexual preferences or behaviour in most public spheres); *apwint* (individuals with male assignation at birth who openly identify as feminine, are sexually oriented towards men and otherwise regarded as transgender women); and, *thange* (behaviourally bisexual men who identify as heterosexual and often maintain relationships with women)

At first presentation and every subsequent visit during the 15-month pilot period, peer educators collected the following behavioural information during pre-test counselling using handheld tablets: reason for HIV testing (condomless anal sex/injected drugs or shared needles/suspected HIV infection based on symptoms/routine testing/other); source of referral (self/referred by peer educator/referred by other organization); history of HIV testing (yes/no); time since last HIV test (<6 months/6–12 months/1–2 years/>2 years); and any contact with peer outreach worker in the past three months (yes/no). Clients who reported being sexually active in the past three months were asked about: sex with casual male partners (yes/no); sex with regular male partners (yes/no); sex with female partners (yes/no); condom use by partner type (never/occasionally/often/always); HIV status of regular male partner (HIV positive/HIV negative/unknown/prefer not to answer); experience of sexually transmissible infection (STI) symptoms in the past three months (urethral inflammation or discharge, dysuria, genital sores or ulcers, scrotal swelling or pain, inguinal or groin pain, genital warts, other symptoms; yes/no); paid money or gifts in exchange for sex (yes/no) or received money or gifts in exchange

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for sex in past three months (yes/no); and means of meeting casual male partners during past three months (multiple responses allowed: cruising sites/beauty salons/night clubs/online or phone/spa or massage venue/festival/other). A paper-based version of all eDMS fields was developed in Myanmar language and available for use by DIC staff who did not wish to use the English-version tablets, or when the tablets were unavailable. Information from these paper-based forms was subsequently entered into the eDMS by a senior DIC staff member.

Following pre-test counselling, a trained nurse authorised to conduct HIV testing used a two-test algorithm - Alere Determine HIV 1/2 (Abbott; Illinois, USA), followed by HIV 1/2 STAT-PAK Assay (Chembio; New York, USA) – to test clients for HIV. Final results were recorded as HIV positive/HIV negative/indeterminate in the eDMS, and delivered to the client with post-test counselling. Three-monthly testing was recommended to all HIV negative clients. Clients returning HIV positive or indeterminate results were referred to a local NGO for confirmatory HIV testing as part of initiation of free ART.

Consent

Service-level permission was sought and granted from MBCA prior to the implementation of the eDMS to access to de-identified client records. At the first visit during the pilot period, clients were informed of the use of their de-identified data for research purposes and provided with a plain language participant informed consent form by peer educators. After describing the aims and duration of the research, permission was sought from clients to include their de-identified clinic records in future data extractions during the pilot period; clients were informed of their ability to opt-out and withdraw consent at any stage during this period. A specific field was built into the eDMS which, when checked, meant that records of clients who did not consent would be automatically excluded during data extraction.

Data Management

All data entered into the eDMS between 01 August 2016 and 30 November 2017 were extracted for analysis. To maintain data continuity and fidelity during the pilot period and for ongoing reporting to program donors, DIC staff continued to use a data entry spreadsheet for recording

HIV testing outcome, date of visit and basic demographic information at each testing episode. The eDMS and spreadsheet used the same UID, and the latter was used to validate testing episodes recorded in the eDMS and enhance data completeness. When consolidating the data sources, duplicate records matched by UID and occurring within 28 days of one another were consolidated into a single testing event; this cut off accounted for the reported low likelihood of repeat testing within one month and allowed for delays in data entry into either data source.

Analysis

Data collected during the first HIV test received at the DIC during the pilot period ('baseline test') was used to describe socio-demographic characteristics, reported HIV testing history and sexual behaviours, and HIV testing outcomes of MSM and TW. We describe the proportion of clients HIV positive at baseline; defined as the number of individual clients who tested positive at their first test, divided by the total number of individual clients with a valid test result during the pilot period. We examined factors associated with HIV positivity at baseline test through logistic regression and included all variables in both unadjusted and adjusted models. Collinear variables or variables with insufficient observations were excluded from the adjusted model.

Repeat testing behaviour was identified among clients receiving more than one HIV test at the service during the pilot period and median follow up time between first and last recorded test was calculated. HIV incidence was calculated among repeat testers, defined as the total number of incident cases divided by total follow-up time accrued during the pilot period. Incident cases were defined as clients who returned a HIV positive test result during the pilot period following a negative result at their first valid (i.e., determinate positive or negative) test result. Follow-up time was measured in person-years (PY) and defined as the time between the first negative result and either a HIV positive result or last recorded negative result.

Analyses were conducted using Stata (Version 13, Stata Corp., College Station, TX, USA). Statistical significance in all analysis was set at $p \leq 0.05$.

Ethics

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Ethics approval was granted by the Alfred Hospital Ethics Committee, Australia and the Department of Medical Research, Myanmar.

3.4 Results

Between August 2016 and November 2017, 2801 individual clients received at least one test at Yangon or Mandalay DIC; seven of these clients returned an indeterminate test and were excluded from analysis. The remaining 2794 individuals were tested at least once at Mandalay (n=1280; 45.8%) and Yangon (n=1515; 54.2%). Among reporting clients, most identified as *apone* (44.7%) and 7.7% identified as *apwint* or TW. Most clients were aged 15–25 years (77.1%) and 63.5% were educated to a secondary or tertiary level. Approximately one third of clients reported a lifetime history of HIV testing (38.2%), with over half (55.4%) reporting a previous test at the DIC. Nearly all MSM and TW were sexually active during the past three months (93.0%). Among these clients, most reported sex with casual male partners (74.8%) and approximately one third reported sex with a regular male (31.9%), or a female partner (34.3%). Among those reporting sex with casual partners, 28.7% reported consistent use of condoms. The most commonly reported way of meeting casual male sex partners was via cruising sites (55.0%) and internet/phone-based applications or websites (28.7%). Approximately one in five clients (18.9%) reported selling sex and 11.8% reported buying sex in exchange for money/gifts during the past three months. Ten per cent of clients reported experiencing STI symptoms in the past three months (Table 3).

Baseline visit proportion HIV positive

Two hundred and ninety-one clients tested positive at their first valid HIV test (proportion positive 10.4%; 95%CI: 9.3 – 11.6). Unadjusted and adjusted correlates of testing HIV positive are presented in Table 2. In adjusted analysis, clients testing positive at baseline were significantly more likely to identify as *apone* (aOR 7.1; 95%CI: 3.0–16.5) or *apwint* (aOR 8.7; 95%CI: 3.1–24.9), be aged 26–39 years (aOR 2.8; 95%CI: 1.5–5.1), and were significantly less likely to report a lifetime history of HIV testing (aOR 0.3; 95%CI: 0.1–0.6) (Table 4).

Repeat HIV testing and HIV incidence

The 291 clients who tested positive at their first test were excluded from incidence analysis. Among the remaining 2503 clients, 2224 had a single test during the pilot period (88.9%) and 279 were repeat testers (220 tested twice, 53 tested three times and six tested four times during the pilot period). There were no significant differences in sexual risk behaviours among repeat and single-testing clients (data not reported). Among repeat testers, 12 incident HIV infections were detected across 344 post-baseline visit testing events and 118.8 person-years. Median follow-up time was 147 days. All incident infections occurred among clients with male gender identity. HIV incidence was 10.1 per 100 person-years (95%CI: 5.73–17.8). Limited number of incident infections and missing variable data prevented analysis of potential correlates.

3.5 Discussion

To our knowledge, this is the first study to report on correlates of HIV positivity and the first to generate an estimate of HIV incidence among MSM and TW attending a HIV testing service in Myanmar. Approximately 10% of MSM and TW tested positive at their baseline visit test, lower than the 14% HIV positivity detected among previously undiagnosed participants in the 2015

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IBBS (7). We report on important factors associated with HIV positivity among MSM and TW not previously documented in Myanmar, including sexual identity, age, and HIV testing history. The rate of HIV incident infection among repeat testing MSM clients was high relative to estimated incidence of HIV among MSM reported elsewhere in the region (22, 214, 234). These findings, in combination with low levels of reported condom use among MSM and TW, carry important implications for HIV prevention activities in Myanmar, particularly in relation to enhancing uptake of regular HIV testing and timely access to treatment.

This study used service-level data to estimate HIV burden and factors associated with HIV positivity at baseline among MSM and TW presenting for testing. As we elaborate below, service level data can be associated with substantial biases. However, with limited epidemiological data on MSM and TW in Myanmar and known challenges of achieving population-based estimates for hard-to-reach and marginalised groups (235), the findings presented here are novel and support the utilisation of routine program data to increase understanding of HIV risk and burden among MSM and TW. Given the evidence of MSM and TW's ongoing predisposition to HIV risk (7, 42), our findings carry important implications for shaping future HIV prevention programming in Myanmar.

HIV incidence among MSM documented in this study – 10.1 cases per 100 person years – is the first assessment of HIV incidence for any group in Myanmar, and demonstrates a higher rate of HIV transmission than other estimates among MSM in Asia (214, 236), including among service-engaged MSM in Bangkok (21). While HIV incidence was calculated among clients receiving more than one test during the pilot period and whose repeat testing behaviour may have been prompted by higher levels of risk than single testers, this finding points to a high level of HIV transmission among clients already engaged in a HIV prevention service. While the short follow-up period and relatively small number of incident cases detected and missing variable data (discussed further below) precluded analysis of factors prospectively associated with HIV acquisition risk, other findings suggest that undiagnosed HIV in the context of infrequent testing and ongoing sexual risk behaviours may be a key contributor to ongoing transmissions (73, 153). While a lack of CD4 testing at HIV diagnosis in Myanmar prevents an assessment of

time spent undiagnosed, the significant association between reporting no HIV testing history and baseline visit HIV positivity implies that some MSM and TW may have spent substantial time undiagnosed.

Despite participating services recommending three-monthly repeat testing, only about one in 10 clients repeat tested during the 15-month observation period. Moreover, clients who did not report a testing history at baseline were 70% less likely to repeat test during the observation period (OR: 0.29; 95% CI: 0.2 – 0.4), with no significant difference in risk behaviours between those who did and did not repeat test (data not reported). While MSM and TW in Myanmar self-report high levels of regular HIV testing (22, 239), the dissonance with data presented in this paper may suggest an overestimation of testing behaviours among MSM or TW, or on going barriers to enacting testing aspirations. Documented barriers to HIV testing among MSM and TW in Myanmar include experiences of stigma and discrimination, perceived unfriendliness of government or mainstream health staff, and avoidance of HIV prevention services manifestly catering for MSM and TW among those for whom concealment of sexual identity is a key priority (41, 218, 229, 230, 231).

Encouraging frequent HIV testing and improving retention in HIV prevention programs must be a key focus of local HIV prevention strategies for MSM and TW in Myanmar. In particular, peer-delivered HIV testing may be a key strategy for promoting testing uptake and retention among MSM and TW, and has demonstrated utility in increasing HIV testing uptake among stigmatised populations in other Asian settings (13, 212). There is a documented willingness among MSM and TW to access peer-delivered and self-testing (230, 113), which is backed by a policy environment broadly supportive of novel testing modalities in Myanmar [5]. These factors provide an opportunity to diversify testing delivery approaches and should be considered alongside condom reinforcement programs and consideration of HIV pre-exposure prophylaxis (PrEP) (undertaking PrEP demonstration projects is currently recommended in the national strategic plan but are yet to occur) (1, 153).

Sexual identity was significantly correlated with baseline HIV positivity. Transgender identity was identified as a significant predictor of prevalent HIV; *apwint* clients were more than ten

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times more likely to test positive at baseline than *thane* or behaviourally bisexual men. A range of documented risk factors may contribute to the disproportionate HIV burden among TW relative to other sexual and gender identities in Myanmar, including being more likely to report receptive anal sex positioning, higher numbers of sexual partners, lower levels of condom use, earlier sexual debut, and experiences of forced sex (30, 43, 108, 229). Globally, TW are nearly 50 times more likely to have HIV than all adults of reproductive age (16), while in Asia, TW are also less likely to be retained in ART care (86), suggestive of broad structural and social barriers for TW across the HIV care continuum. Additionally, *apone* clients – men who are sexually oriented towards other men but typically do not openly identify as gay – had nine-times higher risk of HIV positivity at baseline than *thane*. Across Asia, non-disclosure of sexual identity has been associated with higher levels of condomless sex (237) and a lower uptake of testing for HIV (98, 99) and STIs (100), which may explain some of the increased vulnerability to HIV observed among *apone* clients in this study. Awareness of sexual orientation is an important precursor to provider-initiated HIV testing (103), and non-disclosure of sexual behaviours may hinder the provision of relevant and tailored sexual health information, including assessments of eligibility for biomedical HIV prevention options. Our findings corroborate reports of differential levels of HIV vulnerability and access to HIV services among sexual identities in Myanmar (7, 43, 212, 231) and support the need for HIV prevention strategies tailored to the specific needs of MSM and TW sub-populations.

Our findings should be considered with the following limitations in mind. First, as mentioned above, the self-selection bias inherent in service-level data may limit the generalisability of these findings to the wider MSM and TW population in Myanmar. Engagement in HIV prevention and testing may be motivated by perceptions of HIV risk which may overestimate our estimates of HIV burden. Conversely, the risk of HIV may be lessened among clients actively engaging in HIV prevention services; we note that proportion positive reported in this study is lower than that reported in the latest IBBS, which used RDS to recruit a population-based sample of MSM and TW participants (7). Second, our incidence estimates may be underestimated due to the limited number of clients engaging in repeat testing behaviour - potentially an artefact of the

short period of observation. Third, this data was collected from MSM and TW residing in the two largest cities in Myanmar with the highest prevalence of HIV (30), which are also well serviced by local and international NGOs. MSM and TW in this study may therefore have relatively high levels of access to HIV prevention and testing services and our findings may not be generalisable to MSM and TW who are not engaged with services or reside in peri-urban or rural areas of Myanmar. Finally, we acknowledge that implementation issues encountered during the piloting of this new electronic system resulted in some missing socio-demographic and sexual behaviour data which limited our ability to further characterise incidence infections and the potential representativeness of our findings. Nonetheless, we believe that given the absence of data to date on HIV epidemiology among MSM and TW in Myanmar, the novelty of the data collection system in the local context and the implicit need for more robust data collection systems to better monitor HIV infection and to inform programming priorities in Myanmar, the findings presented in this paper represent an important starting point for further research into factors associated with HIV infection among MSM and TW in Myanmar.

Despite the implementation challenges noted above, the use of electronic health data in low-income countries remains limited and the data presented here highlights both the utility and potential of novel electronic data collection system to capture data that can inform HIV prevention priorities. This pilot project demonstrated high HIV incidence, relative to other MSM in the region, combined with high levels of risk behaviours and infrequent engagement with HIV testing services. These factors strongly support the scale-up of HIV prevention activities, the prioritisation of regular HIV testing and enhanced retention among MSM and TW in Myanmar, as well as consideration of more contemporary testing and prevention approaches such as peer-delivered and self-HIV testing and PrEP into the national HIV response in Myanmar. Such strategies must be cognizant of socio-demographic and other factors that may influence engagement with HIV testing services. This study supports the utilisation of community-based HIV testing services as an important source of ongoing epidemiological data in Myanmar, as well as in other low-resource settings in the region.

3.6 Acknowledgements

VV, MS and CH designed the study and developed the data collection tools. VV, ZMO, TTT, NNO and HM managed in-country data collection efforts. Data cleaning and analysis was led by VV, MT and MS. AP provided input into data analysis and manuscript preparation. All authors read and approved the final manuscript.

Table 3: Socio-demographic and sexual behaviour characteristics among clients at first valid test

	Participants at first valid test (n=2794)	
	n	%
Location		
Mandalay	1280	45.8
Yangon	1514	54.2
Gender		
Apone	1236	44.7
Apwint	214	7.7
Thange	1316	47.6
Age at registration		
15 - 25	931	77.1
26 - 39	237	19.6
40 - 60	39	3.2
Highest level of educational attainment		
Primary school or below (<5 years)	119	9.6
Middle school (6 - 9 years)	332	26.9
Secondary school (11 years)	480	38.9
Tertiary	304	24.6
Reported lifetime history of HIV testing		
No	746	61.8
Yes	461	38.2
Previous test conducted at DIC?		
No	205	44.6
Yes	255	55.4
Sexually active, past three months		
No	85	7.0
Yes	1123	93.0
Sex with female partner		
No	726	65.6
Yes	380	34.3
Sex with regular male partner		
No	762	68.3
Yes	352	31.9
Sex with casual male partner		
No	282	25.3
Yes	840	74.8

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Consistent condom use with casual male partner during past three months		
No	589	71.3
Yes	237	28.7
Met casual sex partners through cruising sites		
No	544	45.0
Yes	666	55.0
Met casual sex partners using online/phone-based apps or sites		
No	863	71.3
Yes	347	28.7
Sex sold past three months		
No	951	81.1
Yes	222	18.9
Sex bought past three months		
No	1040	88.2
Yes	139	11.8
STI symptoms past three months m		
No	1063	89.7
Yes	123	10.3

Table 4: Associations between socio-demographic and sexual behaviour characteristics and testing HIV positive at baseline test

	Associations between demographic and sexual behaviour characteristics and testing HIV positive test at baseline (n=291)			
	OR	(95% CI)	aOR	(95% CI)
Location				
Mandalay	1		1	
Yangon	1.9*	(1.5 - 2.5)	0.8	(0.4 – 1.5)
Gender				
Apone	6.1*	(4.3- 8.5)	7.1*	(3.0 – 16.5)
Apwint	7.2*	(4.5 -11.4)	8.7*	(3.1 – 24.9)
Thange	1		1	
Age at registration				
15 - 25	1		1	
26 - 39	2.1*	(1.3-3.2)	2.8*	(1.5 – 5.1)
40 - 60	2.6^	(1.1 – 6.1)	0.5	(0.1 – 4.1)
Reported lifetime history of HIV testing				
No	1		1	(2.3 – 9.4)
Yes	0.7	(0.5 – 1.1)	0.3*	(0.1 - 0.6)
Previous test conducted at DIC?				
No	1		1	
Yes	0.6	(0.3 – 1.1)	NA	
Highest level of educational attainment				
Primary school or below (<5 years)	1		1	
Middle school (6 - 9 years)	1.7	(0.7-4.2)	2.0	(0.6 – 6.7)
Secondary school (11 years)	1.6	(0.7-3.8)	1.7	(0.5 – 5.5)
Tertiary	3.2^	(1.3- 7.7)	2.1	(0.6 – 7.1)
Sexually active, past three months				
No	1		1	
Yes	1.0	(0.5-2.1)	NA	
Sex with female partner				

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No	1		1	
Yes	0.2*	(0.1-0.4)	0.5	(0.2 – 1.4)
Sex with regular male partner				
No	1		1	
Yes	2.8*	(1.9-4.2)	1.5	(0.8 – 2.9)
Sex with casual male partner				
No	1		1	
Yes	0.7	(0.5-1.1)	NA	
Consistent condom use with casual male partner during past three months				
No	1.6	(0.9 – 2.9)	1.6	(0.8 – 2.7)
Yes	1		1	
Met casual sex partners through cruising sites				
No	1		1	
Yes	0.9	(0.6-1.2)	1.4	(0.7 – 2.8)
Met casual sex partners using online/phone-based apps or sites				
No	1		1	
Yes	2.5*	(1.7- 3.6)	1.5	(0.8 – 2.8)
Sex bought past three months				
No	1		1	
Yes	1.5	(0.8-2.6)	2.4	(1.0 – 6.0)
Sex sold past three months				
No	1		1	
Yes	1.0	(0.6- 1.7)	0.8	(0.4– 1.8)
STI symptoms past three months				
No	1		1	
Yes	1.4	(0.8-2.4)	1.2	(0.5 – 2.6)

*p<0.001; ^p<0.01; #p<0.05; ^a OR and aOR could not be calculated due to the small count for this category

Note: incomplete or missing data means that denominators for variables may be less than the overall sample size.

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4 The influence of sexual and gender identity on engagement in HIV prevention among MSM and TW in Myanmar

The data presented in Chapter 3 showed low levels of repeat HIV testing, which was also lower than repeat testing behaviours self-reported by MSM and TW in other studies. High HIV incidence among repeat testers and low levels of any HIV testing history and its association with testing HIV positive at the first test highlight the potential of undiagnosed HIV as a key driver of ongoing HIV transmissions in Myanmar. The discrepancy between self-reported and observed testing behaviours presented in Chapters 2 and 3 respectively, may reflect barriers faced by MSM and TW in enacting aspirational testing intentions or engaging more frequently in HIV testing.

In Asia, sexual and gender identities of men who have sex with men are diverse and variegated, and in Myanmar, up to half of the MSM and TW population are thought to be non-disclosing of their sexual identity or same-sex behaviours. Despite this, little is known about the specific characteristics of so called ‘hidden’ MSM and TW and how this shapes engagement with HIV prevention services.

This chapter presents research gathered through a qualitative, formative study conducted in Myanmar in 2015. Data were gathered through a combination of in-depth interviews and focus group discussions with MSM and TW community members, leaders and service providers. This study reinforces the role of stigma and discrimination, fear of disclosure of sexuality and the need to conceal same-sex orientation from family and friends as key barriers to service engagement for some MSM and TW in Myanmar. This research highlights the need for HIV service models that can provide both friendly and non-judgmental services to MSM and TW, while also meeting clients’ need for privacy and confidentiality.

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“We are not gays...Don’t tell me those things”: engaging ‘hidden’ men who have sex with men in HIV prevention in Myanmar

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4.1 Abstract

In Myanmar, HIV is concentrated among key populations, yet less than half of the estimated 250,000 men who have sex with men (MSM) and transgender women (TW) report recent HIV testing. As many as 50% of MSM and TW may conceal their same-sex preferences and behaviours, yet little is known about the barriers faced by those who are locally regarded as 'hidden' – that is, MSM who do not disclose same-sex preferences and/or identify as gay. This study explored specific barriers to accessing HIV testing and other prevention services among 'hidden' MSM to inform appropriate models of service delivery.

In-depth interviews with MSM (n=12) and TW (n=13) and focus group discussions (FGD) with MSM and TW community members, leaders and key informants (n=35) were undertaken in Yangon during June – September 2015. Participants were recruited by word-of-mouth by trained peer data collectors. Responses to questions from semi-structured guides were transcribed and coded using Atlas Ti. Codes were based on key domains in the guides and applied to transcripts to identify and analyse emerging themes.

Fear of stigma and discrimination and the need to meet gender expectations were key reasons for non-disclosure of same-sex preferences and behaviours; this typically manifested as avoidance of other MSM and settings in which sexual identity might be implicated. These concerns influenced preference and interaction with HIV services, with many avoiding MSM-specific services or eschewing HIV testing services entirely. The difficulties of engaging hidden MSM in HIV prevention was strongly corroborated by service providers.

Hidden MSM face multiple barriers to HIV testing and prevention. Strategies cognisant of concerns for anonymity and privacy, such as One-Stop Shop services and online-based health promotion, can discretely provide services appropriate for hidden MSM. Enhanced capacity of peer-service providers and mainstream health staff to identify and respond to the psychosocial challenges reported by hidden MSM in this study may further encourage service engagement. Overarching strategies to strengthen the enabling environment, such as legal reform and LGBTI

community mobilisation, can lessen stigma and discrimination and increase hidden MSM's comfort and willingness to discuss same-sex behaviour and access appropriate services.

4.2 Background

Against a background of low and decreasing global HIV prevalence, men who have sex with men (MSM) and transgender women (TW) continue to be disproportionately affected by HIV (16, 123). In Asia, HIV prevalence greater than 10% has been observed in some MSM and TW communities (15, 19, 30, 123), while emergent epidemics in countries as diverse as Thailand (214), India (63) and the Philippines (17) have been recently noted. This ongoing vulnerability of MSM and TW to HIV acquisition may suggest limitations in both the scale and effectiveness of current HIV prevention responses in the region. This includes Myanmar, where the estimated HIV prevalence among MSM and TW is over 11% nationally, and the concentrations reported in major urban cities comprise some of the highest rates seen across Asia (30). Despite known risks, less than half of all MSM and TW in Myanmar reported receiving an HIV test in the past 12 months and coverage of HIV prevention programs remains suboptimal (30).

Global elimination targets suggest that ending AIDS by 2030 will require 90% of people living with HIV knowing their status (109). As well as facilitating early initiation of HIV treatment, HIV testing provides an important entry point to bio-medical HIV prevention strategies such as PrEP (238). Controlling the HIV epidemic requires regular engagement of MSM and TW at risk of or living with HIV in prevention, treatment and care; this includes those that do not or are unwilling to identify as MSM or TW and may be out of reach of specific HIV programs targeting these groups. In Myanmar, as in other Asian countries, a number of indigenous and diverse gender and sexual identities exist among same-sex attracted men. Unlike typical Western characterizations that utilize separate categories to define sexual and gender identities one set of labels are often used across Asia to characterize both sexual and gender identities, such as *Kothis* in India and *Bóng lồ* in Vietnam (37, 102). These labels typically encompass sexual

positioning, power dynamics, and gender expression and are reflective of one's willingness to disclose their sexual preferences, behaviours and gender identity (30, 239).

There are three main local terms used to classify sexual and gender identity among MSM and TW in Myanmar. *Apwint* are commonly regarded as transgender women, and locally understood as individuals with male assignation at birth but who openly identify as female and attracted to men. Conversely, *apone* are males that typically have a masculine presentation, are sexually oriented towards other men yet conceal their sexual preferences in most social spheres or circumstances and are often locally referred to as 'hidden, or 'hider' for their presentation as 'men' in public and certain social environments. *Apwint* and *apone* are thought to share the same 'feminine' inner self, but differ in their outward gender expression (39). Lastly, *thange* are males with masculine presentations who also engage in sex with other men, yet do so sporadically or incidentally, while also maintaining a heterosexual identity and relationships with women (39, 41-43, 229). There are an estimated 250, 000 MSM and TW in Myanmar (estimates not disaggregated by gender identity) and as many as 50 % are thought to conceal same-sex preferences and behaviours (42).

In Myanmar, sexual and gender identity has been associated with differences in sexual positioning, age of sexual debut, experiences of forced sex, condom use at last sex and access to HIV-related services among MSM and TW and is therefore an important consideration for understanding HIV risk and vulnerability (30, 220, 229, 240). While in the scientific literature, the term MSM is utilized to reflect behavioural characteristics among male-identified individuals with the intention of respecting individual sexual identity, in Myanmar TW do not consider the term MSM to be restricted only to male-identified individuals and participate in and lead many MSM programs and activities (39). Additionally, much of the research conducted with MSM and TW is not representative or inclusive of the diversity among sexual minorities in Myanmar. In one of the only published studies on characteristics and risk behaviours among MSM and TW, the majority of participants reported their occupation as beautician or *Nat Kadar* (spiritual dancer), roles typically assumed by TW (41, 43). While some literature is beginning to emerge that disaggregates findings by sexual and gender identity

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(108), very little specifically addresses subgroups of MSM in Myanmar who are locally regarded as 'hidden': those that do not disclose same-sex preference or behaviour or identify as gay.

Performance of gender and expression of sexuality among same-sex attracted men in Myanmar is further complicated by the legal environment in which they exist; under Myanmar law, homosexual sex remains criminalised and sexual minorities continue to report ongoing discrimination and harassment (26).

Myanmar's National Strategic Plan for HIV and AIDS 2016-2020 includes a target of reaching 90% of MSM and TW with combination HIV prevention services and prioritizes the engagement of non-disclosing, or 'hidden' MSM (30). A growing body of evidence from the region highlights the ways in which non-disclosure of sexual identity affects HIV service utilization (100, 102, 241), yet much remains unknown about the barriers faced by hidden MSM in Myanmar in accessing HIV services, hindering the development of culturally-relevant and responsive HIV prevention approaches. This formative research was undertaken to better understand the challenges and experiences of MSM and TW in accessing HIV testing, prevention and care and was conducted as part of a broader implementation science study to improve MSM and TW's access and retention in the HIV Care Cascade in Myanmar (181, 242). This paper presents a secondary analysis that explores these issues as they specifically relate to hidden MSM and seeks to further our understanding of the characteristics of this group and the barriers and challenges to engaging with HIV prevention services. We consider the perspectives of hidden MSM, the broader MSM and TW community and the service providers and community leaders who seek to engage hidden MSM in HIV prevention. We have included the perspectives of TW in relation to the experiences of hidden MSM in light of the fluidity of sexual and gender identity in Myanmar (i.e., individuals may move between MSM and transgender identities, often depending of social contexts), the common experiences of TW and MSM (e.g., stigma and marginalisation) and the social and physical spaces TW and MSM share in Myanmar.

4.3 Methods

Data were originally collected as a formative study to inform a trial to develop and test novel approaches to HIV testing and engagement in HIV care among MSM and TW in Myanmar led by Johns Hopkins University (181, 242). In-depth interviews (IDI) were conducted with MSM and TW community members to explore personal information and perspectives related to the following domains: characteristics of MSM and TW; social context for MSM and TW including experiences of stigma; availability and accessibility of HIV testing services; knowledge and perceptions on HIV self-testing; preferences for HIV testing, treatment and care models, and; issues related to operational implementation. Eligibility criteria for IDIs was defined as: biologically male, aged 18 years and above, reported anal sex with a male in the past 12 months, resident of greater Yangon and spoke Myanmar. Focus group discussions (FGDs) were also conducted with MSM and TW community leaders and service providers to explore HIV prevention, treatment and care availability and delivery, and participant experiences related to service provision. Those who reportedly engaged in providing services to MSM and TW for one year or more, were aged 18 years and over, and spoke Myanmar were eligible for FGDs.

IDIs and FGDs were recorded, transcribed and translated into English. English transcripts were checked for accuracy by local study staff and subsequently entered into Atlas. Ti (Cincom Systems, Berlin). Data from IDIs and FGDs were analysed collectively using open interpretive coding. Research team members (AW, EC, VV) independently coded transcripts after establishing consistency in the use of codes across team members. Codes were developed based on key domains in the interview guides and openly applied to transcripts to identify and analyse emerging themes. Regular meetings were held to ensure ongoing consistency of coding. A community validation workshop was held in September 2016 in Yangon during which the preliminary findings and analysis were shared with community interviewers and facilitators from the study to verify and validate authors' interpretations.

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A secondary analysis of this data was undertaken to better understand the characteristics of hidden MSM in Myanmar and the barriers and challenges to engaging them in HIV prevention. Specific domains used for this paper include: experiences related to the MSM and TW community; knowledge, preference and perceptions related to HIV prevention, treatment and care services; experiences of stigma and discrimination and access to HIV-related services.

While government literature utilizes the term ‘non-disclosing’ MSM to characterize MSM who do not openly identify their sexual or gender identity, in this paper we utilise the term ‘hidden’ to reflect local parlance and ensure consistency with participant data. The term ‘hidden MSM’ is therefore applied to participants who were purposively recruited to the ‘Hidden MSM’ FGD or who identified as hidden or *apone*, or those who described concealing behaviours in their interview narratives. Our reference to local identity labels throughout this paper is done with fidelity to the way in which they were utilised by participants throughout the study to convey the way these labels and identities are locally understood by the community members themselves.

We compare and contrast the barriers and experiences of hidden MSM to other MSM and TW and to the perspectives of the services providers and community leaders who seek to engage them in services, in order to highlight the implications for service provision. The analysis of data in this light resulted in the identification of three broad themes, which have been used to organise and discuss our data below. Overall participant characteristics are described in Table 5.

Ethics approval was granted by the Johns Hopkins School of Public Health Institutional Review Board and the Myanmar Department of Medical Research, Ethical Review Committee.

4.4 Results

In-depth interviews were conducted with 25 participants in total, 12 of whom identified as MSM (48%) and 13 as TW (52%). The median age of in-depth interview participants was 23 years (range 18 – 42) and 16 (64%) were aged between 18 – 25. The majority of participants were single (n=10), while 4 and 7 participants reported a current relationship with a casual and regular partner (s) respectively. Sixteen participants were HIV negative (64%), eight were HIV positive (32%) and one was HIV status unknown or undisclosed (4%). Five FGDs were also held with 35 participants in total; two with service providers (n= 8 and 6), one with MSM and TW community leaders (n= 9), one with hidden MSM community leaders (n=6) and one with TW community leaders (n=6) (Table 5).

"I have never admitted I'm a MSM because I am hidden": Characterising the lived experience of hidden MSM in Myanmar

Participant responses highlighted the perceived interconnectedness between sexual and gender identities in Myanmar, with participants expressing a belief that men who are sexually oriented towards other men share an inherent desire to dress and present in a feminine form:

When we become gays ... also the hiddens who become gays... we want to look or behave like girls. Forget about the rules. As soon as we realize we are not straight, we want to look/behave like girls...

Participant 1, FGD 2, Hidden MSM

Transgender women were therefore regarded as those who successfully embraced this desire while those who repudiated it were typically regarded as 'hidden' due to their efforts to

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maintain heteronormative behaviour and presentation. As the following participant notes, expression of gender and sexual identity was often related to the external environment:

There are environments where hidden MSM cannot dress like *apwints*... So they take hidden forms...

Participant 3, FGD 2, Hidden MSM

These 'hidden forms' enabled MSM to conceal their sexual preferences by maintaining gender-confirming appearances and behaviours. As the above participant suggests, disclosure and concealment of sexuality was often contextual and tied to specific environments. This quote, and the one that follows, points to a fluidity of sexual and gender expression among MSM and TW in Myanmar:

Interviewer: First, have you heard of the words *apone*, *apwint*, etc?

Participant: Yes, I know

Interviewer: Which type would you identify yourself with?

Participant: I am more like *apwint*

Interviewer: More *apwint*?

Participant: Yes, because I am no longer *apone*.

IDI 34, TW, age 36.

A key influence on the disclosure of sexual and gender identity was the perception or expectation of stigma and discrimination. Participants directly connected the degree of anticipated or experienced stigma and discrimination to the extent to which sexuality was publicly disclosed or observed. For example, participants who were more 'visible' as sexual minorities, such as TW or MSM who openly had relationships with male partners, more commonly experienced stigma from both significant others and the community. Consequently, concealment of their sexual identity and gender-conforming presentation enabled hidden MSM to avoid similar experiences to those described by this TW participant:

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Of course, there are challenges. As I have a husband (long term male partner), I have to face more problems in my neighbourhood. I have to face things like that... Since I started identifying myself as a gay, there has been discrimination from my siblings and community.

IDI 23, TW, age 22

The extent to which MSM felt the need to conform to traditional gender roles, including in the context of meeting family expectations to marry and have children, also had significant bearing on disclosure of sexuality. Underscoring the primacy of preserving good family relationships was an assumption that families would be disapproving of same-sex orientation. The following quote illustrates a possible consequence of disclosure to families:

To admit openly... that he is MSM, it will be difficult for him to be accepted by his family and community. There is a concern that the family will find out and abandon him.

IDI 11, MSM, age 22

Participants engaged in a range of negotiated identity practices in order to conceal their sexuality from their family and community and avoid anticipated stigma and discrimination. Many described their general avoidance of other MSM and TW and their beliefs that any association would enable others to identify them as part of the MSM or TW community. While some avoided other MSM and TW all together, others restricted their socialization only to other hidden MSM:

I deny it when my family asked me. I have never admitted I'm a MSM either in the past and now because I am a hidden MSM and not an open type... I don't know whether they pretend they don't know about me. But they don't like my *apwint* friends and I choose *apone* as my friends

IDI 26, Hidden MSM, age 23

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Other participants described a careful demarcation between their family and social lives, in order to maintain concealment of their sexuality around family, while selectively disclosing in certain social settings:

When I was in 8th or 9th Standard, I met some gays in the neighbourhood. They told me “Hey ... Here. You have to dress like this.” and “A gay has to live like this.” ...My family did not allow me to live in a gay (feminine) appearance. Even my hair was short like a boy and I wore a *longyi* (sarong typically worn by men in Myanmar). So, I had to meet them secretly at night.

IDI 27, MSM, age 24

Selective disclosure also meant that participant’s sexual identity and gender presentation was not static; many participants described a fluidity of sexual and gender performance which highlights the situational and contextual nature an application of sexual identity labels in Myanmar. This participant shares their experience of moving between transgender and male forms:

Although I was a gay, I still wanted to live like a boy. I mean – I wanted to dress like a boy. Others dressed like women at night. I did it sometimes. Also these days, as I am working as a dancer in a *Zat* band (traditional dance band), I dress like a woman. For the time being, as our team disbands for the season ... I stay with friends, in places where there are MSM.

IDI 27, MSM, 24 years old

"Hidden MSM do not try to learn much [about HIV] thinking people might find out their MSM status": Barriers to accessing HIV prevention services among hidden MSM

The behaviours and concerns of potential discrimination and stigma among hidden MSM described above presented a range of barriers to their engagement with HIV prevention services. Most notably, many participants described the perceived threat of disclosure of their sexual identity associated with HIV testing services – either related to the need to disclose or discuss potential sexual risk behaviours, or questions that may be raised following a possible HIV diagnosis:

With hidden MSM, most families don't know them. Since they are MSM, it will be a bit more difficult for them to test (in case) somebody finds out while he is testing. (Also) If he is hidden and he has it [HIV] and people don't know his orientation, I think it can hurt him mentally.

IDI 26, Hidden MSM, age 23

The priority given to concealing sexuality by hidden MSM shaped their preferences for HIV testing locations and providers. Many described the paramount importance of maintaining privacy and confidentiality in relation to their sexual orientation. While many MSM and TW participants expressed a preference for tailored HIV services, hidden MSM tended to weigh the perceived suitability of such MSM and TW-specific services against the threats to their confidentiality that these services were seen to pose. This ambivalence among hidden MSM towards MSM and TW-specific services was compounded by their avoidance of other MSM and TW. This participant describes an example of such avoidance from a fellow MSM waiting for HIV testing:

When I took a blood test in June, there was another *apone* and I recognized him as an *apone* at a glance. He was using the umbrella with anti-discrimination day label. I knew he was *apone*. And he most probably recognized me as well. But he didn't want me to

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know he came there for a blood test. He was sitting in a corner silently. He didn't want me to notice him.

IDI 24, Hidden MSM, aged 30

Government-provided services were viewed unfavourably by most MSM and TW, often related to past experiences or expectations of stigmatization and discrimination by government staff.

This was particularly felt by TW participants and more 'open' MSM:

With the NGOs, since we are MSM, they do counselling regarding sexual disease if we have it. They treated us warmly without discrimination. That is the difference. It is difficult for MSM to enter government clinic. They don't go there. There are many MSM staffs at NGOs. We just go where we are comfortable.

IDI 33, TW, age 22

While both 'open' MSM and TW, and hidden MSM shared this fear of stigmatization by health staff, for hidden MSM, the specific requirements of government services, as described below, and the inherent risk of indiscretion that these requirements carried presented additional barriers to accessing HIV testing at government services:

If an *apone* like me went to NAP [National AIDS Programme], there would be a lot of challenges. They insist we bring one family member to their counselling session. And they don't do history taking and counselling sessions individually. They ask about sexual issues in front of several doctors and female nurses. And they tell us to bring our male partners for blood test.

IDI 24, Hidden MSM, age 30

In general, health-seeking behaviour among hidden MSM was largely influenced by the extent to which services could offer anonymity. Below describes a participant's recent visit to a HIV testing clinic that served MSM and TW clients as well as the broader community. Service

satisfaction was related to the relative anonymity provided by this clinic, coupled with the skill and sensitivity of the service provider towards MSM and TW clients:

Although it was a general clinic, many MSM went there. It was good for me as there were not too many MSMs. Hidden ones can also visit. All kinds of them. It was good because there was an MSM project (also at the clinic) ... I felt more secure and safe. It is better for the clients.

IDI 24, Hidden MSM, aged 30

The need for anonymity also held important implications for hidden MSM diagnosed with HIV. As this participant describes, hidden MSM may choose to prioritize the concealment of their sexuality over their own health and well-being. For some, a HIV diagnosis would be regarded as an unwelcome intrusion of their private 'hidden' life, into their daily, more 'visible' lives, such as the need to take daily treatment for example.

I think *apone* will face more challenges (with HIV testing). They are hiding themselves and when they get a positive result, they can have more worries and emotional problems. Some don't want to disclose even if they get a positive result. And you know? They might think, "Why should I care a positive result. I am not going to seek medical care." *Apwints* have more guts to disclose and discuss. They will seek medical care if they get a positive result. I think they have more knowledge than *apone* do; compared to *apone*, many *apwint* know about HIV. *Apones* do not try to learn much (about HIV) thinking people might find out their MSM status

IDI 16, MSM, age 23

The need to navigate between these two worlds likely impacts the perceived suitability and appropriateness of HIV treatment and support. The following participant describes the differentiated perspectives of home-based peer-support - a service commonly provided by NGOs to promote adherence to HIV treatment and ensure ongoing psychosocial wellbeing - among hidden MSM and TW:

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Interviewer: Was it okay when there were visitors at home?

Participant: For transgender, they mostly spend time outside the home. And those who are accepted by their families, home visits are okay. For hidden MSMs, home visits are not okay.

Interviewer: So, you make appointments and meet him/her in a convenient place?

Participant: They (hidden MSM) just don't want people around.

IDI 24, Hidden MSM, age 30

"We are peers and we know what hidden MSM do But, at the counselling session, they would say they are not that kind of person ... What do we do then?" Service provider and community leader perceptions of barriers to engaging hidden MSM in HIV prevention

Data from service providers and community leaders highlighted the ways in which characteristics of hidden MSM presented barriers to effectively engaging this group in HIV prevention. In discussing the challenges, service providers demonstrated an awareness of concerns and inner struggles faced by hidden MSM and recognized the impact this had on their approaches to service provision, as this service provider demonstrates:

Interviewer: How do you identify open and hidden type?

Participant: Hidden type hides himself. It is quite difficult to persuade him to do blood test. The thought is that what if someone see him if he comes here?

Participant, FGD 3, Service Provider

Some service providers observed that hidden MSM had low levels of HIV prevention knowledge and were less likely to engage in protective behaviours compared to other MSM and TW:

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Hidden MSM don't admit it (that they have sex with men). They don't always use condoms. Even if they use condoms, they sometimes don't know if they are wearing the condoms correctly or inside-out.

Participant, FGD 1, MSM Community leader

This behaviour may be a result of a deliberate avoidance of the purchase of or access to condoms in order to conceal sexual behaviours, or reflect the limited knowledge of HIV prevention and safe sex practices due to minimal engagement with HIV prevention services and providers. For example, this service provider describes their experience encountering MSM who deny both their sexual orientation and therefore their need for HIV-related health promotion during community-based outreach and health promotion:

In hidden types, they don't even want to be known among themselves. They live with their pride. When you look at them, they look like real men... When you tell them to do blood test, they are scared to death. When you tell them about health education, they told (us) "We are not gays. Since I don't think of myself as gay, don't tell me those things."

Participant, FGD 3, Service provider

Some participants believed that the constant need among hidden MSM to hide their same-sex preferences and behaviours resulted in negative psychological effects such as feelings of internalized stigma and homophobia. In some cases, these negative feelings led to a sense of antipathy towards other MSM and TW. This hidden MSM reflects on these feelings arising from self-stigma and an ongoing need to conceal their sexual identity:

They (hidden MSM) can't let the community know at all. And they can't let their families know at all. So, finally they develop an attitude that they can't even accept themselves as MSM....They have a gay instinct but they hide themselves so much and try so hard to prove they are not gays .. and then they gradually begin to hate gays.

Participant 5, FGD 2, Hidden MSM community leader

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The denial of same-sex behaviour commonly employed as a strategy by hidden MSM was seen as a strategy to distance themselves from other MSM and TW as part of their broader attempts to conceal their sexuality. This behaviour persisted even in situations where MSM sought HIV testing. Service providers noted how the reluctance of hidden MSM to discuss same-sex behaviours limited the ability of HIV testing staff to accurately assess risk and provide appropriate counseling. As this service provider notes, prevarication from hidden clients during HIV testing was a common experience:

We are peers and we know what hidden MSM do. But, at the counselling session, they would say they are not that kind of person ... What do we do then? As we are peers, we know who is doing what. And things were okay when they first talked to us... Then, when they faced the counselor, and when the counsellor started explaining, they said “I’m not that kind of person” and come out of the counselling room.

Participant, FGD 1, MSM Community leader

Service providers also acknowledged the negative ways non-disclosure of sexuality intersected with HIV diagnosis and the impact this had on HIV treatment. As this following quote highlights, the need to keep sexual and family lives separate prevented some HIV-positive MSM from accessing family support. This quote also illustrates the contextualized nature of disclosure of sexuality among MSM as well as the potential impact - such as delayed or disrupted treatment - on access to HIV prevention and care services:

Interviewer: Are there conditions where MSM cannot come for HIV treatment all?

Participant: I have seen one... He is only 22. He lives with his aunt. She discriminates him because he is MSM. He came to our clinic and said he wants to test. He is “out of the closet” type but he lives like “in the closet” type at home in front of his aunt. When tested, his HIV test was positive. When I showed him the long-term plan (for treatment and care) he said that his aunt does not agree with him being an MSM (so) he has to live like a man. She does not like him going out.... The aunt will be worse if he has HIV because she doesn’t like him being MSM.

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Participant, FGD 3, Service provider

In response to these complexities, service providers described the different approaches they would adopt to engaging hidden MSM, demonstrating an understanding of the characteristics of this group and a level of empathy for their struggles. In particular, many service providers were cognizant of hidden MSM's need for privacy and discretion. This service provider reflects on how these priorities are reflected in their professional practice:

The one who is doing prevention knows them (hidden MSM). However, they hide. I know I cannot approach them like they are gay. I call them big brother or little brother. They liked to be called like that.

Participant, FGD 3, Service provider

Conversely, while many service providers and community leaders expressed understanding and empathy towards hidden MSM, others expressed feelings of frustration and impatience in the face of the difficulties they experienced working with this group. Underpinning this frustration was an expectation of responsibility among MSM and TW to prevent the spread of HIV. The following quote assumes a sense of community that underpins this sense of responsibility, however this sentiment is unlikely to extend to hidden MSM. This quote also speaks to the importance of rapport- and trust-building in the HIV prevention work carried out by peers - which is often developed over time and through repeated interactions - which is typically a precursor to longer-term engagement of MSM and TW with HIV prevention services. This community leader reflects on the challenges to engaging with hidden MSM and conveys a sense of frustration:

We want to help them understand such things as HIV prevention. It's not that we have left the hidden ones out but they have left us. There will be no discrimination if they have open discussions with us... They need to cooperate by doing their part.... They are not interested in how to use condoms to prevent HIV and how to take treatment. We don't leave them out but they have left us.

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Participant, FGD 1, MSM Community leader

Responses from some service providers and community leaders also conveyed a sense of powerlessness against the numerous influences that prevented MSM from more freely disclosing their sexual preferences and behaviours. These responses also displayed their recognition of the need for supportive and enabling environments if such behaviours were to change:

What can we do when hidden people from the community don't disclose? ... Rather than tell them to take HIV tests, they don't even know what HIV is and what AIDS is. To face this thing (HIV testing) is something that comes later. From the very beginning, their parents did not accept them being gays. If these problems (like a positive HIV diagnosis) are added, a lot of them will be dead.

Participant, FGD 1, MSM Community Leader

This quote also hints at recognition by some community leaders and service providers of a hierarchy of priorities for hidden MSM that may supersede the need for HIV testing and prevention. For example, denying or concealing same-sex orientation may enable hidden MSM to maintain family relationships and support, which may be disrupted by an HIV diagnosis that may force hidden MSM to reveal their sexuality and potentially upset family dynamics.

4.5 Discussion

Increasing the reach of HIV prevention programs among hidden MSM has been identified as a national priority for HIV control efforts in Myanmar (243), yet much remains unknown about this group. This study furthers our understanding of the characteristics of hidden MSM and how they influence levels of engagement with HIV prevention services. This study identified a number of barriers to HIV service access and uptake which largely stemmed from hidden

MSM's preference to conceal same-sex behaviour and orientation; for example, through avoidance of other MSM and TW, reluctance to attend HIV prevention services, denial of same-sex behaviours and adopting gender-conforming behaviours and presentations, particularly around family. Additionally, fear of stigma and discrimination and a need for privacy and confidentiality were key factors in shaping preferences for HIV prevention services among hidden MSM. Service providers and community leaders corroborated the experiences and characterizations of hidden MSM and noted the unique ways in which these barriers impacted their ability to engage hidden MSM in HIV prevention. Taken together, these findings provide some context for the low rates of HIV testing currently observed among MSM and TW in Myanmar (30) and carry important implications for the enhancing service demand through the development of culturally-relevant HIV prevention programs that are acceptable and can adequately address the specific needs and concerns of hidden MSM in Myanmar.

In this study, we found that non-disclosure of same-sex behaviour and preferences was commonly employed by MSM as a strategy to avoid stigma and discrimination from their families and communities. In Myanmar, although rarely enforced, homosexual sex remains constitutionally illegal and contributes to an environment in which sexual minorities continue to report ongoing harassment and discrimination (41). The criminalization of homosexual sex has also been associated with reduced levels of access to HIV services among MSM and TW (163). Service providers in Myanmar have noted how the current legal environment complicates the delivery of HIV prevention services by preventing community-based organizations from official state registration (42). Anti-homosexual legislation works to legitimize discrimination and negatively impacts the acceptance of sexual minorities, promoting concealment of sexual identity and behaviours among MSM. Across Asia, non-disclosure of sexuality has been associated with higher rates of condomless sex (237) and lower rates of HIV testing among MSM (97, 244). Similarly, in this study, we found that the requirement to disclose same-sex behaviours in order to receive appropriate HIV services and commodities effectively inhibited hidden MSM's access to these services; this reluctance hinders the provision of appropriate and tailored care, including specific risk-reduction counselling. Current WHO guidelines for

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example, recommend the provision of condoms and lubricant and the opportunity for anal cancer screening for all MSM (113), however these services are unlikely to be offered if same-sex behaviours are not revealed.

This study found that many hidden MSM engage in negotiated identity practices in order to carefully manage the concealment and disclosure of their sexual identity. Often this behaviour was tied to environment, with many hidden MSM describing adoption of gender-conforming behaviours and presentation around family and the careful demarcation of social/sexual lives and family/community contexts. This demarcation often involved the public avoidance of other MSM and TW and underscore the importance of privacy and confidentiality as a key determinant of health seeking behaviours and preferences for HIV prevention services among hidden MSM.

Peer-based outreach and health promotion is a fundamental component of Myanmar's national response to HIV (243) and has been identified as a key strategy to drive up rates of HIV testing among MSM (30). Yet the demonstrated reluctance among hidden MSM to publically engage with peer outreach workers may undermine the potential effectiveness of national HIV prevention strategies and programs in Myanmar. While some peer workers adopted inconspicuous approaches to engaging hidden MSM in outreach, and in doing so, demonstrated an awareness of this group's preference for privacy (for example, using more generic terms to address hidden MSM such as "*friend*" or "*brother*"), others indicated a sense of frustration at the difficulty of engaging hidden MSM that suggested limited empathy for the psycho-social struggles they experienced. There is an opportunity to strengthen community-based HIV prevention programs by ensuring all peer staff are comprehensively trained to both recognize and deal with these psychosocial struggles, including internal stigma and homonegativity, experienced specifically by men unwilling or unable to disclose same-sex preferences.

In general, responses to HIV are often based on easily identifiable risk categories, including "MSM" and "TW", which many have argued detract from properly appreciating the complexity of gender and sexual expression and the way this shapes HIV vulnerability and risk (245-247), including in the Asian context (248-250). Yet, the reappropriation of the term 'MSM' as an

identity category has been noted, signalling the transformation of ‘MSM’ from epidemiological term to subject position (251). In this study, numerous participants used the term ‘MSM’ as an identity label, parallel to local parlance as has been noted in other settings among same-sex attracted men (252). Neither continued reliance on the binary MSM/TW categories alone, nor the wholesale integration of local terminology in HIV programming would be sufficient; as argued by Thomann (252), the key to more responsive HIV programming is the recognition of the diverse lived experiences contained within local identities and how this intersects with other local and social realities to shape vulnerability to HIV. Indeed, the differing experiences and perspectives among the various sexual and gender identities, even within the same identity group, documented in this study highlights the importance of service provision that can appropriately cater for different groups and their heterogeneous needs. In Laos, for example, behaviourally bisexual men demonstrated reluctance to attend MSM-specific services (100), underscoring the importance of identifying as the intended recipient of HIV services. In this study, attendance at MSM-specific services was believed to present a high risk of association with the MSM community. Yet, while general testing clinics were viewed as providing greater anonymity, these clinics also presented barriers for hidden and disclosing MSM and TW including experiences of stigmatisation and discrimination from health care staff. Owing to similar concerns for confidentiality, recent research found that hidden MSM were more likely to seek treatment from public clinics, general practitioners or self-medicate compared to other MSM (42) or may simply eschew HIV services all together (220). In such contexts, generic Men’s Clinics staffed by MSM-friendly providers who can discretely provide services appropriate for this group’s sexual risk behaviours may be an appealing option for hidden MSM. The latest National Strategic plans identifies ‘One stop shops’ as a potential strategy to increase HIV testing rates among MSM (30); the findings from this study suggest that such an approach would be well-received by this group, provided staff were appropriately trained and aware of specific barriers encountered by hidden MSM. Delivery of comprehensive training for staff in mainstream HIV services and other government health services, and inclusion into medical and nursing curricula, to enhance both sensitivity towards MSM and other sexual minorities and capacity to provide appropriate and tailored services among health care workers would also

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increase the ability of providers in these settings to more comprehensively address the specific needs of MSM.

Myanmar is currently experiencing a period of significant transition and development, which has included an evolving interpretation of homosexuality (including the adoption of more 'Western' terminology such as 'homo', 'gay' and 'queer', particularly among younger, urban individuals and/or those connected to the NGO sector as demonstrated by some study participants; (39, 40, 42)). This ongoing development has also led to changing social and political environments, characterised by an emergent LGBTI community and an increasing number of civil society groups and social networks for sexual minorities, many of which are actively engaging in policy discussions and highlighting issues in their communities (42). In 2012, Myanmar held its first gay pride parade (253), a sign of the shifting attitudes and growing tolerance towards sexual minorities in Myanmar. However the prevailing legal environment sustains a sense of fear of discrimination and possible arrest among some MSM and TW whose desire to avoid both may supersede the importance of HIV testing and engagement with HIV prevention services, particularly those that pose a risk of disclosure, and should be recognized as a key barrier to service access. The expanding availability of information and communication technology (ICT) and infrastructure (254) in Myanmar, including a growing ubiquity of cyber networks among MSM communities (255) offers opportunities to engage MSM and TW in HIV prevention who may otherwise be reluctant to do so. ICT-based approaches have demonstrated some positive results in engaging MSM in HIV testing (190, 192, 195, 256), including among non-gay identified MSM (257), and are increasingly used to engage hard to reach and hidden MSM populations across Asia (24, 258). The evolving social and political context offers opportunities to reduce some of the identified barriers to engaging MSM through increasing the social acceptance of sexual minorities in Myanmar, while technological advances can be used to enhance the reach of hidden MSM in HIV prevention through the innovative use of online and new technologies. Together, this new landscape can promote an enabling environment in which some of the barriers to engaging hidden MSM in HIV prevention services described in this study are reduced.

This study has several limitations that should be considered alongside the results. Study participants were recruited from partner NGO organizations and their views and perspectives may not represent MSM and TW who are harder to reach or not currently connected to services. Additionally, this study did not specifically ask participants to identify their sexual identity *a priori* using the locally accepted terms described in this paper and we cite them insofar as they were used by participants themselves during FGDs and IDIs. Therefore, it is possible that some of the references to hidden MSM may be in relation to *thange* participants, who are also considered 'hidden' but who are likely to face unique barriers related to their specific sexual identity. More research is warranted to explore how the barriers faced by hidden MSM described in this study may be uniquely and variedly experienced by *thange* and *apone* MSM respectively. Additionally, our sample was recruited from Yangon, the largest city in Myanmar and may not reflect the lived experiences of MSM and TW in rural or remote areas where access to HIV services and tolerance towards gender non-conformity may be lower. Lastly, we did not collect specific socio-economic information that would enable us to comment on how these findings intersect with income and relative advantage/disadvantage. However, we believe the findings are relevant to other urban locations in Myanmar which are typically characterized by larger populations of MSM and TW compared to peri-urban and rural areas (30).

As highlighted by this study, MSM in Myanmar who are unwilling or unable to disclose their sexual behaviour and preferences face multiple and overlapping barriers to accessing HIV testing and other prevention services. Strategies such as building the capacity of peer service providers to identify and respond to psychosocial challenges experienced by non-disclosing MSM, sensitivity training to reduce discriminatory attitudes and practices among mainstream health providers and government workers, and innovative approaches such as one stop shop services and ICT-based health promotion that can discretely provide services tailored to the distinct needs of MSM and TW, while ensuring their privacy, may help circumvent some of the barriers identified in this study. Such activities should be considered as part of an overarching HIV prevention strategy that also addresses the broader structural barriers related to stigma and discrimination in the general community to improve the social acceptability of sexual

minorities and create an environment in which hidden MSM can comfortably discuss same-sex behaviour and access services appropriate for their risk behaviours.

4.6 Acknowledgements

CB, SN, EC, AW, and SB collaborated in the design and oversight of the overall study. AW, EC, and VV contributed to the design and analysis of qualitative research. AW and KHT led trainings of qualitative interviewers and KHT oversaw qualitative data collection. VV wrote the initial drafts of this manuscript with assistance and guidance from MS. All authors had full access to the data, reviewed and edited the manuscript, and all take responsibility for its integrity as well as the accuracy of the analysis. All authors read and approved the final manuscript

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Table 5: Characteristics of MSM and TW participating in in-depth interviews and focus group discussion participants in Yangon.

In-depth interview participants	n (%) (n= 25)
Median age, years (range)	23 (18 – 42)
18 – 25 years	16 (64)
26 – 35 years	5 (20)
36 years and above	2 (8)
Sexual identity	
TW	13 (52)
MSM	12 (48)
Current relationship status	
Single	10 (40)
Casual partner(s)	4 (16)
Regular male partner (s)	7 (28)
Sex worker	3 (12)
HIV status	
HIV positive	8 (32)
HIV negative	16 (64)
HIV unknown/not disclosed	1 (4)
Focus group discussion participants (n)	Characteristics
FGD 1: MSM and TW Community leaders (n= 9)	MSM and TW Outreach workers, peer educators and supervisors, volunteers and community workers; both HIV positive and negative participants
FGD 2: Hidden MSM (n=6)	Hidden MSM, both HIV positive and negative participants, low and middle income status
FGD 3: Service providers (n=8)	MSM Outreach worker, Peer educators and supervisors, HIV testing counsellors
FGD 4: Service providers (n=6)	General Practitioners, Sexual Reproductive health educator, Peer educators, Outreach worker
FGD 5: Transgender women (n=6)	Transgender women, both HIV positive and negative, sex work

CHAPTER FIVE

5. Assessing attitudes towards peer-based models of HIV service delivery

In Chapter 4, we identified that stigma and discrimination towards MSM and other sexual minorities remains a key barrier to HIV testing and prevents the establishment of the regular testing practices that are needed to detect infection early and prevent onward transmission, particularly for MSM and TW for whom concealing their sexual and gender identity is a defining priority. Myanmar's current National Strategic Plan for HIV is broadly supportive of peer-based models of HIV service delivery. However, to date, peer-involved service models (including the service from which data was collected in the study described in Chapter 3) have not used peers to deliver HIV tests, instead limiting their role to outreach education and condom distribution and in pre- and post-test counselling. The changing landscape of HIV prevention in Myanmar, including ongoing decentralisation of HIV testing services and introduction of rapid point of care testing potentiates a more direct role of peers in the delivery of HIV testing. However, attitudes and perceived acceptability among MSM and TW for peer-delivered testing as a novel service delivery model remains unknown.

This study explored attitudes towards peer-delivered HIV testing. The study findings suggest that MSM and TW, particularly those engaging in sexual risk behaviours or more likely to conceal their sexual orientation, would be willing to receive HIV testing from a peer. This research supports the consideration of a more direct role for peers in HIV testing as a strategy to promote more regular engagement of MSM and TW in testing services.

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Acceptability of peer-delivered HIV testing among men who have sex with men and transgender women in Myanmar

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5.1 Abstract

Men who have sex with men (MSM) and transgender women (TW) are a priority population for HIV prevention in Myanmar but report sub-optimal HIV testing frequency. Previous studies have shown that peer involvement in HIV testing can normalize stigmatised sexualities and reduce barriers to testing.

We explored the acceptability of peer-delivered HIV testing among 425 undiagnosed MSM and TW in Yangon and Mandalay. An overwhelming majority of participants (86%) reported being 'comfortable/very comfortable' with peer-delivered HIV testing. Logistic regression identified reporting sexual identity as *apone* (adjusted odds ratio (aOR)=3.8; 95%CI=1.2-11.7), recent HIV testing (aOR=3.1; 95%CI=1.4-6.5), reporting a high likelihood of HIV acquisition (aOR=3.6; 95%CI=1.7-7.6), and reporting ≥ 5 casual partners in the past three months (aOR=0.2; 95%CI=0.1-0.6) were associated with peer-delivered HIV testing acceptability.

Given the ongoing HIV vulnerability among MSM and TW in Myanmar, peer-delivered testing may offer prevention benefits by increasing testing rates and identifying undiagnosed infection earlier.

5.2 Background

Ambitious UN targets to virtually eliminate AIDS by 2030 are predicated on 90% of people with undiagnosed HIV infection knowing their HIV status (109). Achieving this target is reliant on regular HIV testing among populations at risk of HIV infection. HIV testing offers important primary prevention opportunities through pre- and post-test discussions with providers and post-diagnosis reductions in risk behaviours (154), and facilitates secondary HIV prevention through early treatment access and viral suppression (259, 260).

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Men who have sex with men (MSM) and transgender women (TW) are a key population in the Asian HIV epidemic and are at substantially increased risk of HIV acquisition through risk behaviours such as unprotected anal intercourse with multiple sexual partners (15, 214). In Myanmar, HIV prevalence among MSM and TW in 2015 increased to 11.6% from an estimated 6.6% in 2009, and the concentration of HIV reported among MSM and TW in the major cities of Yangon (26.6%) and Mandalay (21.6%) are among the highest seen across Asia-Pacific (30, 228, 232). HIV infections among MSM and TW currently account for 13% of all incident cases in Myanmar; this is estimated to increase to 27% by 2021 in the absence of adequate interventions (261). Consequently, MSM and TW are a priority for HIV control in Myanmar's national response and this concentrated focus has seen a rise in HIV prevention programs targeting this group (30, 228).

The new National Strategic Plan for HIV highlights the need to strengthen the enabling environment for HIV prevention interventions among key populations (30). Strategies such as expanding HIV testing models, strengthening affected communities' involvement in service delivery, and the tailoring of community-based HIV services are identified as priority activities to reach 90% of MSM and TW by 2030 (30). In part, these activities are designed to address low rates of HIV testing among MSM and TW in Myanmar (30), where the illegality of homosexual acts and discrimination and harassment of sexual minorities act as barriers to uptake of HIV testing (41, 88, 96). In such settings, the involvement of MSM and TW peers in service delivery can enhance demand and uptake of HIV and sexual health services (41, 262-264) by creating environments in which stigmatised sexual identities are normalised and where MSM and TW can talk openly about same-sex behaviours (265). When applied specifically to HIV testing, the involvement of peers in countries as diverse as Nigeria, Australia and France has demonstrated effectiveness in increasing diagnoses of HIV and linking more HIV-positive MSM to care compared to non- peer involved models (266-268).

Recent developments in Myanmar have expanded opportunities for new models of HIV testing, beyond those provided by government or private providers. In particular, the introduction of decentralised HIV testing in 2013, the introduction of HIV rapid point-of-care (RPOC) testing

and increasing provision of HIV prevention services by domestic and international NGOs (206, 269) has enabled the expansion of HIV testing for MSM and TW into community settings. While there are some examples of the positive impact of MSM and TW peer-testing (270) and peer-involvement (271) on HIV testing rates in Asia, models that include the direct provision of HIV testing by MSM and TW remain relatively uncommon in this region. Moreover, the acceptability of peer-delivered models of testing among MSM and TW in Asia is also unknown; only one study has explored acceptability among key populations in Asia, revealing a high level of acceptance for peer-delivered testing among people who inject drugs in Thailand (272). However, factors such as the perceived professionalism and skill of peer testers (273), boundaries between personal and professional relationships (274), and concerns for confidentiality (275) may affect the acceptability of peer-delivered testing and the extent to which such models can contribute to improved service engagement and rates of HIV testing among MSM and TW.

In 2014, we conducted a study among MSM and TW in Myanmar to: 1) determine the level of acceptability of peer-delivered HIV testing; and 2) identify factors associated with peer-delivered HIV testing acceptability.

5.3 Methods

Cross-sectional surveys were completed by self-identifying MSM and TW recruited in Yangon and Mandalay in November and December 2014. Participants were recruited by 12 trained MSM and TW peer workers selected from community-based NGO Myanmar Business Coalition on AIDS (MBCA). MBCA implements an MSM and TW-targeted outreach HIV education and prevention program which is coordinated by Burnet Institute as part of their HIV education and prevention program in Myanmar. This program has been operating since 2009 and provides condoms and lubricant distribution and HIV testing education and referral activities to MSM and TW through outreach activities and fixed-site drop in centres in five locations.

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Recruitment

MSM and TW were recruited in Yangon and Mandalay. These are the two largest cities in Myanmar and were chosen based on high HIV prevalence among MSM and TW (26.6% in Yangon and 21.6% in Mandalay respectively;(30)) and their subsequent centrality in Myanmar's HIV prevention response.

Trained peer workers recruited participants using convenience and snowball sampling at known MSM/TW-hotspot locations. Following a short study description, MSM and TW expressing interest in participating were provided with a non-study identifying participation card containing a list of times and locations where they could participate in surveys. Participants that indicated they knew others in their peer network that might be interested in participating were provided with up to three participation cards to give to their peers. Eligible participants were biologically male, aged over 18 years, self-reported anal sex with another male in the past one year and had not previously participated in the study. We estimate that approximately 15% of eligible MSM and TW provided with a study card did not present at the agreed time and place for interview. All participants were required to provide informed written consent prior to participation and received 3000 Myanmar Kyat (MMK; approximately USD\$2.20) for their time and travel expenses at the completion of the survey.

Data collection

Surveys were researcher- administered using electronic, password-protected tablets at fixed-site locations selected on the basis of their confidentiality and safety. These included established drop in centres, the Burnet Institute office in Yangon, and locations where MSM and TW gather such as teahouses. Given the sensitivity of same-sex behaviours in Myanmar, no personally identifying information was collected or recorded from participants during interviews. The survey was designed to inform ongoing HIV prevention and testing services for MSM and TW in Myanmar. The survey was conducted in the local language and explored a range of socio-demographic factors, sexual risk behaviours, HIV prevention practices, knowledge, attitudes and use of HIV/STI risk reduction strategies and self-perceived HIV risk among MSM and TW.

Factors included in this analysis were: age, sexual identity (*apone*, *apwint* and *thange*; see below), highest level of education (primary, middle, secondary, tertiary), monthly income (equal or below median, above median), number of regular (none, 1, >1) and casual (none, 1-5, >5) male partners in past three months, condom use by partner type during the past three months (never, occasionally, often, always), any sex with female partners in past three months (yes, no), self-perceived risk of acquiring HIV (very unlikely, unlikely, neither unlikely or likely, likely, very likely), how serious participants considered HIV (not at all serious, not serious, neither serious nor unserious, serious, extremely serious), lifetime history of testing for HIV (yes, no) and time since last HIV test (past 6 months, 6 months – 2 years, > 2 years, never).

Sexuality was defined using locally accepted labels *apone*, *apwint* and *thange* that are commonly used in Myanmar to describe sub-groups of MSM and TW and have typically been indicative of sexual positioning, sexual behaviour and power dynamics (43). However these labels are equivocally defined (39, 229) and continue to evolve (39), particularly in response to increasing exposure to Western media and acceptance of sexual minorities in Myanmar. To reflect current understandings of male sexual identities in Myanmar we operationalized these terms in the following way: *apwint* are biological males who are typically disclosing of same-sex preferences, and have a feminine presentation and/or may be regarded as transgendered. *Apone* are men who have a masculine presentation, and in some spheres or circumstances may disclose same-sex behaviour and identify as gay, while in others are likely to conceal, or deny their same-sex preferences and are often referred to as 'hidden'. *Apwint* and *apone* are typically receptive partners in sexual positioning. *Thange* are masculine, heterosexual-identifying men who conform to heteronormative expectations, and may engage in sexual relationships with women, while also engaging in incidental sex with other men and may also be referred to as 'hidden'. *Thange* typically partner with *Apwint*, often commercially, as well as *apone*, and assume the insertive role in sexual partnerships (30, 41, 43, 229).

Analysis

The primary outcome of interest was acceptability of peer-delivered HIV testing. Participants were asked to respond to the following question: “How comfortable would you be with an appropriately trained peer counsellor providing you with HIV testing and counselling?” Those that reported being *very comfortable* or *comfortable* were classified as ‘accepting’ of peer-delivered HIV testing while those who reported being *neither comfortable nor uncomfortable*, *uncomfortable*, *very uncomfortable* were classified as ‘not accepting’ of peer-delivered testing. Analyses were restricted to those who provided a valid response to the primary outcome and who self-reported being HIV undiagnosed (either through reporting their last HIV test as negative or reporting their HIV status as unknown). Exposures were chosen *a priori* based on previous research on factors associated with testing uptake and knowledge of the local context. Socio-demographic characteristics, sexual risk behaviours, HIV prevention practices, barriers to HIV testing and self-perceived HIV risk were analysed descriptively. Univariable and multivariable logistic regression identified significant associations between these variables and acceptability of HIV testing delivered by peers. A multivariable model was constructed retaining all variables analysed in univariable analyses. Analyses were conducted using Stata (Version 13, Stata Corp., College Station, TX, USA). Statistical significance in all analysis was set at $p \leq 0.05$.

Ethics

Ethics approval was granted by the Alfred Hospital Ethics Committee (Australia; #445/14) and the Department of Medical Research (Lower Myanmar) Ethical Review Committee (761 Ethics 2004).

5.4 Results

520 MSM and TW were recruited for this study. Ninety-five participants (18.3%) were excluded from analysis based on missing data on the primary outcome ($n=19$) or HIV status ($n=10$) or

who self-reported an HIV-positive status (n=66). Among the remaining 425 HIV-undiagnosed participants, 173 (40.7%) were recruited in Yangon and 252 (59.3%) in Mandalay. Three hundred and fifty four (83.5%) identified as male and 70 (16.5%) as TW. Two hundred and forty seven (58.3%) of MSM and TW were aged under 25 and 210 (49.9%) identified as *thane*. Thirty seven percent of MSM and TW had completed secondary level education (equivalent to 11 years of schooling). The median monthly income was MMK 150,000 (approximately USD \$190; IQR: 90,000 - 200,000).

Most MSM and TW reported anal sex with a regular male partner; 174 (40.9%) and 81 (19.1%) participants reported one, and more than one regular partner in the past three months, respectively. Among these 255 participants, 160 (69.9%) reported inconsistent condom use with their regular partner(s) during the past three months. Recent sex with casual partners was also common, with 199 (48.3%) and 88 (21.4%) participants reporting sex with 1 – 5 and more than 5 casual partners in the past three months, over half of whom (56.9%) reported inconsistent use of condoms. Thirty three percent of all participants reported both regular and casual partner(s) in the past three months. Sex with female partners was rare and reported by 64 (15.1%) participants.

One hundred and ninety (46.0%) MSM and TW considered it '*likely*' or '*very likely*' they would acquire HIV in the future and 246 (58.7%) considered HIV '*very serious*'. HIV testing within the past six months was reported by 282 (66.8%) of participants. Three hundred and sixty-six (86.1%) indicated they were '*comfortable/very comfortable*' with the idea of receiving HIV testing from a trained peer and classified as accepting of peer-delivered HIV testing (Table 6).

In unadjusted analyses, participants who identified as *apone* (OR= 3.6; 95% CI: 1.5 – 8.9), who considered their risk of HIV acquisition as '*likely/very likely*' (OR=3.0; 95% CI: 1.6 – 5.7), who perceived HIV as '*very serious*' (OR = 2.3; 95% CI: 1.3 – 4.1), and who reported their last HIV test within the past six months (OR=3.3; 95% CI: 1.8 – 6.0) or between six months and two years (OR=4.6; 95% CI: 1.5 – 14.1) were significantly more likely to find peer- delivered HIV testing acceptable. MSM and TW with more than five casual partners in the past three months were

significantly less likely to accept peer- delivered HIV testing (OR= 0.5; 95% CI: 0.2 – 1.0) (Table 6).

In multivariable analysis, self-identifying as *apone* (aOR=3.8; 95% CI: 1.2-11.7), considering the risk of HIV acquisition as '*likely/very likely*' (aOR=3.6; 95% CI: 1.7 – 7.6), reporting an HIV test in the past six months (aOR= 3.1; 95% CI: 1.4 – 6.5) or between six months and two years ago (aOR=4.3; 95% CI: 1.2 – 15.4) remained positively associated with acceptability of peer-delivered HIV testing. Reporting more than 5 casual partners in the past three months (aOR= 0.2; 95% CI: 0.1 – 0.6) also remained negatively associated with acceptance of peer- delivered HIV testing (Table 6).

5.5 Discussion

This study revealed a high level of acceptance for peer-delivered HIV testing among MSM and TW in Myanmar. The acceptability of HIV peer-testing among key populations in Myanmar has not been previously investigated. Acceptability of peer-delivered HIV testing was high across all variables that characterised MSM and TW in our sample, demonstrating broad acceptability of peer-delivered HIV testing models. Acceptability of peer-delivered HIV testing was particularly high among MSM and TW identifying as *apone*, those who reported recent HIV testing and perceived themselves as at high risk of acquiring HIV in the future. These findings have implications for future models of HIV testing in Myanmar and, given recent national recommendations for peer-involved models of service delivery, have immediate translational potential. Alongside new global guidelines supportive of lay HIV testing (276) MSM and TW peer-based HIV testing emerging in other countries (277, 278), nascent community mobilization and the increasing availability of RPOC HIV testing enhance the feasibility of new MSM and TW peer-based HIV testing models in Myanmar.

Our finding that *apone* were more likely to accept peer-delivered HIV testing than heteronormative men self-identifying as *thange* likely reflects their relative level of comfort accessing peer-involved services more obviously tailored to MSM and TW. While over 80% of *thange* still considered peer-delivered testing as acceptable, ensuring these service models appeal to *thange* who may not identify as the intended target population of MSM and TW-specific services is crucially important to increase the reach and effectiveness of HIV testing in Myanmar. Across Asia, men who have sex with both men and women are less likely to test for HIV compared to men with exclusively male partners (160, 279), suggesting that heteronormative MSM are not adequately reached or served by existing models of HIV testing. However, while the avoidance of heteronormative men of HIV services that manifestly cater for MSM and TW may be expected, our finding that four in five *thange* were accepting of peer-delivered HIV testing suggests potential benefits of a peer-based model for this group. Mainstream health services in Asia have been identified as locations where HIV risk populations perceive and experience significant discrimination (96, 167, 280). Mainstream health professionals in Asia have also been shown to exhibit highly stigmatising attitudes to people at risk or living with HIV (281, 282). Peer-based services can minimise reluctance to test associated with service-provider stigma (163, 283) by providing environments in which same-sex behaviours can be openly discussed with other MSM and TW, thereby ensuring that clients receive counselling and testing commensurate with their actual risk behaviours.

Our sample, recruited in the context of an existing community-based HIV prevention program, demonstrated a high level of existing engagement with HIV testing services. Two thirds of MSM and TW reported an HIV test in the past six months and the proportion reporting an HIV test in the past 12 months was one and a half times higher than the national average (30). We found that MSM and TW with a more recent history of HIV testing were more likely to find peer-delivered HIV testing acceptable. This result is not surprising, given that MSM and TW who routinely engage with testing services are likely to have already overcome certain barriers to accessing HIV testing and may therefore be more willing to consider alternative models of testing. In recent studies, Chinese MSM who recently tested were more willing to consider

couple-based HIV testing (284), while people who inject drugs in Thailand who reported recent avoidance of HIV testing were around three times less likely to accept peer-delivered HIV testing compared to those that did not (272). Taken together, these findings highlight the need to consider specific strategies to identify and engage naïve and infrequent HIV testers to facilitate ongoing and routine engagement with HIV prevention services, including new and novel models of HIV testing. Innovative use of online technologies, for example, have demonstrated positive results in engaging MSM for HIV testing (190, 256, 257, 285), including non-gay identified MSM (257), and are increasingly being used across Asia to reach hard to reach and hidden MSM and TW populations (258, 286). Such approaches could be considered in Myanmar, particularly in light of the burgeoning information, communication and technology (ICT) environment (254) and increasing use of cyber networks among MSM and TW communities (255).

MSM and TW in this study who perceived they were at a greater risk of HIV acquisition were more accepting of peer-delivered HIV testing. In other studies, fear of a positive result has been identified as a barrier to HIV testing among MSM (287, 288). Decisions to test among people at risk of HIV may be influenced by perceptions about the availability and quality of post-diagnosis support and HIV treatment and care following a positive result (287). Our finding suggests that expectations among MSM and TW about the nature of post-diagnosis support provided by peers may similarly influence decisions to test and reflect a preference to be diagnosed by peers or by people with whom they have an existing relationship. This finding was potentially influenced by the recruitment of a sample through an established and peer-involved HIV education and prevention service. In any case, the common experiences and characteristics between peer workers and clients has been identified as a major benefit and appeal of peer-based services (289) and may help promote better engagement with HIV testing, particularly among those who consider themselves at high risk of HIV.

Somewhat contradictory of the positive relationship between acceptability of peer-delivered HIV testing and perceived risk of HIV acquisition, we found that those who reported a higher number of casual sex partners were less likely to find peer-delivered HIV testing acceptable.

Others have reported peer-led models of HIV testing have attracted MSM and TW who report higher levels of sexual risk behaviour compared to non-peer-based services (176, 268). Our finding may reflect the context in which MSM and TW meet sex partners in Yangon and Mandalay mostly through a small number of public cruising areas, and concerns identified by others in relation to a potential overlap of social and sexual MSM and TW networks (290, 291). While most MSM and TW reporting more than five sex partners in the past three months still found peer-delivered HIV testing acceptable, for some, concerns about privacy, confidentiality or fear of being judged by peers in relation to their risk behaviours or when receiving a positive diagnosis may present certain barriers (292). While others have noted that peer-based models are perceived by MSM and TW as non-judgemental (275, 293), a perceived lack of confidentiality and potential for community gossip has been identified recently as a concern among MSM and TW in Myanmar regarding community-based HIV services (294).

Our sampling approach, which recruited MSM and TW engaged with an existing HIV prevention service in the two largest urban settings in Myanmar, may limit the generalisability of our findings to smaller cities or more rural locations. However, the findings are likely to be informative of attitudes among MSM and TW in the major cities of Yangon and Mandalay given that the MBCA-Burnet Institute outreach program through which the sample was recruited was among the most extensive (distributing approximately 1 million condoms per annum through outreach) of the MSM and TW peer involved services operating in Yangon (four services) and Mandalay (three services) at the time of recruitment. MSM and TW included in this study reported rates of HIV testing higher than the national average (295) suggesting regular engagement with HIV prevention services. This frequent exposure to HIV services and health promotion may have contributed to the high level of acceptance for peer-delivered testing. Our sample was also relatively well educated and remunerated and their preferences may not reflect those of MSM and TW who are more isolated, have less access to HIV services, or who are economically and socially-disadvantaged. However, the recruitment of MSM and TW being reached by a NGO HIV education and prevention program in outreach settings in Yangon and Mandalay enhances the translation potential of findings. As noted earlier, the new National

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Strategic Plan for HIV in Myanmar (30) emphasizes an expanded role for peers in HIV models of care. To our knowledge no HIV peer-delivered testing model has yet been implemented in Myanmar, with peer roles in testing typically restricted to pre-test counselling in NGO services. Soon after data collection was completed for this study the MBCA-Burnet Institute program introduced HIV testing, with peers involved in promoting testing services and in pre-test counselling and nurses delivering the RPOC tests. These services have since delivered on average 650 and 850 HIV tests per month to MSM and TW. Our findings showing high levels of acceptability for peer-delivered testing among MSM engaged with this NGO-delivered HIV program, suggest the direct provision of tests by peers (rather than nurses) would potential enhance demand for testing even further and expand opportunities for prevention education.

MSM and TW in South and South-east Asia have low rates of HIV testing compared to other low- and middle-income countries (296). Our findings demonstrate that peer-delivered HIV testing is highly acceptable and, given the low national rates of HIV testing and ongoing experiences of stigma and discrimination among MSM and TW in Myanmar, may help circumvent barriers to HIV testing and increase engagement of MSM and TW in HIV treatment and care. The current policy, regulatory and community context in Myanmar is conducive to the introduction of community-based models of HIV testing and the inclusion of peer-testing models (30) and our findings provide strong support for the integration of HIV testing by peers in community-based models. Further research is needed to understand implementation barriers to integrated HIV peer-delivered HIV testing models across a range of community and clinical settings, including those associated with potential concerns for privacy and confidentiality among more sexually-active MSM and TW.

5.6 Acknowledgments

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Table 6: Participant characteristics and logistic regression associations with acceptability of peer- HIV testing among MSM and TW

	Total (N=425)	Accepting of peer- HIV testing (n= 366)	Associations between acceptability of peer- HIV testing and participant characteristics			
			OR	95% CI	aOR	95% CI
Location						
Yangon	173 (40.7)	150 (86.7)	1.1	0.6 – 1.9	0.6	0.3 – 1.3
Mandalay	252 (59.3)	216 (85.7)	1	-	1	-
Gender						
Male	354 (83.5)	305 (86.2)	1.0	0.5 – 2.2		
Transgender woman	70 (16.5)	60 (85.7)	1			
Age						
Median (IQR)	25 yrs (20 – 28)					
<25 years	247 (58.3)	211 (85.4)	0.8	0.4 – 1.7	1.1	0.4 – 2.7
25-29 years	101 (23.8)	87 (86.1)	0.8	0.3 – 2.0	1.1	0.4 – 3.1
30> years	76 (17.9)	67 (88.2)	1	-	1	-
Sexual Identity						
Apone	108 (25.7)	102 (94.4)	3.6	1.5 – 8.9**	3.8	1.2 – 11.7*
Apwint	103 (24.5)	88 (85.4)	1.3	0.7 – 2.4	1.6	0.8 – 3.9
Thange	210 (49.9)	173 (82.4)	1	-	1	-
Highest level of education achieved						
Primary school or below (<5 years)	33 (7.8)	27 (81.8)	0.7	0.3 – 1.9	0.9	0.2 – 3.0
Middle school (6 – 9 years)	105 (24.8)	94 (89.5)	1.3	0.6 – 3.0	2.2	0.8 – 6.1
Secondary school (11 years)	159 (37.5)	134 (84.3)	0.8	0.4 – 1.6	1.0	0.4 – 2.2
Tertiary and above (12> years)	127 (30.0)	110 (86.6)	1	-	1	-

PEER-DELIVERED HIV TESTING

Monthly income						
Median monthly (IQR; MMK)	150,000 (90,000 – 200,000)					
Above median (>150,000 MMK; USD 110)	135 (32.1)	116 (85.9)	1.0	0.5 – 1.7	0.7	0.4 – 2.0
Below median (<150,000 MMK; USD 109)	286 (67.9)	247 (86.4)	1	-	1	-
Number of regular male partners in past three months						
None	170 (40.0)	143 (84.1)	1	-	1	-
One	174 (40.9)	155 (89.1)	1.5	0.8 – 2.9	0.8	0.4 – 2.0
More than one	81 (19.1)	68 (84.0)	1.0	0.5 – 2.0	0.6	0.3 – 1.5
Condom use with regular partner(s)						
Consistent	70 (30.4)	65 (92.9)	0.5	0.2 – 1.3	-	-
Inconsistent	160 (69.6)	138 (86.3)	1	-	-	-
Number of casual male partners in past three months						
None	125 (30.3)	111 (88.8)	1	-	1	-
1 – 5 casual partners	199 (48.3)	176 (88.4)	1.0	0.5 – 2.0	0.9	0.4 – 2.2
More than 5 casual partners	88 (21.4)	69 (78.4)	0.5	0.2 – 1.0*	0.2	0.1 – 0.6 **
Condom use with casual partners						
Consistent	122 (43.1)	108 (88.5)	1	0.3 – 1.2	-	-
Inconsistent	161 (56.9)	133 (82.6)	0.6	-	-	-
Sex with both regular and casual male partners in the past three months*	139 (33.7)	118 (84.9)	-	-	-	-
Any sex with female partners in past three months						
Yes	64 (15.1)	54 (84.4)	0.9	0.4 – 1.9	1.2	0.4 – 2.9
No	360 (84.9)	311 (86.4)	1		1	
Self-reported likelihood of acquiring HIV in the future						
Likely/ Very likely	190 (46.0)	176 (92.6)	3.0	1.6 – 5.7 **	3.7	1.7 – 7.8**
Very unlikely - Neutral ¹	223 (54.0)	180 (80.7)	1	-	1	-
Self-perceived seriousness of HIV						
Very serious	246 (58.7)	222 (90.2)	2.3	1.3 – 4.1**	2.0	1.0 – 3.9*
Not at all serious – Serious ²	173 (41.3)	138 (79.8)	1	-	1	-
Time since last HIV test						
During past 6 months	282 (66.8)	252 (89.4)	3.3	1.8 – 6.0**	3.1	1.5 – 6.6**

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>6 months and <2yrs	51 (12.1)	47 (92.2)	4.6	1.5 – 14.1**	4.2	1.2 – 14.8*
>2years /Never tested	89 (21.1)	64 (71.9)	1	-	1	-

*p<.05; **p <.01

¹Includes 'Very unlikely', 'unlikely', 'neither unlikely or likely' and 'likely'

²Includes 'Not at all serious', 'Not serious', 'Neither unserious nor serious' and 'Serious'

* Given the lack of association between condom use variables at peer testing acceptability and collinearity of these variables with the number of sex partners, condom use was not included in the adjusted mode

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6. The role of digital technologies to improve HIV testing uptake among MSM and TW

The previous chapter identified that peer-delivered HIV testing is acceptable to MSM and TW and may be a strategy to increase engagement with HIV testing, particularly among those reporting indicators of sexual risk or who are less likely to disclose their sexual orientation. This thesis has highlighted the ways in which multiple barriers limit access to HIV testing among MSM and TW and the importance of novel approaches to service delivery that may circumvent some of these challenges.

Internet-enabled digital communication technology has emerged as a recognised tool to scale up HIV prevention efforts among MSM and TW. The ongoing use of online platforms by MSM to meet sex partners, combined with evidence about higher sexual risk taking among those that regularly use these platforms suggest that digital technology may present opportunities to deliver health promotion to MSM in potential environments of risk. As noted in Section 1.6.3 internet, social media and mobile applications are being closely considered in Myanmar as a potential means for reaching MSM and TW with HIV prevention activities and for referral to services.

While a growing number of studies have investigated the role of technology to increase HIV testing uptake among MSM and TW, there is little guidance available to inform future implementation or development, including evidence of the collective effectiveness of digital approaches and identification of specific features associated with greatest impact. This chapter presents a systematic review and meta-analysis that explored the impact of digital communication technologies on HIV testing uptake among MSM and TW. Evidence of increased HIV testing uptake associated with exposure to digital interventions confirms the potential utility of this medium for HIV prevention, particularly when interventions utilise

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existing social media platforms, are interactive and directly facilitate testing through referrals or provision of home-based HIV testing kits.

The work in this chapter reproduces the following manuscript:

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Using digital technology to increase HIV testing among men who have sex with men: A systematic review and meta-analysis

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6.1 Abstract

HIV continues to disproportionately affect men who have sex with men (MSM) and transgender women (TW). Undiagnosed HIV is a major driver of HIV transmission rates and increasing the uptake of regular HIV testing and facilitating timely initiation of HIV treatment is a global HIV prevention priority. However, MSM and TW experience a range of barriers that limit their access to testing and other prevention services. Given their growing ubiquity, digital communication technologies are being increasingly being used to support HIV prevention efforts, and a growing number of studies have trialled the use of digital technology to promote HIV testing among MSM and TW.

We undertook a systematic review and meta-analysis to assess the impact of digital communication technology on HIV testing uptake among MSM and TW. Sub-meta-analyses aimed to identify the features and characteristics of digital interventions associated with greater impact.

A systematic literature review was undertaken using select databases and conference repositories. Studies describing the use of a digital technology - internet-enabled devices including phones, tablets and computers - to increase HIV testing uptake among MSM or TW using either randomised or observational cohort design with pre- and post-intervention measured and published in English between 2010 – 2018 were included. Pooled effect estimates were calculated using a random effects meta-analysis. Sub-analyses calculated effect estimates grouped by selected features of digital interventions.

Thirteen randomised or observational studies were included in the final review. Digital interventions most commonly used mainstream, existing social media platforms (n= 7) or promotion through online peer educators (n=5). Most interventions (n=8) were categorised as interactive and allowed user engagement, and most directly facilitated testing (n=7) either through providing self-testing kits or referral to testing services. 1930 participants were included across the 13 studies. HIV testing uptake among MSM and TW exposed to digital

interventions was 1.5 times higher than unexposed MSM and TW (RR: 1.5; 95% CI: 1.3 – 1.7). Sub-analyses suggested increased impact on HIV testing uptake among interventions that were delivered through mainstream social media-based platforms (RR: 1.7; 95% CI: 1.3 – 2.1), included direct facilitation of HIV testing (RR: 1.6; 95% CI: 1.4 – 1.9), were interactive (RR: 1.6; 95% CI: 1.4 – 1.8), and involved end-users in design process (RR: 1.6; 95% CI: 1.3 – 2.0).

These findings provide broad support for the integration of technology with existing approaches to promote and facilitate HIV testing among MSM and TW. Our findings identified key features that may be associated with greater impact on HIV testing uptake and can be used to inform future development efforts given the growing interest and application of digital technologies in HIV prevention.

6.2 Introduction

Globally, men who have sex with men (MSM) and transgender women (TW) are disproportionately affected by HIV (15, 16, 123, 161). Evidence of expanding epidemics among MSM have been noted, with new infections among this group comprising up to half of all incident cases in some regions (17, 18, 234, 297, 298) and up to 70% in specific countries (234). This burden of HIV occurs against a background of expanded access to HIV testing and treatment and the emergence and growing coverage of bio-medical HIV prevention strategies (297).

The timely diagnosis of HIV plays an important role in preventing transmission, both by prompting reductions in risk behaviours to prevent onward transmission (157, 159), as well as facilitating early access to treatment and viral suppression. It is now known that people with suppressed HIV cannot transmit the virus to others (126, 130, 211, 260); promoting regular HIV testing is therefore a key global prevention strategy (109). However, a range of barriers faced by MSM and TW limits their access to HIV testing and other preventive services. Stigma and

discrimination remains a key deterrent to HIV service utilisation in many parts of the world, particularly in settings where legislation prohibits same sex relationships and legitimises discriminatory behaviour towards sexual minorities (163, 299, 300). Other structural barriers, such as accessibility of services, costs, waiting time and confidentiality concerns (301-305) also limit access to HIV testing among MSM and TW and prevents levels of testing coverage required to impact HIV incidence (84).

The use of digital communication technology - internet-enabled technology such as mobile phones, computers and tablets that allow access to digital platforms and applications (“apps”) - to promote HIV testing among MSM and TW is an area of growing interest. It has been suggested that internet-enabled technology may be particularly useful as a discrete method of HIV health promotion targeting MSM and TW in locations where same sex behaviours are highly stigmatised or illegal (173). Interest in digital technology as an HIV prevention platform also reflects the prominent role of technology in contemporary gay culture (306), and to a lesser extent in TW communities (307), particularly as a tool to meet sex partners (308-310). A growing body of evidence suggests that delivering HIV prevention interventions through digital communication technologies is acceptable to MSM and TW (196, 311-316), while research findings have shown higher rates of condomless sex (187, 317, 318) and STI diagnoses (307, 308, 319, 320) among MSM and TW who use online platforms to find sex partners; together, these findings enhance the appeal of digital technology to reach those at high risk of HIV.

We performed a systematic review and meta-analysis to describe the impact of digital communication technology interventions on the uptake of HIV testing among MSM and TW and identify intervention characteristics associated with increased impact.

6.3 Methods

We systematically searched for current literature that describes the impact of digital communication technology interventions on the uptake of HIV testing among MSM and TW. We defined digital communication technology as technologies that were internet-enabled (through devices such as computer, mobile phone or tablet) and which provided access to digital platforms such as social media sites, websites, apps, and email. The systematic review was conducted in accordance with the PRISMA guidelines (321) and was registered on Prospero (registration number: CRD42017070055).

Eligible studies were defined as those which:

1. Utilised at least one digital communication platform to deliver an intervention to promote HIV testing;
2. Reported uptake of HIV testing as a result of a digital communication intervention for MSM and TW participants; and
3. Measured impact either by prospectively comparing testing rates pre- and post-intervention exposure within a single cohort or through a randomized study design.

Studies that measured HIV testing outcomes but utilised digital communication technologies primarily for a purpose not directly related to improving HIV testing uptake (e.g., to facilitate data collection or recruitment) and those reporting intention to test outcomes only were excluded.

Uptake of HIV testing was defined as any quantitative count of HIV testing events among MSM and TW measured using either self-report or clinic records.

For randomised controlled studies, we report on HIV testing uptake among participants in intervention and control groups at study endpoint. For non-randomised studies, we report on HIV testing uptake at pre-intervention baseline and post-intervention study endpoints.

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Search strategy

We conducted a systematic search of the literature published in English using Medline, CINAHL, Embase, Pubmed and PsychInfo databases. We limited our search to studies published between January 1, 2010 to May 1, 2018 to account for redundancy of older platforms and technologies. Our search strategy comprised key terms, MeSH terms and subject headings related to participant (e.g., *MSM*), intervention (e.g., *internet*) and outcome (e.g., *HIV testing and counselling*) variables (see appendix for illustration of search strategy and MESH terms).

Electronic repositories of the International AIDS Society and International AIDS Conferences were manually searched for abstracts from January 2010 onwards. Reference sections of identified papers were also searched for additional articles. No restrictions were placed on participant age or other demographic characteristics of the study population, or geographical location or setting of the intervention.

Data extraction

Following the literature search, the first author (VV) removed duplicate records and assessed the remaining abstracts on the basis of the eligibility criteria. The second author (KR) reviewed a random sample (equivalent to 10%) of discarded abstracts to ensure accuracy. Both authors then conducted a full text review of remaining abstracts to determine their inclusion in the final analysis.

The following domains were extracted for final analysis by two authors (VV, KR) using a standardised, Excel-based tool: study identification; study design (data collection period, recruitment and sampling method); intervention characteristics (aim of intervention, mode of intervention delivery and duration); study population (inclusion and exclusion criteria, sample size, primary HIV testing outcome used and time frame for outcome, mean age of sample, proportion reporting previous testing); results and analysis (number of testing outcomes, effect size measurement and reported effect size).

Any discrepancies identified between the two authors during the review and data extraction process were discussed with a third author (MS).

Analysis

A qualitative synthesis was undertaken to characterise included studies by their study participants, location of study, study design, digital communication intervention platform, intervention features, length and frequency of exposure, sample size and rated study quality. For each study we then described the proportion of MSM and TW reporting previous HIV testing at baseline, how testing uptake was defined and measured during the study period, whether testing was provided or offered as part of the intervention and the proportion of MSM and TW reporting or receiving HIV testing at the end of the study period.

The primary outcome of this study was uptake of HIV testing among MSM and TW participants, which we defined as the number of individual MSM and TW reporting or receiving an HIV test divided by the total number of MSM and TW exposed to a digital intervention. Intervention effectiveness was determined by manually calculating risk ratios (RR) comparing testing uptake between groups exposed and unexposed groups for RCTs or between pre- and post-intervention commencement for non-randomized studies. HIV testing uptake among controls or at pre-intervention time point was used as the reference group so that an RR greater than one demonstrates higher chance of HIV testing uptake following exposure to a digital communication intervention.

We performed a meta-analysis of intervention effectiveness to generate pooled RR using a DerSimonian and Laird random-effects model to account for the anticipated heterogeneity between studies. We identified a range of characteristics common to digital communication interventions or regarded as features that potentially enhance intervention effectiveness and performed sub-meta-analyses to generate pooled RR to examine the impact of these characteristics on overall intervention effectiveness:

1. Intervention interactivity (yes/no): interventions that permitted end users to interact or engage, for example by chatting with peer educators or other participants, as opposed to passive viewing of an online video.

2. End user involvement in design process (yes/no or not reported): any reported involvement of the intended end-users in the intervention design process (e.g., consultation, pilot testing).
3. HIV testing facilitated as part of the intervention (yes/no): interventions that directly provided (e.g., provided self-tests) or facilitated (e.g., direct referral) HIV testing to participants, as opposed to simply promoting HIV testing.
4. Social media platform (yes/no): interventions implemented through an established social media platform (e.g. Facebook) that facilitates social networking among the general population or specifically among gay and other men who have sex with men, as opposed to non-social media platforms.
5. Single dose exposure (yes/no): interventions that delivered a single, time-bound exposure as opposed to multiple exposures over time.

The presence and magnitude of heterogeneity was assessed in meta-analyses using the χ^2 and I^2 test, respectively.

Assessing study quality

Study quality was assessed by two authors (VV, KR) using the quality assessment tool for quantitative studies (322). This tool critiqued studies on the basis of: selection bias, study design, confounders, blinding, data collection methods, and withdrawal and dropouts. Each criteria was rated as strong, moderate or weak. Based on the combined scores, studies were given a final, global rating of strong (no weak ratings), moderate (one weak rating), or weak (two or more weak ratings). As the final global rating was determined by number of sub-categories scored as 'weak', the tool was modified to include an 'N/A' option for blinding, and withdrawal and drop out fields to account for non-randomised studies.

6.4 Results

The systematic literature search resulted in 1436 identified records, including eight conference abstracts and six articles identified in references of included studies. Five hundred and forty-one records (37.3%) were removed as duplicates. The remaining 909 records were reviewed at the abstract level, of which 40 (5%) were retained for full-text review. Thirteen papers were included in the final analysis (257, 285, 323-333) (Figure 5).

Study and sample characteristics

Table 7 presents characteristics of included studies. All included studies specifically targeted men who identified as gay or self-reported anal sex with a male partner. Two studies included TW (328, 329). Study participants were typically aged in their mid-twenties. Based on World Bank classifications (334), the majority of studies took place in high-income countries (Hong Kong n=1, Taiwan n=1, USA n=6), four occurred in upper-middle income countries (China n=1, Peru n=3), and one in a low-middle income country (India). Studies collectively included 8875 participants, 64 (0.7%) of whom were reported as TW, with a mean sample size of 682 participants (SD = 808; range 56 – 3092 participants). Two studies excluded participants with a history of HIV testing and two studies did not report on participants' previous testing history. Among the nine remaining studies, the mean proportion of participants reporting a history of HIV testing was 44.1% (SD = 19.0; range 21.3% - 73.8%). One study only reported the proportion of participants with a lifetime HIV testing history, while others reported on participants' recent testing history, with recall period ranging from three months to three years. Ten studies used a randomised control trial design (257, 323-325, 327, 329-333). The specific study design used by the remaining three studies were: prospective cross-sectional study with non-equivalent control group (326); prospective, single-group cross-sectional study (285), and; prospective cross-sectional matched-pair randomized trial design (328). Due to the lack of individual-level randomisation and non-equivalence of control groups, we calculated relative risk for these three studies using reported HIV testing uptake at pre-intervention baseline and post-intervention

intervention endpoints in the intervention arm only. One RCT described two intervention arms and did not present disaggregated findings so this study was treated as a single cohort and relative risk was calculated based on HIV testing uptake at baseline and endpoint (327).

Study aims

Promoting HIV testing uptake was identified as a primary aim of all 13 studies. Five studies had multiple primary aims: mutual disclosure of HIV status with sexual partners (i.e., asking and disclosing HIV sero-status;(325)), STI testing (323), intention to test (257, 327) and reduction of unprotected anal intercourse (325, 326) (data not reported).

Intervention description and digital communication technology platforms

Table 8 presents the characteristics of digital interventions among included studies. Studies utilized a variety of digital communication platforms to deliver interventions. Six used only social media platforms, three used only online videos and one delivered a tailored online HIV/STI testing intervention through a customised website. The remaining three studies used multiple platforms: one used online videos in conjunction with motivational messages sent via email or instant messaging; one used social media and live chat applications, and one used online videos in conjunction with live chat applications.

Five of the seven studies that used social media delivered interventions using Facebook (326, 327, 330, 332, 333). All of these studies used closed or private Facebook groups to promote HIV testing, using a range of accompanying features and modalities including using internet popular opinion leaders to disseminate HIV-related information and engage in conversations about HIV testing, prevention and risk behaviour (326); using trained peer educators to deliver HIV prevention and testing information and promote HIV testing uptake (330, 333) including through the provision of HIV self-tests (332); delivering weekly videos promoting HIV testing alongside moderated group discussion (47); and sending HIV prevention and HIV testing promotion messages (in conjunction with messages sent by WhatsApp and email) (327).

Two social-media based interventions were delivered through sites specifically targeting the gay community (285, 328). Both reported on the Cyber-Based Education and Referral/testing (CyBER/testing) intervention, which utilized trained peers to promote HIV testing through existing social and sexual networking sites popular among the gay community. CyBER/testing was implemented through an existing chat room used by MSM (285) and later through four geographically focused social media sites used by MSM and TW (328), both in the USA.

Only one intervention was delivered through a custom-built website (Get Connected!) which aimed to promote and connect HIV and STI testing to young MSM (323). The website delivered customised content to participants based on socio-demographic, sexual identity and behaviour and previous engagement with HIV testing data provided during a baseline assessment, so that messaging and content was personalised to mirror participant profiles, and experiences with testing, including motivations and perceived barriers.

Four studies used online videos to promote HIV testing (257, 324, 325, 329). One used single-session online videos focusing on HIV prevention to motivate HIV testing among MSM in the USA, in which participants received either dramatic- or documentary-style video, or both (325). A 2010 intervention delivered one five minute video promoting HIV testing customised based on self-reported sexual identity (gay/non gay identified) to MSM in Peru (257). In 2014, this intervention was repeated with the addition of motivational messages sent by email or instant messaging to encourage HIV testing to MSM in Peru (324). Lastly, online videos developed with crowdsourced content depicted two Chinese men falling in love and getting testing together to target MSM and TW naïve testers in China (329). One study used online videos in combination with live-chat applications to deliver a home-based HIV self-testing service to MSM in Hong Kong (331); in this study, all participants were exposed to an online video promoting HIV testing, then participants in the intervention group were offered a home-based self-testing kit and online, real-time HIV pre and post-test counselling and instruction through Line, WhatsApp or Skype.

Regarding length of intervention and frequency of exposure, interventions that used online videos were typically shorter in duration and involved a single exposure to a video (257, 329,

331). Two studies sent multiple videos (325, 330) and one combined videos and motivational messages via text, email or instant messaging but did not report on the length or number of videos and frequency of motivational messages (324). The customised website-based intervention (323) was also a single-exposure but data about length of time spent on the website was not reported.

Most interventions (n=8) were categorised as interactive for their ability to allow user engagement, for example through social media platforms, responses on messaging platforms or through email, or via a website. Interventions that involved online peer educators interacting with participants through social media platforms were typically longer in duration – ranging from 12 weeks (327, 332, 333) to 12 months (328). Frequency of exposure to online peer educators was user-determined, that is, participants were free to choose how often, if at all, they interacted with online peer educators. The exception involved participants receiving twice-weekly messages through Facebook, email or instant messaging, over a 12 week period (327).

Seven studies directly facilitated HIV testing, through the provision of HIV home or self-testing kits (331, 332), referrals to specific, local HIV testing clinics (257, 324, 333), or providing location details of free, local HIV testing sites (327, 330). The remaining six studies provided general promotion of HIV testing only.

Five studies specifically mentioned involvement of intended end users in the implementation design process (257, 285, 323, 330, 331). Theoretical underpinning to intervention development was described by nine studies (257, 285, 323, 325, 327, 328, 330, 331, 333).

Outcomes

Table 9 presents reported outcomes of studies using RCT study design respectively. Most RCT studies measured testing uptake through self-report (323, 325, 329, 330). The length of follow-up over which testing was measured varied greatly from three weeks (329) to six months (331).

Based on calculated RRs, three of nine RCTs demonstrated a significant improvement in HIV testing uptake (330, 331, 333), while four demonstrated non-significant improvements (257, 323,

325, 329). The two remaining RCTs did not demonstrate any impact; in one RCT, testing uptake was extremely low in both intervention and control arms (324), and in another, no members of the control group tested for HIV during follow-up (332).

Table 10 presents outcomes from non-randomised studies. All four non-randomised studies relied on self-reported HIV testing uptake. Length of follow up ranged from 12 weeks (327) to 12 months (328) and all four studies demonstrated significant improvements in testing uptake based on calculated RRs.

Across all 13 studies included in this review, 1930 participants (21.7%) received an HIV test during a cumulative 3.6 years of study follow up. Three studies reported on HIV diagnoses (all RCTs; (257, 329, 331)), with 75 new HIV infections detected across these studies (56% in intervention arm; data not reported).

Meta-analysis

The pooled RR across 12 studies (RR could not be calculated for one study due to no tests being recorded in the control arm (332)) indicated a significant increase in the uptake of HIV testing following exposure to digital interventions (RR: 1.5; 95% CI: 1.3 – 1.7). Statistical heterogeneity was high ($\chi^2 = 31.7$; $I^2 = 65.2\%$) (Figure 6).

Sub-analysis of study characteristics

A positive impact was seen on HIV testing uptake across all intervention type sub-analyses. The highest pooled RR were seen for interventions that were delivered through mainstream social media-based platforms (RR: 1.7; 95% CI: 1.3 – 2.1), interventions that included direct facilitation of HIV testing (RR: 1.6; 95% CI: 1.4 – 1.9), interventions that were interactive (RR: 1.6; 95% CI: 1.4 – 1.8), and interventions that involved end-users in design process (RR: 1.6; 95% CI: 1.3 – 2.0) (Table 11).

Study quality

The majority of studies (n=9) were classified as ‘moderate’ quality (257, 285, 323, 328-331, 333), four were classified as ‘weak’ (324-327) and one was classified as ‘strong’ (332). The most common limitation across studies was insufficient description of blinding procedures (rated as ‘weak’ in nine studies), while controlling of confounding in either study design or analyses was a common strength (rated as ‘strong’ in nine studies) (See table in appendix).

Publication bias and precision of study estimates

The observed asymmetry in the study funnel plot (Figure 7) may be explained by the heterogeneity between studies, given the variability in intervention design. Attributing the asymmetry to heterogeneity is also supported by the high level of variance between studies ($I^2 = 65.2\%$).

6.5 Discussion

In this review, exposure to digital communication interventions was associated with greater HIV testing uptake among MSM and TW compared to those unexposed. Our findings provide broad support for the integration of technology into existing tools and approaches to HIV prevention among MSM and TW. We extend the current state of evidence regarding the impact of digital interventions on HIV testing by examining the role of key intervention features on effectiveness. Our findings identified key features that were associated with greater uptake for HIV testing for MSM and TW - specifically, interventions that facilitate HIV testing through provision or direct referral to HIV testing services, the use of mainstream social media platforms to engage the target population, interactivity, and involvement of end-users in design processes.

Global guidance has recommended the integration of digital technology as a strategy to enhance the reach and effectiveness of HIV prevention efforts among MSM and TW (113, 173). Numerous acceptability studies have identified that MSM would be willing to use phone- and web-based technologies for HIV prevention (312, 313, 335, 336). Recent systematic reviews have explored the potential of digital technology to advance various HIV priorities among MSM and other key populations (185, 190). One systematic review to date has attempted to quantify the role of digital communication technologies on increasing engagement among key populations across the care continuum through meta-analysis (191); this study specifically looked at randomised and observational studies describing the impact of social-media based interventions on HIV testing uptake among key populations. All nine studies included in this meta-analysis targeted MSM and collectively were associated with an approximately 50% increase in HIV testing uptake. Compared to this review, our study adopted a broader definition of digital interventions that encompassed website, online videos, instant messaging and live chat applications and resulted in the inclusion of six additional studies. Overall, we found that exposure to digital interventions was associated with around a 50% increase in HIV testing uptake, in line with the previous study's estimates, supporting the conclusion that digital communication technologies are effective in promoting HIV testing among MSM and TW. In addition, our study also identified specific features of digital interventions associated with greater impact on HIV testing uptake among MSM and TW.

First, interventions that went beyond creating general demand for testing, either through health promotion or providing educational content, and instead directly facilitated HIV testing through service referrals or the provision of self-tests demonstrated greater impact on HIV testing uptake compared to the overall estimate. Direct facilitation of HIV testing may potentially address some of the more structural barriers MSM and TW face to HIV testing (97, 163, 337). In particular, HIV self-testing has emerged as a strategy to mitigate barriers related to HIV service access (180, 338), however some MSM and TW populations have expressed concerns about the limited availability of support during the testing process (181, 182). Wang and colleagues' study included in this review (331) suggest that digital interventions can play a

role in promoting HIV self-testing by mitigating user concerns through the provision of real-time, online counselling. It should also be noted that the majority of studies included in this review recruited participants with generally high levels of previous HIV testing behaviours, which may be critical to the success of this approach. Past research has shown that a history of testing is a strong predictor of future testing behaviours among MSM (339-341), suggesting that the direct facilitation of testing through digital communication interventions may work best for those who are experienced in HIV testing and may enable participants to access more frequent testing.

Second, interactive interventions- those that allowed participants to engage directly with online content or other users - demonstrated greater impact on HIV testing uptake compared to the overall pooled estimate. Interactivity in digital interventions has been associated with achieving a greater impact on behaviour change across a range of health areas (342-344) and has been identified as a desired feature of digital HIV prevention interventions among MSM and TW (316, 345). Third, our sub-analysis also identified that interventions that used mainstream social media platforms, such as Facebook, were also associated with greater uptake of HIV testing. However, all interventions that utilised social media platforms were also categorised as interactive, making it difficult to isolate the source of the enhanced effect. Social networking-based interventions are commonly used for sexual health promotion (346) and the use of existing social media platforms has been identified as a way to enhance retention among young MSM and TW in online HIV prevention activities (316). Using existing and well-utilised social media platforms may also enhance the reach of digital HIV prevention interventions (347) compared to those that are delivered through a new or separate platforms. Interestingly, interventions that used social media sites specifically for gay and other MSM were less effective in increasing HIV testing uptake than interventions delivered through general social media. Others have noted the reluctance of users of gay social networking sites to receive health promotion messages, which are often seen as an intrusion or surveillance and may limit user engagement (348).

Fourth, evidence of enhanced impact was found among digital interventions that reported involvement of end-users in the design process. This involvement is a key component of user-centred design, an approach that prioritizes user needs and experiences to maximise functionality, increase engagement and relevance to target population (349-351). User involvement is particularly important when developing digital interventions tailored to specific target populations to ensure that such interventions appropriately reflect group priorities, preferences and culture (350). While the literature confirms the value of user-centred design, our review only assessed studies on whether any involvement of end-users in the design process was reported; however, it is probable that the quality and depth of this involvement may be a stronger determinant of overall effectiveness. Additionally, grounding in theoretical frameworks may also be another indicator of effectiveness as suggested by the greater uptake of HIV testing reported by theoretically-based interventions included in this review. While the majority of studies in this review reported a theoretical basis to their intervention, the limited number of theory-based, HIV-focused digital interventions have been noted by others (352, 353); this may be attributed to the speed of development and proliferation of digital approaches to improving HIV outcomes. The findings presented here suggest that theoretical grounding is an important component of effective interventions and should be prioritised in future development.

The findings of this review should be considered with the following limitations in mind. Firstly, due to the restrictions we placed on study design, the interventions included in this review reflect only those conducted as research projects and may not reflect the real-world application of digital technology, including interventions that were not formally evaluated or represented in the published literature. Second, despite our finding that digital interventions included in this review had a positive overall effect on HIV testing uptake among MSM and TW, the findings do not necessarily reflect the actual quality of the content delivered or levels of end-user acceptability, which are likely to interact in important ways with intervention impact. Third, TW participants were underrepresented in included studies. TW may use social and sexual networking apps less frequently than MSM, which may reflect the limited number of

social and sexual networking sites specifically catering to TW relative to MSM (194). However, factors such as TW's reported reliance on online sources of sexual health information (354), perceived acceptability of digital approaches to HIV prevention (316) and examples of real-world applications of digital communication technologies to HIV prevention among TW (194) suggest that TW also stand to benefit from digital approaches to HIV prevention and their inclusion in future trials should be prioritised. Lastly, the majority of studies were conducted in high or middle income settings. Although the use of digital technology to advance HIV prevention priorities in low-resource settings has been both recommended and applied (185, 197), further research is warranted to assess the impact of digital interventions of HIV testing among MSM and TW in these settings.

HIV testing is a key focus of global HIV prevention efforts among MSM and TW, yet multiple barriers continue to prevent levels and frequency of testing required to facilitate the early detection of undiagnosed HIV and initiation of treatment. Digital communication technologies are now an accepted medium for HIV prevention efforts; this review provides further evidence of the role of such technologies to increase HIV testing uptake among MSM and TW. The inclusion of intervention features such as direct facilitation of HIV testing, involvement end-users in the design process, interactivity and delivered through existing mainstream social media platforms may enhance overall impact and maximise the contribution of digital communication technologies to advancing HIV prevention priorities among MSM and TW.

6.6 Acknowledgements

This study forms part of the PhD of VV, who is funded through an NHRMC post graduate scholarship. VV, MS, ML and MP were responsible for study design, VV and KR conducted the literature review and data extraction, VV analysed data and developed the manuscript, KR, ML, AP, CH and MS provided input into manuscript development. All authors have read and approved the final manuscript prior to submission.

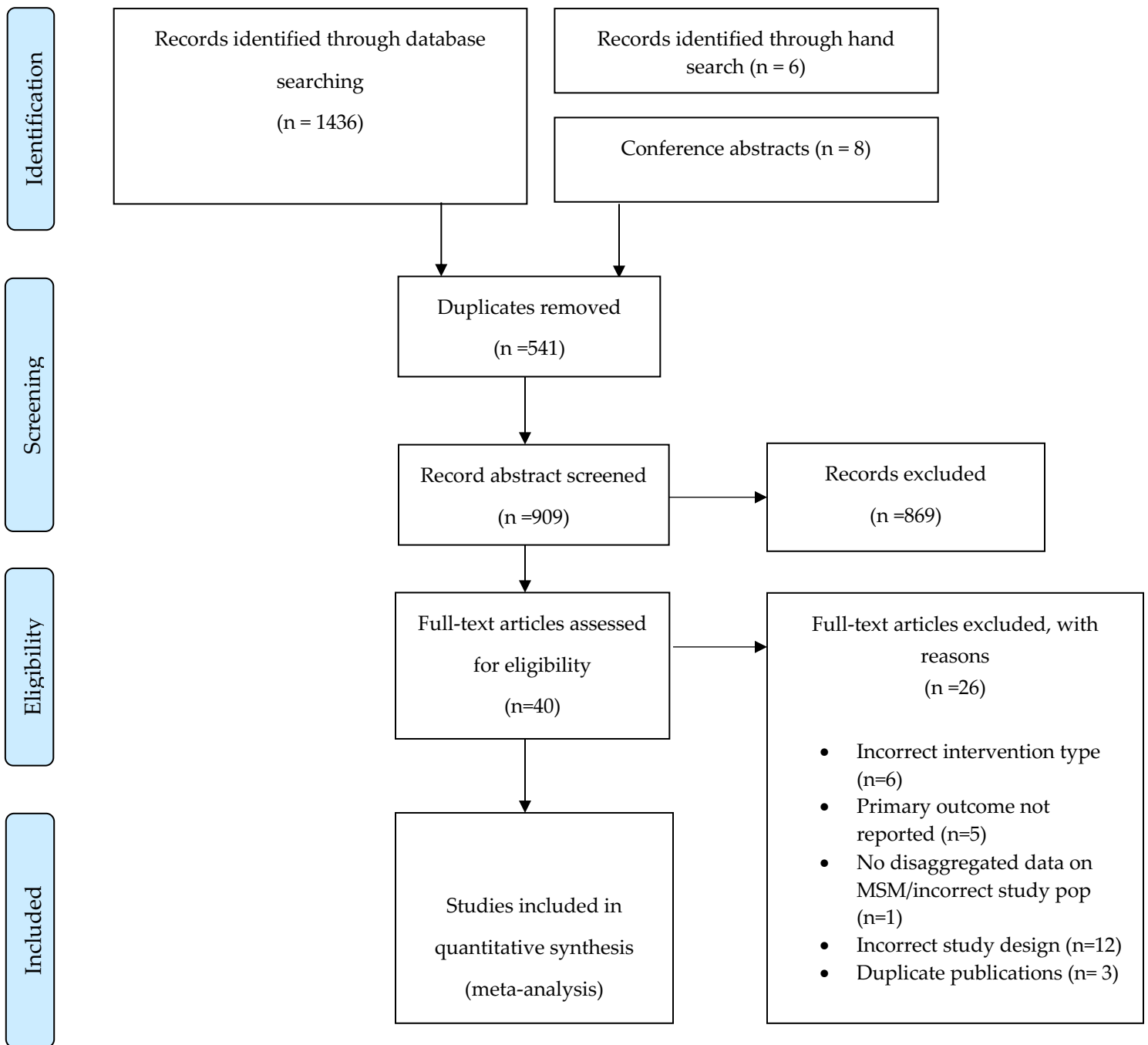


Figure 5: PRISMA flow diagram of systematic review of literature

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Table 7: Overview of studies selected for inclusion in systematic review

Study reference	Study participants	Location (country income classification ^a)	Total sample size	Number (%) of TW participants	Percentage of participants reporting previous HIV testing pre-intervention (time frame for testing history)	Study design
Bauermeister 2015 (323)	Young MSM aged 15 - 24, self-identified cis male, reported sex with male partner past six months	Michigan, USA (High)	130	0	73.8 (lifetime)	RCT
Blas 2010 (257)	MSM aged 18 and over reporting lifetime sex with another man, and not reporting testing within past 12 months	Lima, Peru (upper-middle)	459	0	21.3 (more than 1 year ago)	RCT
Blas 2014 (324)	NR	Peru (upper-middle)	400	0	NR	RCT
Hirschfield 2012 (325)	Male aged 18 or above, reporting oral or anal sex with current male partner and oral, anal or vaginal sex with at least one new partner (male or female) in past six months	USA (high)	3092	0	69 (past three years)	RCT
Ko 2013 (326)	MSM aged 18 and above, reported sex with another man past 12 months	Taiwan (high)	1037	0	29.4 (past six months)	Prospective cross-sectional study with non-equivalent control
Patel 2016 (327)	MSM aged 18 or older living in Mumbai	Mumbai, India (low-middle)	244	0	61.5 (past six months)	RCT

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Rhodes 2011 (285)	Male, registered user of chat room servicing MSM in North Carolina, USA, mean age 37 years, gay-identifying	North Carolina, USA (high)	346	0	44.5 (past three years)	Prospective cross-sectional study
Rhodes 2016 (328)	Male, social media user, mean age 40 years, gay-identifying	USA (high)	1292	28 (2)	36.6 (past 12 months)	Prospective cross-sectional matched-pair randomized trial design
Tang 2016 (329)	Male aged 16 or above reporting lifetime anal sex with another man and no HIV testing history	China (upper-middle)	721	36 (5)	N/A	RCT
Washington 2017 (330)	Black/African American male aged 18 – 30 reporting sex with another man during past three months and not tested within past six months	Los Angeles, USA (high)	56	0	46.5 (past 12 months)	RCT
Wang 2018 (331)	Hong Kong Chinese speaking males aged 18 or over reporting anal sex with 1 or more male partner in past six months with access to online live chat applications (Line, WhatsApp and Skype)	Hong Kong, China (high)	430	0	NA	RCT
Young 2013 (332)	African American or Latino male aged 18 or above, registered Facebook users, reporting sex with another man in past 12 months	Los Angeles, USA (high)	112	0	NR	RCT

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Young 2015 (333)	MSM aged 18 and over reporting sex with another man during past 12 months	Lima, Peru (upper-middle)	556	0	33.4 (past three months)	RCT
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TW: transgender

^a: Classification based on World Bank country and lending groups (334)

Table 8: Characteristics of digital interventions used in studies included in the systematic review

Study reference	Platform	Description	Interactive?	Intervention length (frequency of exposure)	HIV testing provided or facilitated?	Involvement of end-users in intervention design	Theoretical framework
Bauermeister 2015 (323)	Website	Interactive, customised website (Get Connected!) that delivered HIV/STI testing and prevention content tailored to specific participant profiles of based on psychosocial data and previous engagement with HIV testing	Yes	One time	No	Yes	Self-determination theory principles and Integrated Behavioural Model
Blas 2010 (257)	Online video	One 5 minute video promoting HIV testing customized based on self-identification of participant as either gay or non-gay	No	One time (five minutes)	Yes – facilitated (referral)	Yes	Health belief model
Blas 2014 (324)	Multiple: online videos, email/ instant messaging	Motivational videos and messages about HIV testing sent through email and instant messaging respectively	No	NR	Yes– facilitated (referral)	No/ not reported	None reported
Hirschfield 2012 (325)	Online video	HIV prevention videos in either dramatic or documentary style and designed to promote	No	One time (9 and 5 minutes)	No	No/not reported	Social learning theory

		critical thinking about HIV disclosure, testing and condom use					
Ko 2013 (326)	Social media (Facebook)	Trained internet popular opinion leaders (iPOL) leaders promoting HIV testing and prevention to members of a closed Facebook group	Yes	6 months (user-dependent)	No	No/not reported	None reported
Patel 2016 (327)	Multiple: social media (Facebook) Online live chat applications (Whatsapp) ; Email	16 health promotion messages promoting HIV testing framed in either approach- or avoidance-style of messaging sent by trained peers via their preferred modality (private Facebook group, individual Whatsapp messaging, or email)	No	12 weeks (twice weekly)	Yes– facilitated (test locator)	No/ not reported	Information motivation behavioural skills model
Rhodes 2011 (285)	Social media (MSM-specific sites)	Trained peer posting regular triggers about HIV and HIV testing in existing chat room used by gay and other MSM and engaging in direct communication about testing services, processes and locations with chat room users	Yes	6 months (daily)	No	Yes	Natural helping

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Rhodes 2016 (328)	Social media (MSM-specific sites)	Trained peer posting regular triggers in four existing social media sites used by gay and other MSM about HIV and HIV testing, and engaging in direct communication with users about testing services, processes and locations	Yes	12 months (daily)	No	No/ not reported	Empowerment education, social cognitive theory and natural helping
Tang 2016 (329)	Online video	Online video promoting HIV testing based on a crowdsourced design	No	4 weeks (one time)	No	Yes	None reported
Washington 2017 (330)	Social media (Facebook)	Five, one minute long videos promoting HIV testing sent through a private Facebook group to Black/African American MSM, with moderated group discussion	Yes	6 weeks (weekly)	Yes - facilitated (test locator)	Yes	Integrative model of behaviour change
Wang 2018 (331)	Multiple: Online video; online live chat applications (Line, WhatsApp and Skype)	Home-based self-testing service comprising online promotional video about HIV testing, plus additional video on home based HIV self-testing and offer of free HIV self-testing kit and online real-time instructions and pre- and post- test counselling	Yes	6 months (one time)	Yes— provided (HIV self-testing)	Yes	Health belief model

		provided via live chat applications					
Young 2013 (332)	Social media (Facebook)	Trained peer educators providing HIV prevention and testing messages, including 4 weekly reminders about availability of HIV home testing, to participants of a closed Facebook group	Yes	12 weeks (user - dependent)	Yes– provided (HIV self-testing)	No/ not reported	None reported
Young 2015 (333)	Social media (Facebook)	Trained peer educators providing HIV prevention and testing messages, including 4 weekly reminders about availability of HIV home testing, to participants of a closed Facebook group	Yes	12 weeks (user- dependent)	Yes– facilitated (referral)	No/ not reported	Diffusions of innovation theory and social normative theory

Table 9: Reported HIV testing outcomes in included randomised control trial studies

Study reference	Measurement of HIV testing uptake used	Length of follow up period for outcome	Comparator	Control group		Intervention group		RR (95% CI)
				Total number of participants	Participants tested (%)	Total number of participants	Participants tested (%)	
Bauermeister 2015 (323)	self-reported	30 days	Control group: Test-locator website	36	4 (11.1)	68	18 (26.5)	2.4 (0.9 – 6.5)
Blas 2010 (257)	attendance based	125 days ^a	Control group: Standard public health text	220	10 (4.5)	239	19 (7.9)	1.7 (0.8 – 3.7)
Blas 2014 (324)	attendance based	184 days ^a	Control group: Health promotion message with invitation for free HIV testing	200	3 (1.5)	200	2 (16)	0.7 (0.1 – 3.9)
Hirschfield 2012 (325)	self-reported	60 days	Control group: no content	240	48 (20)	676	142 (21)	1.1 (0.8 – 1.4)
Tang 2016 (329)	self-reported	3 weeks	Control group: Non-crowd sourced Online video (standard public health text)	317	111 (35)	307	114 (37)	1.1 (0.9 – 1.3)
Wang 2018 (331)	self-reported or observed uptake of self-testing	6 months	Control group: Online video about (general)	215	109 (50.7)	215	193 (89.8)	1.8 (1.5 – 2.0)

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HIV testing only								
Washington 2017 (330)	self-reported	6 weeks	Control group: Closed Facebook group receiving generic health information	22	8 (36.4)	20	16 (80)	2.2 (1.2 – 4.0)
Young 2013 (332)	Requested and returned home based HIV testing kit and followed up results	12 weeks	Control group: Closed Facebook group receiving per-delivered generic health information	55	0 (0)	57	8 (14.0)	NA
Young 2015 (333)	attendance based	12 weeks	Control group: Closed Facebook group providing HIV testing information without peer leaders	246	16/(6.5)	252	43 (17.1)	2.6 (1.5 – 4.5)

Table 10: Reported HIV testing outcomes in included quasi-experimental studies

Study reference	Measurement of HIV testing uptake used	Length of follow up period for outcome	Baseline		End line		RR (95% CI)
			Total number of participants	Participants tested (%)	Total number of participants	Participants tested (%)	
Ko 2013 (326)	self-reported	6 months	501	150 (29.9)	499	219 (43.9)	1.5 (1.2 – 1.7)
Patel 2016 (327)	self-reported	12 weeks	130	42 (32.3)	130	57 (43.8)	1.4 (1.0 – 1.9)
Rhodes 2011 (285)	self-reported	6 months	346	154 (44.5)	315	187 (59.4)	1.3 (1.4 – 1.5)
Rhodes 2016 (328)	self-reported	12 months	353	122 (34.6)	399	216 (63.7)	1.6 (1.3 – 1.9)

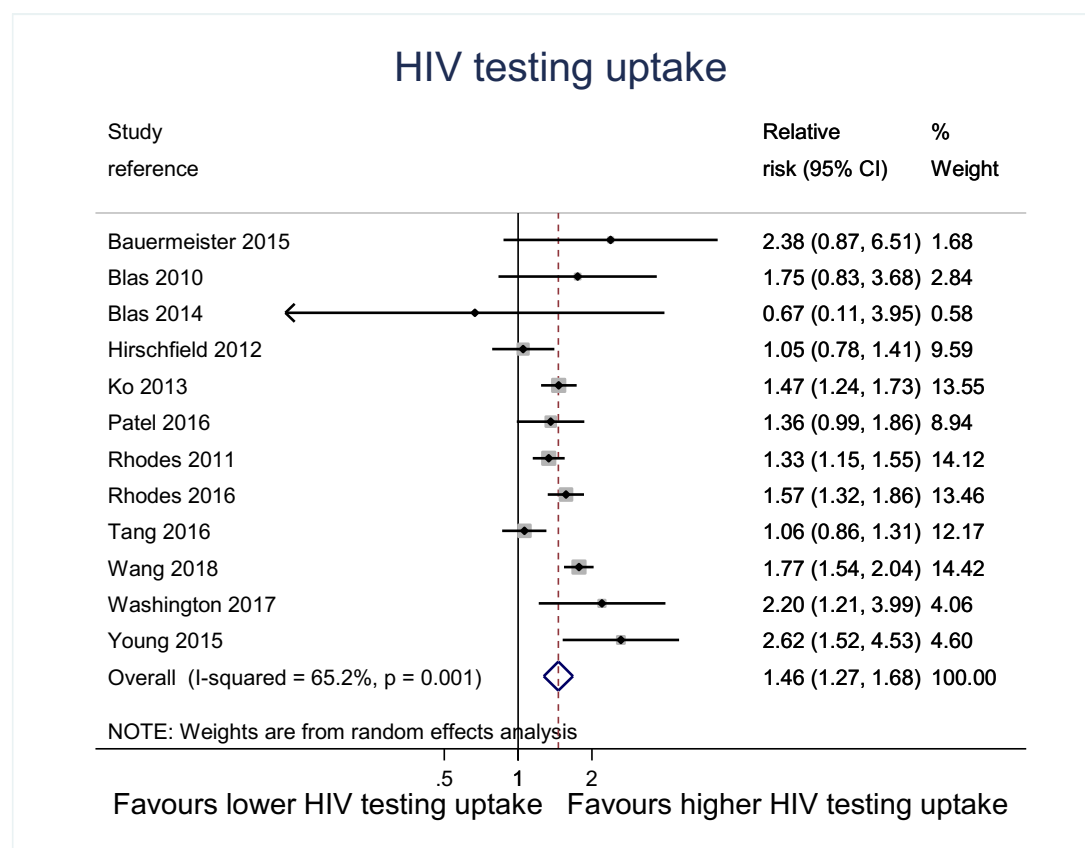


Figure 6: HIV testing uptake among MSM and TW following exposure to digital interventions

Table 11: Sub- meta analyses of digital interventions impact on HIV testing uptake among MSM and TW by selected study and intervention characteristics

Study reference	k ^a	RR	95% CI	χ^2	I ²
Overall effect size	12	1.5	1.3 – 1.7	31.7	65.2
<i>RCTs only</i>	8	1.6	1.2 – 2.1	29.1	76.0
<i>Quasi experimental</i>	4	1.4	1.3 – 1.6	2.1	0
Direct facilitation of HIV testing					
Yes	8	1.6	1.4 – 1.9	13.8	65.2
No	4	1.3	1.0 – 1.6	9.4	58.1
Interactive intervention					
Yes	7	1.6	1.4 – 1.8	15.0	46.7
No	5	1.1	1.0 – 1.3	1.7	65.2
User involvement in design					
Yes	5	1.6	1.3 – 2.0	9.4	57.6
No/not reported	6	1.4	1.1 – 1.6	18.0	66.7
Theoretical basis to intervention					
Yes	9	1.6	1.3 – 1.8	20.5	61.0
No/not reported	3	1.2	0.9 – 1.7	6.2	67.5
Social media-based intervention					
Yes – mainstream	4	1.7	1.3 – 2.1	6.0	49.8
Yes – gay oriented	2	1.4	1.2 – 1.7	2.0	48.7
No	6	1.4	1.0 – 1.9	23.1	78.4
Single dose intervention					
Yes	5	1.4	1.0 – 1.9	22.4	82.1
No	6	1.5	1.3 – 1.7	8.5	41.2

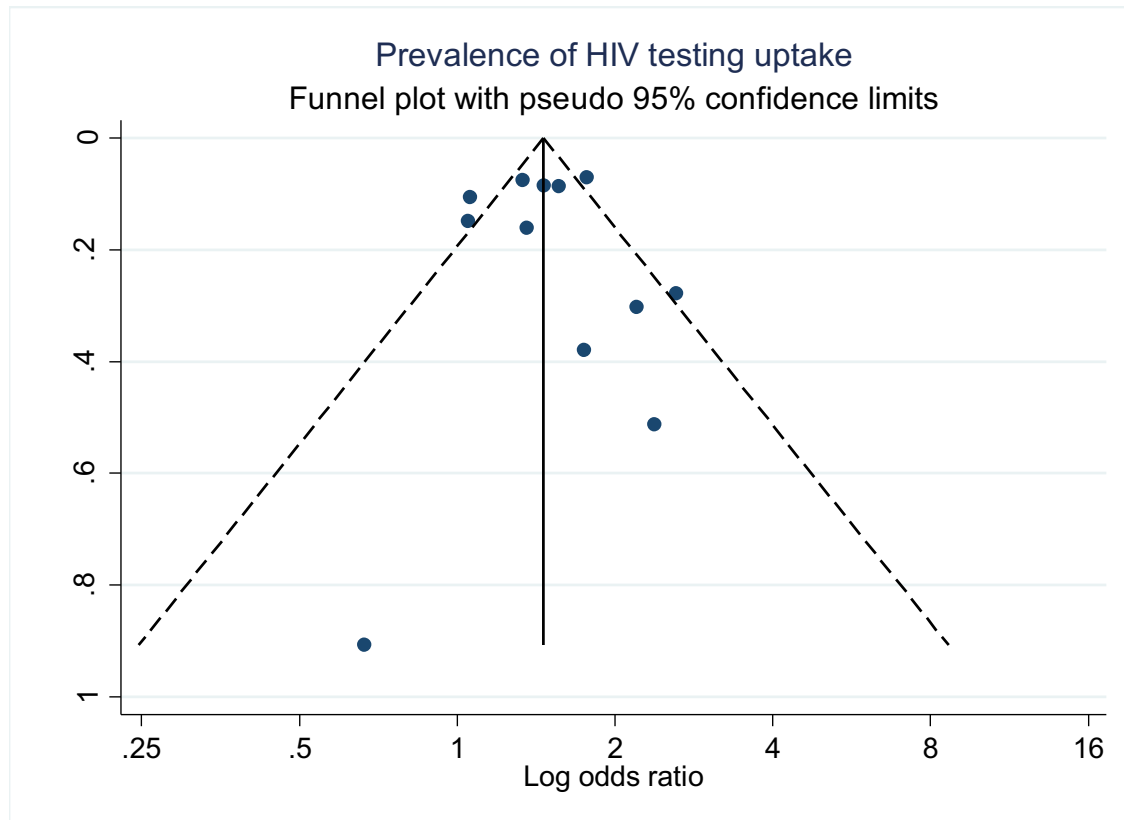


Figure 7: Estimate of publication bias and precision of estimate

Table 12: Assessed quality of included studies

Study reference	Components rating						Global rating
	Selection Bias	Study Design	Confounders	Blinding	Data collection method	Withdrawals and drop outs	
Blas 2010 (257)	Strong	Moderate	Strong	Weak	Moderate	Moderate	Moderate
Blas 2014 (324)	Moderate	Strong	Strong	Weak	Moderate	Strong	Moderate
Bauermeister 2015 (323)	Moderate	Strong	Strong	Weak	Moderate	Strong	Moderate
Hirschfield, 2012 (325)	Strong	Strong	Strong	Moderate	Weak	Weak	Weak
Ko 2013 (326)	Strong	Strong	Moderate	Moderate	Moderate	Strong	Strong
Patel 2016 (327)	Strong	Moderate	Strong	Weak	Moderate	Moderate	Moderate
Rhodes 2016 (328)	Moderate	Moderate	Weak	Weak	Weak	Weak	Weak
Rhodes 2011 (285)	Weak	Moderate	Weak	Weak	Moderate	Strong	Weak
Tang 2016 (329)	Moderate	Moderate	Weak	Weak	Moderate	Weak	Weak
Wang 2018(331)	Moderate	Moderate	Strong	Weak	Moderate	NA	Moderate
Washington 2017 (330)	Strong	Moderate	Strong	N/A	Weak	NA	Moderate
Young 2015 (333)	Strong	Moderate	Strong	Strong	Weak	Strong	Moderate
Young 2013 (332)	Moderate	Strong	Strong	Weak	Moderate	Strong	Moderate

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7. Integrated discussion

This thesis aimed to improve understanding of HIV testing behaviours among MSM and TW in Myanmar and explored barriers and facilitators to improved engagement in HIV testing and prevention services. Novel and feasible approaches to enhancing HIV testing uptake were also explored. Research in this thesis addresses gaps in knowledge related to estimates of current HIV transmission rates and factors associated with persistent HIV burden among MSM and TW. Findings provide insights to shape future programmatic responses to mitigate risk and limit HIV transmission among MSM and TW in Myanmar.

The following section provides a synthesis of the key outcomes of this thesis presented as thematic findings. The implications of these findings are then discussed, situated within the context of Myanmar's current HIV response.

7.1 Key Findings

The data presented in this thesis points to ongoing engagement in sexual risk taking among MSM and TW in Myanmar and suboptimal HIV testing frequency. In this context, the factors associated with HIV testing among MSM and TW and the indications for ongoing barriers to frequent engagement in HIV testing identified in this thesis confirms the prioritisation of MSM and TW in Myanmar's national HIV response. High levels of sexual risk behaviours, including inconsistent condom use with casual and regular partners, multiple recent casual sex partners, concurrent sexual relationships and the buying and selling of sex were reported by MSM and TW study participants. These reported behaviours continue to occur despite a recent scale-up of HIV prevention services, and in the context of infrequent testing and high estimated HIV

prevalence, likely underpin the high rates of HIV transmission documented in this thesis. Improving the enabling environment and coverage of services through increased and sustained investment in primary prevention, alongside enhanced efforts to engage and retain MSM and TW in HIV testing and cascades of care, will be crucial for minimising the burden of HIV experienced by MSM and TW in Myanmar and progressing national elimination targets.

A key outcome of this thesis was to characterise current patterns of engagement with HIV testing services among MSM and TW. In Chapter 2, I explored the high frequency testing behaviours of MSM and TW. Observing very high rates of self-reported recent testing, we developed a composite variable in an attempt to strengthen the reliability of self-reported HIV testing behaviours and reduce recall and reporting bias. This composite variable combined reporting HIV testing within the past six months and a typical six-monthly testing routine to categorise high frequency testers, and suggested that MSM and TW maintained high levels of regular engagement with HIV testing services. In Chapter 3, I described directly observed HIV testing frequency using data from an eDMS that utilised a unique client identifier to prospectively link clients' HIV testing events and behavioural information provided during HIV test counselling. Despite participants from these two studies being recruited through the same HIV prevention programs in Yangon and Mandalay, few clients engaged in repeat testing during the 15-month observation period.

This thesis also sought to better understand the HIV epidemiology among a group of MSM and TW presenting for testing in Yangon and Mandalay. The resulting data, described in Chapter 3, provides an update to previous estimates of HIV prevalence and identifies correlates of HIV infection and, for the first time, estimates HIV incidence within a key population in Myanmar. This is also the first study to describe directly observed HIV testing frequencies among key populations in Myanmar. The discrepancy between the observed versus self-reported HIV testing frequencies suggests that self-reports of testing behaviours may have over-estimated true testing habits. Given that participants were recruited through an existing community-based HIV prevention program, the high proportion of MSM and TW self-reporting regular HIV testing may be a product of social desirability bias. Lower rates of self-reported testing

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behaviours in the past six months (around 50%) have been noted among MSM and TW in Myanmar recruited through RDS– a methodology thought to be more representative of the population in question (7, 69, 229) - compared to the 80% of participants in our study who reported testing during the same time frame. This discrepancy and the potential role of bias in self-reported testing behaviours underscores the importance of establishing robust and sustainable surveillance systems that can provide objective and more reliable measures of engagement with testing services to inform programmatic decisions and priority setting.

In Chapter 3, I note the limited observation of repeat testing and identified associations between returning a positive test and reporting no prior testing history. This finding implies that extended periods of undiagnosed infection and ongoing sexual risk behaviours are key drivers of HIV transmission in Myanmar and contribute to the high estimates of HIV incidence described. As has been discussed, MSM and TW in Myanmar continue to face significant barriers that limit their engagement with HIV prevention services and regular testing. This includes experiences of stigma and discrimination, perceived unfriendliness of government or mainstream health staff, and social and cultural positions that reflect gendered expectation and the importance of heteronormative behaviour. Chapter 4 illustrated some of the ways these factors influence interaction with HIV testing and other prevention services, particularly for MSM and TW who conceal their sexual orientation or gender identity.

In the context of a concentrated epidemic where sexual minorities experience substantial stigma and discrimination, peers can play a central role in normalising stigmatised sexual identities and discussions around sexual behaviours. The growing number of international NGOs whose program delivery approaches reflect global and regional guidance encouraging the use of peers to better reach and engage key populations has cemented the role of peers in HIV prevention in Myanmar (113, 355). So too, has the current National Strategic Plan which outlines key service delivery roles for peers including community outreach, contact tracing and accompanied referrals to enhance linkage and retention in care (30). The findings presented in Chapter 5 identified a high level of acceptability for HIV testing delivered by MSM and TW peers - ,

particularly among clients with indicators of sexual risk, and reinforce the acceptability of peer-based models among MSM and TW in Myanmar.

The increasing number of international NGOs is a reflection of the broader change occurring in Myanmar that has seen a greater openness to international business, investments and organisations, and rapid economic and social development. This change has also seen a significant increase in the availability of affordable, internet-enabled phones with current estimated ownership exceeding 90% (254, 356). The growing use of online platforms by MSM and TW in Myanmar to find sex partners has been noted (357, 358) and offers potential to leverage this technology to expand efforts to reach and engage MSM and TW in HIV prevention and testing (30, 197). Peers can also play a central role in online outreach and health promotion efforts; in Chapter 6, using online peer educators was highlighted as a feature of effective digital interventions and was associated with greater levels of HIV testing uptake compared to other interventions, providing support for the involvement of peers in both online and offline health promotion strategies.

7.2 Implications

The key findings described above have important implications for the current HIV prevention landscape in Myanmar. As discussed in Chapter 1, the national response is focused on eliminating HIV as a public health threat by 2030 by adopting global 90-90-90 targets. Specific strategies include reaching 90% of MSM and TW with combination HIV prevention services, in part to help detect undiagnosed HIV and facilitate linkages to treatment and care cascades. The national strategy also notes plans to strengthen community health systems by expanding service delivery models and conducting community strengthening activities to reduce stigma and discrimination towards key populations (30). However, broader challenges such as resource limitations and systems weakness may constrain plans for program scale up. While there was a three-fold increase in government contributions to the national response between

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2012 – 2015, including \$9 million allocated specifically to HIV treatment and methadone programs for PLHIV and key populations, the national response is still largely dependent on international donors for the majority of funding (30, 207). To increase the sustainability of the national response, the current National Strategic Plan outlines plans to transition leadership and management of ART services back to the public sector, as well taking a more prominent HIV service provision role in medium and low-burden areas (30).

The following section discusses the implications of the findings presented in this research, situated within the current context of Myanmar's national response to HIV and its evolution towards greater public sector control.

7.2.1 HIV testing priorities for MSM and TW

The observation of limited repeat testing behaviours identified in this thesis suggests this must be a central focus of future HIV prevention efforts among MSM and TW in Myanmar. The discrepancy between observed and self-reported testing frequency may also reflect broader impediments to enacting testing intentions suggesting the need for structural interventions to improve the enabling environment (discussed below). This discrepancy may also reflect limitations in current service delivery and the need for innovative approaches that can better facilitate the regular engagement of MSM and TW in HIV testing services.

The changing landscape of HIV prevention in Myanmar is currently conducive to new models of HIV service delivery. At the beginning of the response, HIV testing availability was largely limited to government-run sentinel sites. The first NGO-provided HIV testing services began in 2006 (206), marking the beginning of a decentralised approach to HIV testing and service provision and enabling greater expansion of HIV testing into community-based settings. Peers have played an integral part in these community-based models; peer-led interventions have been associated with increased HIV testing among MSM (359) and the findings in this thesis suggest that peer-based services are an important component of the national HIV response.

However, the current role of peers in Myanmar is restricted to increasing demand for HIV testing through health promotion and community outreach and providing pre- and post-test counselling. Consideration should be given to the expanded role of peers in the actual delivery of HIV testing as a way to improve testing engagement and uptake in Myanmar; this would align with global recommendations for provision of lay-testing and a national policy supportive of peer-involved service delivery models (30, 276). Peer-delivered testing may reduce barriers to frequent testing among MSM (360) and evidence from the region supports the capacity of MSM and TW peers to provide confidential, professional and high-quality HIV testing services (13, 361). Peers could be capacitated to conduct HIV testing at existing fixed-site services – which we have identified as a highly acceptable service delivery model – or as an outreach-based activity given the growing availability of RPOC testing discussed in Chapter 1. Given differences in sexual risk behaviour, self-identification, preferences for, and barriers to HIV prevention service engagement identified among *apone*, *apwint* and *thange* in this thesis, it will be important that any peers selected to deliver HIV testing are representative of the diversity in sexual identity seen among MSM and TW in Myanmar.

HIV self-testing is another novel service model that should be considered as a way to increase entry points to HIV testing. Key populations in general have expressed attitudes broadly accepting of HIV self-testing (180), and features such as perceived privacy and confidentiality have been identified as benefits of HIV self-testing by MSM populations (180, 362). A recent study explored the potential role of HIV self-testing in Myanmar and identified a high level of acceptability for HIV self-testing, particularly for MSM and TW who face barriers to service access (181). However, MSM and TW's concerns about the availability of psychosocial support during the self-testing process will need to be overcome in future HIV self-testing service models. Mobile and digital technologies may offer support in this area; a recent trial has explored the role of online HIV pre-and post-test counselling to support MSM in Hong Kong to self-test and found a significantly higher rate of HIV testing in the intervention group compared to controls, as well as reductions in reported sexual risk behaviours (331). Further work is ongoing to investigate the role of HIV self-testing in enhancing the uptake of HIV testing and linkages to

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treatment and care in Myanmar (242). In general, HIV self-testing has been associated with higher testing frequency among MSM when compared to standard care (363, 364) and evidence from the region suggests HIV self-testing may be a useful strategy for increasing testing uptake among naïve testers and detection of undiagnosed HIV compared to conventional testing models (13).

The current National Strategic Plan and UN policy briefs both recommend the innovative use of social media and other online platforms as a way to increase demand for HIV prevention activities among MSM and TW in Myanmar (30, 197). As mentioned above, this thesis found evidence of the impact of digital intervention to increase HIV testing uptake, as well as evidence of MSM and TW in Myanmar reportedly using online platforms to find casual sex partners. Others have also noted the growing use of online platforms by men in Myanmar to find sex partners (357, 358); this has largely been facilitated by significantly expanded internet connectivity and availability of affordable, internet-enabled smart phones (254). Additionally, the current National Strategic Plan suggests that MSM and TW who are non-disclosing of their sexual or gender identity might benefit from online approaches to HIV prevention and demand creation (30). The studies included in the systematic review presented in Chapter 6 recruited a substantial proportion of MSM who concealed their sexual orientation or identified as something other than homosexual; the overall impact on HIV testing identified in the review and the relative anonymity and privacy associated with online methods of health promotion supports the suggestion that digital technology may particularly benefit those for whom concealment of sexual identity or same-sex behaviours is a priority and a barrier to HIV testing in Myanmar.

There are some existing examples of digital technology already being applied in Myanmar. While few have been rigorously evaluated, available evidence suggest that online outreach may substantially improve recruitment of MSM and TW for HIV testing (198). However, the limited application of digital technology in Myanmar as well as the limited number of high quality studies in LMICs supports the need for implementation and trial research in Myanmar as a precursor to attempts to scale up this type of approach. Concerns for data security and privacy

have been consistently highlighted as required features of digital HIV prevention applications among MSM and TW (381 – 383). It is crucial that any digital intervention introduced into the Myanmar context is cognisant of the concerns and experiences of stigma and discrimination among MSM and TW and appropriately incorporated into the design if such applications are to be widely utilised by MSM and TW in Myanmar

7.2.2 Reinigorating efforts for primary prevention and strengthening the enabling environment

In the context of limited engagement in frequent testing, ongoing sexual risk behaviours and high HIV transmission described in this thesis, condom reinforcement and distribution strategies must be regarded as a key primary prevention priority for MSM and TW. The condom use behaviours reported in this thesis are commensurate with rates of inconsistent condom use described in the latest IBBS, where estimates of condom use at last sex ranged from 66 – 91% among MSM and TW participants across five sites (7). Differences in sexual risk behaviours reported in the IBBS appeared to be clustered by location; for example, compared to MSM and TW in other sites, those in Yangon reported lower rates of condom use at last sex and consistent condom use with regular and casual partners over the past month. Levels of service coverage were also more limited in Yangon, where 57% of MSM and TW reported receiving condoms from outreach workers in the past 12 months, compared to 93% in the town of Pyay. These findings are of particular concern given the high estimated prevalence of HIV in Yangon (7), and suggest that inconsistent condom use is influenced by incomplete coverage of condom distribution programs. It is important to note that the IBBS did not provide any information on potential overlapping or multiple risk factors among MSM and TW and that information on intersecting risk behaviours among key populations in Myanmar is generally lacking. Data on how MSM and TW may overlap with and relate to other key populations is needed to inform comprehensive HIV prevention responses that cater specifically to those with multiple HIV risk factors. Scaling up coverage of HIV service provision can reduce access-related barriers to HIV prevention. While evidence from the region and broader literature suggest that condom

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distribution must be accompanied by efforts to increase self-efficacy and create positive attitudes and peer norms around condom use (365, 366), such behaviour change efforts must be situated within broader attempts to improve the overarching enabling environment. This is evident from successful approaches in Asia: the 100% condom use policy for example, described in Chapter 1, successfully minimised HIV transmission in several Asian countries by achieving 100% condom use in commercial sex venues. This was achieved through a multi-faceted approach that included commodity provision and peer education, along with a strong referral and HIV and STI service network, policy change, and cooperation with various authoritative bodies including local government, health sector services and law enforcement (12). More recently, the Avahan India AIDS Initiative funded by the Bill and Melinda Gates Foundation was a large-scale HIV prevention intervention targeting key populations in six Indian states. Evaluation studies found that MSM and TW in intervention states were significantly more likely to report consistent condom use at last sex and with casual and regular partners compared to baseline (367-369). The Avahan initiative promoted condoms through social marketing and normalised use through advertisements, mass media campaigns and peer outreach and community mobilisation events, while also addressing distal determinants of HIV risk through interventions to reduce stigma and discrimination, violence and barriers to service access.

In addition to increasing access to HIV prevention services through increased coverage, structural interventions in Myanmar are needed to reduce stigma and discrimination in community and health care settings. The Avahan initiative described above included strong community education components designed to improve attitudes towards sexual minorities and diminish the impact of stigma and discrimination on health seeking behaviours (370). Findings in this thesis suggest that fear of stigma and discrimination from family and community members may lead some MSM and TW to conceal or deny their sexual orientation; this may limit access to HIV prevention services that (conspicuously) cater to MSM and TW but are regarded as a threat to confidentiality. Fear of stigma and discrimination in health care settings is another identified barrier to access and limits disclosure of same-sex behaviours and

risk practices. To overcome health service barriers, sensitivity training of mainstream health staff may be needed, particularly in light of the planned transfer of HIV services to government control outlined in the current National Strategic Plan. Evidence from the region suggests that health care providers may be interested in improving their ability to provide competent HIV and STI care to MSM even when holding unfavourable positions regarding same-sex behaviour (371). Lastly, while enactment of the penal code that criminalises same-sex behaviour is rare, efforts to remove this legislation may signal greater public acceptance of sexual minorities.

Given the high levels of sexual risk taking, incomplete primary prevention coverage and levels of HIV transmission documented in this thesis, consideration should be given to the role of PrEP in preventing HIV acquisition among MSM and TW. High levels of willingness to use PrEP have been expressed by MSM and TW in Myanmar, particularly among those who perceived themselves at risk of HIV and who reported indicators of sexual risk behaviour (68). Although PrEP is not yet available, the current National Strategic Plan supports the development of a national model and policy regarding the provision of PrEP for key populations (30). However, the same National Strategic Plan outlines a plan to reabsorb ART provision into a centralised, publically provided service delivery model. While it is unclear if provision of PrEP would also be centrally distributed, the noted reluctance of key populations to access government services may be problematic and would likely present a barrier to PrEP access and ongoing adherence.

An additional barrier to the introduction of PrEP in Myanmar may be the limited availability of ART. Despite a recent scale up of ART availability, coverage is still suboptimal, with an estimated 66% of eligible PLHIV receiving treatment in 2017, compared to 14% in 2010 (6). Decisions around how best to allocate limited ART for treatment and prevention purposes may be influenced by factors such as cost-effectiveness, impact on HIV transmission and other ethical and moral considerations. Modelling studies to determine cost-effectiveness and estimated impact on HIV transmission may help to guide resource allocation decisions, but would need to be appropriately balanced with ethical positions around diverting ART and associated clinical services from treatment to prevention purposes, particularly when other

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primary prevention options, such as condom distribution programs, remain underfunded or insufficiently scaled (372). Additional challenges include the capacity of existing health systems to provide ongoing monitoring of PrEP patients, including the availability of technology for periodic renal function assessments and regular testing for other STIs, which would need to be properly understood prior to the roll out of PrEP. Implementation research or feasibility studies are warranted to identify – and resolve – potential challenges of providing PrEP within existing health systems setting, including best service delivery models and capacity building needs of potential PrEP providers (373, 374). For the benefit of PrEP to be fully realised, HIV testing coverage and regular uptake will need to be enhanced. Additional testing strategies recommended above may also play a role in determining PrEP eligibility and ensuring regular engagement in testing in accordance with global PrEP delivery guidelines (211).

7.2.3 Strengthening models of care and ART coverage

The adoption of strategies described above to increase HIV testing uptake among MSM and TW may result in the increased identification of undiagnosed HIV, but will need to be sufficiently supported by efforts to better link MSM and TW into cascades of care and minimise attrition. Currently, more than 40% of ART services are provided by the NGO sector in Myanmar, while a further 20% is provided through NGO-National AIDS Programme collaboration [32]. However, as noted, plans for the centralisation of ART provision have been made and clients currently receiving ART through NGO services will be transferred to public facilities to ensure sustainability and coordination of long-term care for PLHV (30).

While in Myanmar, there is no specific data on HIV treatment coverage among MSM and TW living with HIV, estimated coverage among PWID (14% in 2017) suggests that coverage among key populations remains a particular challenge (6). The noted reluctance of MSM and TW and other key populations to access government provided HIV services in Myanmar, influenced by expectations of stigma and discrimination by public health care providers and perceived threats to confidentiality (7, 42, 229), may inhibit their greater engagement in HIV treatment and care. Across Asia, concerns for confidentiality and poor communication between health workers and

clients have been identified as barriers to retention in HIV treatment among key populations (86) and may similarly influence the engagement of MSM and TW in Myanmar. Additionally, a 2013 review of ART provision in Myanmar noted that late presentation to ART centres was common (269), with very low median CD4 counts at initiation noted at most ART sites, which has been corroborated by other studies (208, 375-378). Given the limited engagement in regular HIV testing documented in this thesis, late presentation is likely to be an issue relevant to MSM and TW also.

The suboptimal linkage of MSM and TW living with HIV to treatment and care diminishes the known benefit of ART in reducing onward transmission. In other Asian settings, peers have successfully been used to connect HIV positive MSM and TW to treatment, support ongoing adherence and provide psychosocial support (286). Despite greater government control of ART services in Myanmar, ongoing partnerships with community-based and peer led HIV services should be maintained to garner the trust of the MSM and TW community and to promote greater linkage and retention to ART services. In Vietnam for example, the HIV outpatient clinic 'plus' is an example of a service delivery model that integrates public and community based services. Specifically, this model utilises HIV positive key population members to support clinical services by helping other key populations to navigate the public treatment system, contribute to demand generation activities and support treatment adherence and follow up, which has resulted in reported increases in levels of trust and utilisation of public services by key populations (379). As Myanmar prepares for the centralisation of ART services, successful approaches and lessons learned by the NGO sector in the provision of HIV testing and treatment should also be integrated into the public system to promote the greater engagement of MSM and TW and other key populations.

7.2.4 Strengthening surveillance system to improve M&E capacity.

The discrepancy noted in this thesis between observed and self-reported repeat testing behaviours suggests the need to develop sustainable systems to objectively monitor testing uptake, as well as other indicators of successful referral to, and retention in treatment. This

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thesis described a simple data collection system implemented within two existing community-based testing clinics to monitor HIV testing uptake and outcomes over time. A key advantage of this system was the monitoring of actual testing behaviours, enabling a more accurate and reliable assessment of testing uptake compared to self-reported measures. The addition of behavioural indicators collected at each testing event enabled monitoring of sexual risk behaviours and provided equipoise to data on HIV testing uptake and diagnoses. If maintained, this combination of longitudinal testing data and information on behavioural risk would provide context to observed changes in HIV burden and trends and enable the identification of priorities for a programmatic response.

That much of this behavioural data is collected, or at least discussed in the context of HIV service provision speaks to the sustainability of such a system; what is required is a simple method by which this information can be collected as a limited set of behavioural risk indicators. Currently, the system for service level data in Myanmar is fragmented; individual donor recipients and their implementing partners maintain separate electronic and paper-based collection systems that aim primarily to generate donor reports to international funding bodies. While some national HIV testing indicators have been integrated into these local systems, it is unclear how much this service level data contributes to local surveillance and monitoring and evaluation efforts for health systems strengthening. Given the general push towards greater use of electronic health records in Myanmar, including within coordinated government services (380), there is an opportunity for the integration of HIV data collected at the community level to feed into the broader national surveillance system.

The experiences of setting up the eDMS for this thesis suggest that any future efforts should focus on ensuring high levels of data completeness by providing sufficient training, regular monitoring, and ongoing capacity building efforts of data collectors. Other priorities include the development of a centralised system for data collection that permits linkage of data across service sites. Linkage with HIV treatment services can help contribute to the monitoring of clients across the HIV care cascade and can facilitate the involvement of peer-based services in supporting the retention of MSM and TW in HIV treatment as described above.

7.3 Strengths and limitations

Several limitations must be considered when interpreting the results presented in this thesis. Participants in studies presented in Chapters 2 – 5 were drawn from existing community-based NGOs or civil society organisations and were therefore already connected to HIV prevention services in Myanmar. The findings may not reflect participants who do not have similar access to HIV prevention for a range of factors including levels of HIV knowledge and awareness, socio-economic status or perceptions of stigma and discrimination. These factors are likely to interact with the topics explored in this thesis in important ways that limits the generalisability of the findings. The research in this thesis was conducted in the two largest cities in Myanmar. While this may limit the generalisability of findings to smaller, less urban areas, novel programmatic responses for MSM and TW are likely to be initiated in these cities, given the high estimated HIV prevalence and MSM and TW population estimates, and used to inform subsequent implementation elsewhere.

The connection between research participants and existing HIV prevention services may also have contributed to social desirability bias that shaped participant responses. As these studies used existing peer educators as data collectors, it is possible that participants were recruited from the existing networks of MSM and TW who were familiar with the health promotion messages provided by the peer educators.

However, despite the documented HIV burden, MSM and TW in Myanmar remain relatively understudied. This thesis provides up-to-date insight into sexual practices, socio-demographic characteristics, attitudes and perceptions of HIV prevention services that can be used to inform and shape HIV prevention efforts among MSM and TW. This thesis also presented the first known estimate of HIV incidence among any key populations in Myanmar, and along with associations of baseline HIV prevalence, extends our understanding about risk factors driving ongoing HIV transmission among this group.

7.4 Concluding remarks

This thesis provides updated and novel insights into the current sexual risk behaviours and testing practices of MSM and TW in Myanmar and identifies important barriers and facilitators to engagement in HIV testing and prevention services to help guide policy, practice and the programmatic response. Ongoing sexual risk taking in the context of high background HIV prevalence and limited evidence of routine testing behaviours suggest clear priorities for future programs including: enhanced focus on primary prevention through promotion of condom use; expansion of peer-based services and consideration of digital approaches to encourage more frequent HIV testing behaviours; and provision of services that are cognisant of different sexual and gender identities and cater appropriately for the differential needs and preferences of MSM and TW. These activities should be situated within broader efforts to address the structural barriers that limit enactment of HIV testing intentions or contribution to avoidance of services, as well as efforts to improve the routine collection of epidemiological data to monitor the impact of these interventions on HIV among MSM and TW in Myanmar.

REFERENCES

1. National AIDS Programme. Report on the assessment of HIV surveillance and population size estimates in Myanmar Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2013.
2. National AIDS Programme. HIV Sentinel Sero-surveillance survey report, 2012. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2013.
3. National AIDS Programme. Myanmar National Strategic Plan on HIV and AIDS 2006 - 2010. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports 2006.
4. National AIDS Programme. Myanmar National Strategic Plan on HIV and AIDS 2011 - 2015 Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports
5. UNAIDS. UNAIDS Estimates 2018. Geneva: UNAIDS 2018.
6. UNAIDS. Miles to go: the response to HIV in Asia and the Pacific. Geneva, Switzerland: UNAIDS; 2018.
7. National AIDS Programme. Myanmar Integrated biological and behavioural survey and population size estimates among men who have sex with men: 2015. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports 2015.
8. Commission on AIDS in Asia. Redefining AIDS in Asia: Crafting an effective response 2008.
9. Godwin P, O'Farrell N, Fylkesnes K, Misra S. Five myths about the HIV epidemic in Asia. *PLoS Med.* 2006;3(10):e426.
10. Ruxrungtham K, Brown T, Phanuphak P. HIV/AIDS in Asia. *Lancet.* 2004;364(9428):69-82.
11. Pendse R, Gupta S, Yu D, Sarkar S. HIV/AIDS in the South-East Asia region: progress and challenges. *Journal of virus eradication.* 2016;2(Suppl 4):1-6.
12. Rojanapithayakorn W. The 100% condom use programme in Asia. *Reproductive health matters.* 2006;14(28):41-52.
13. Green KE, Vu BN, Phan HT, Tran MH, Ngo HV, Vo SH, et al. From conventional to disruptive: upturning the HIV testing status quo among men who have sex with men in Vietnam. *Journal of the International AIDS Society.* 2018;21 Suppl 5(Suppl Suppl 5):e25127-e.
14. Vietnam launches national program for pre-exposure prophylaxis for HIV [Internet]. 2018 [cited 11/02/2019]. Available from: <https://www.path.org/media-center/vietnam-launches-national-program-pre-exposure-prophylaxis-hiv/>.
15. Baral S, Sifakis F, Cleghorn F, Beyrer C. Elevated risk for HIV infection among men who have sex with men in low- and middle-income countries 2000-2006: a systematic review. *PLoS Med.* 2007;4(12):e339.
16. Baral S, Poteat T, Stromdahl S, Wirtz AL, Guadamuz TE, Beyrer C. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *The Lancet Infectious diseases.* 2013;13(3):214-22.
17. Ross AGP, Ditangco RA, Belimac JG, Olveda RM, Mercado ES, Rogers GD, et al. HIV epidemic in men who have sex with men in Philippines. *The Lancet Infectious diseases.* 2013;13(6):472-3.
18. Hu H, Liu X, Zhang Z, Xu X, Shi L, Fu G, et al. Increasing HIV Incidence among Men Who Have Sex with Men in Jiangsu Province, China: Results from Five Consecutive Surveys, 2011-2015. *International journal of environmental research and public health.* 2016;13(8).
19. van Griensven F, de Lind van Wijngaarden JW. A review of the epidemiology of HIV infection and prevention responses among MSM in Asia. *Aids.* 2010;24 Suppl 3:S30-40.
20. Dokubo EK, Kim AA, Le LV, Nadol PJ, Prybylski D, Wolfe MI. HIV incidence in Asia: a review of available data and assessment of the epidemic. *AIDS reviews.* 2013;15(2):67-76.

REFERENCES

21. van Griensven F, Holtz TH, Thienkrua W, Chonwattana W, Wimonasate W, Chaikummao S, et al. Temporal trends in HIV-1 incidence and risk behaviours in men who have sex with men in Bangkok, Thailand, 2006-13: an observational study. *The lancet HIV*. 2015;2(2):e64-70.
22. Ananworanich J, Chitwarakorn, A., Varangrat, A., Chaikummao, S., Sriporn, A., Tongtoyai, J., Mock, P., Sukwicha, W. HIV and syphilis infection among men who have sex with men--Bangkok, Thailand, 2005-2011. *MMWR Morbidity and mortality weekly report*. 2013;62(25):518-20.
23. (NACO) NACO. National Integrated Biological and Behavioural Surveillance (IBBS), Hijras/Transgender People, India 2014-15. New Dehli, India: NACO, Ministry of Health and Family Welfare, Government of India 2016.
24. UNDP. Towards Universal Access: Examples of municipal HIV programming for men who have sex with men and transgendered people in six Asian cities Bangkok, Thailand: UNDP; 2011.
25. WHO. HIV/AIDS in the Asia-Pacific Region WHO; 2001.
26. UNAIDS. Situational Analysis on Drug Use, HIV and the Response in Myanmar: Looking forward Yangon, Myanmar: UNAIDS; 2015.
27. Beyrer C, Razak MH, Labrique A, Brookmeyer R. Assessing the magnitude of the HIV/AIDS epidemic in Burma. *Journal of acquired immune deficiency syndromes*. 2003;32(3):311-7.
28. Cohen J. The next frontier for HIV/AIDS: Myanmar. *Science*. 2003;301(5640):1650-5.
29. WHO. Guidelines for second generation HIV surveillance: An update: know your epidemic. Geneva: WHO; 2013.
30. National AIDS Programme. National Strategic Plan on HIV and AIDS: Myanmar 2016 - 2020. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2016.
31. Solomon SS, Lucas GM, Celentano DD, Sifakis F, Mehta SH. Beyond surveillance: a role for respondent-driven sampling in implementation science. *Am J Epidemiol*. 2013;178(2):260-7.
32. Cáceres C, Konda K, Pecheny M, Chatterjee A, Lyerla R. Estimating the number of men who have sex with men in low and middle income countries. *Sexually transmitted infections*. 2006;82 Suppl 3(Suppl 3):iii3-iii9.
33. Purcell DW, Johnson CH, Lansky A, Prejean J, Stein R, Denning P, et al. Estimating the population size of men who have sex with men in the United States to obtain HIV and syphilis rates. *The open AIDS journal*. 2012;6:98-107.
34. Asthana S, Oostvogels R. The social construction of male 'homosexuality' in India: implications for HIV transmission and prevention. *Social science & medicine* (1982). 2001;52(5):707-21.
35. UNDP. Lost in Transition: Transgender People, Rights and HIV Vulnerability in the Asia-Pacific Region Bangkok, Thailand: UNDP; 2012.
36. Ngo DA, Ross, M.W., Phan, H., Ratliff, E.A., Trinh, T., Sherburne, L. Male homosexual identities, relationships and practices among young men who have sex with men in Vietnam: Implications for HIV prevention AIDS education and prevention : official publication of the International Society for AIDS Education. 2009;21(3):251 - 65.
37. Phillips AE, Boily MC, Lowndes CM, Garnett GP, Gurav K, Ramesh BM, et al. Sexual identity and its contribution to MSM risk behavior in Bangaluru (Bangalore), India: the results of a two-stage cluster sampling survey. *J LGBT Health Res*. 2008;4(2-3):111-26.
38. Stief M. The Sexual Orientation and Gender Presentation of Hijra, Kothi, and Panthi in Mumbai, India. *Archives of sexual behavior*. 2017;46(1):73-85.
39. Gilbert D. Categorizing Gender in Queer Yangon. *SOJOURN* 2013;28(2):241-71.
40. Gilbert D, Cho G. Going to Pagan: Gay slang in Burma 2009 [Available from: <http://asiapacific.anu.edu.au/newmandala/2009/10/20/going-to-pagan-gay-slang-in-burma/>].
41. Chua LJG, D. Sexual orientation and gender identity minorities in transition: LGBT rights and activism in Myanmar. *Human Rights Quarterly*. 2015;37:1-28.

42. UNAIDS. Situational Analysis of the HIV response among men who have sex with men and transgendered persons in Myanmar Yangon, Myanmar: UNAIDS; 2015.
43. Aung T, McFarland W, Paw E, Hetherington J. Reaching men who have sex with men in Myanmar: population characteristics, risk and preventive behavior, exposure to health programs. *AIDS and behavior*. 2013;17(4):1386-94.
44. Ho T. Transgender, Transgression, and Translation: A Cartography of "Nat Kadaws": Notes on Gender and Sexuality within the Spirit Cult of Burma. *Discourse: Journal for Theoretical Studies in Media and Culture*. 2009;31(3):279 - 317.
45. Rainbow C. Facing 377: Discrimination and human rights abuses against transgender, gay and bisexual men in Myanmar. Myanmar: Colors Rainbow; 2014.
46. UNAIDS Aa. HIV and associated risk behaviors among MSM in Asia: Implications for policy and programming. Bangkok, Thailand: UNAIDS; 2008.
47. Fletcher G. The Cultural Queasiness Factor: Intersections of Gender, Sexuality and HIV Prevention in Burma/Myanmar. *Asian Studies Review*. 2011;35(2):189-207.
48. Chua LJ. The Vernacular Mobilization of Human Rights in Myanmar's Sexual Orientation and Gender Identity Movement. 2015;49(2):299-332.
49. Coleman E, Colgan P, Gooren LJAoSB. Male cross-gender behavior in Myanmar (Burma): A description of the acault. 1992;21(3):313-21.
50. Thant A. Choosing to be LGBT: Gender and sexuality activism in contemporary Myanmar. USA: Cornell University 2017.
51. Patel P, Borkowf CB, Brooks JT, Lasry A, Lansky A, Mermin J. Estimating per-act HIV transmission risk: a systematic review. *Aids*. 2014;28(10):1509-19.
52. Baggaley RF, Owen BN, Silhol R, Elmes J, Anton P, McGowan I, et al. Does per-act HIV-1 transmission risk through anal sex vary by gender? An updated systematic review and meta-analysis. *American journal of reproductive immunology (New York, NY : 1989)*. 2018;80(5):e13039.
53. de Lind van Wijngaarden JW, Brown T, Girault P, Sarkar S, van Griensven F. The epidemiology of human immunodeficiency virus infection, sexually transmitted infections, and associated risk behaviors among men who have sex with men in the Mekong Subregion and China: implications for policy and programming. *Sexually transmitted diseases*. 2009;36(5):319-24.
54. Chow EPF, Wilson DP, Zhang LJA, Behavior. Patterns of Condom Use Among Men Who Have Sex with Men in China: A Systematic Review and Meta-Analysis. 2012;16(3):653-63.
55. Le TM, Lee PC, Stewart DE, Long TN, Quoc CN. What are the risk factors for HIV in men who have sex with men in Ho Chi Minh City, Vietnam?- A cross-sectional study. *BMC public health*. 2016;16:406.
56. Sadiq ST, Taylor S, Copas AJ, Bennett J, Kaye S, Drake SM, et al. The effects of urethritis on seminal plasma HIV-1 RNA loads in homosexual men not receiving antiretroviral therapy. *Sexually transmitted diseases*. 2005;81(2):120-3.
57. Cohen MS, Hoffman IF, Royce RA, Kazembe P, Dyer JR, Daly CC, et al. Reduction of concentration of HIV-1 in semen after treatment of urethritis: implications for prevention of sexual transmission of HIV-1. AIDSCAP Malawi Research Group. *Lancet*. 1997;349(9069):1868-73.
58. Galvin SR, Cohen MS. The role of sexually transmitted diseases in HIV transmission. *Nature reviews Microbiology*. 2004;2(1):33-42.
59. Xu J, An M, Han X, Jia M, Ma Y, Zhang M, et al. Prospective cohort study of HIV incidence and molecular characteristics of HIV among men who have sex with men(MSM) in Yunnan Province, China. *BMC infectious diseases*. 2013;13:3.
60. Morineau G, Nugrahini N, Riono P, Nurhayati, Girault P, Mustikawati DE, et al. Sexual risk taking, STI and HIV prevalence among men who have sex with men in six Indonesian cities. *AIDS and behavior*. 2011;15(5):1033-44.

REFERENCES

61. Hemmige V, Snyder H, Liao C, Mayer K, Lakshmi V, Gandham SR, et al. Sex position, marital status, and HIV risk among Indian men who have sex with men: clues to optimizing prevention approaches. *AIDS patient care and STDs*. 2011;25(12):725-34.
62. Thienkrua W, van Griensven F, Mock PA, Dunne EF, Raengsakulrach B, Wimonasate W, et al. Young Men Who Have Sex with Men at High Risk for HIV, Bangkok MSM Cohort Study, Thailand 2006-2014. *AIDS and behavior*. 2018;22(7):2137-46.
63. Solomon SS, Mehta SH, Srikrishnan AK, Vasudevan CK, McFall AM, Balakrishnan P, et al. High HIV prevalence and incidence among MSM across 12 cities in India. *Aids*. 2015;29(6):723-31.
64. Kumta S, Lurie M, Weitzen S, Jerajani H, Gogate A, Row-kavi A, et al. Bisexuality, sexual risk taking, and HIV prevalence among men who have sex with men accessing voluntary counseling and testing services in Mumbai, India. *Journal of acquired immune deficiency syndromes*. 2010;53(2):227-33.
65. Chhim S, Ngim C, Chhoun P, Tuot S, Ly C, Mun P, et al. HIV prevalence and factors associated with HIV infection among transgender women in Cambodia: results from a national Integrated Biological and Behavioral Survey. *BMJ open*. 2017;7(8):e015390.
66. Chibo D, Kaye M, Birch C. HIV transmissions during seroconversion contribute significantly to new infections in men who have sex with men in Australia. *AIDS research and human retroviruses*. 2012;28(5):460-4.
67. Zheng C, Xu JJ, Hu QH, Yu YQ, Chu ZX, Zhang J, et al. Commercial sex and risk of HIV, syphilis, and herpes simplex virus-2 among men who have sex with men in six Chinese cities. *BMC infectious diseases*. 2016;16(1):765.
68. Draper BL, Oo ZM, Thein ZW, Aung PP, Veronese V, Ryan C, et al. Willingness to use HIV pre-exposure prophylaxis among gay men, other men who have sex with men and transgender women in Myanmar. *Journal of the International AIDS Society*. 2017;20(1):21885.
69. Aung PP, Ryan C, Bajracharya A, Pasricha N, Thein ZW, Agius PA, et al. Effectiveness of an Integrated Community- and Clinic-Based Intervention on HIV Testing, HIV Knowledge, and Sexual Risk Behavior of Young Men Who Have Sex With Men in Myanmar. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*. 2017;60(252):S45-S53.
70. Aung T, Thein ST, McFarland W. Seroadaptive Behaviors of Men Who Have Sex with Men in Myanmar. *AIDS and behavior*. 2015.
71. Ongwandee S, Lertpiriyasuwat C, Khawcharoenporn T, Chetchotisak P, Thiansukhon E, Leerattanapetch N, et al. Implementation of a Test, Treat, and Prevent HIV program among men who have sex with men and transgender women in Thailand, 2015-2016. *PloS one*. 2018;13(7):e0201171.
72. Cohen MS, Shaw GM, McMichael AJ, Haynes BF. Acute HIV-1 Infection. 2011;364(20):1943-54.
73. Gray RT, Wilson DP, Guy RJ, Stooove M, Hellard ME, Prestage GP, et al. Undiagnosed HIV infections among gay and bisexual men increasingly contribute to new infections in Australia. *Journal of the International AIDS Society*. 2018;21(4):e25104.
74. Ratmann O, van Sighem A, Bezemer D, Gavryushkina A, Jurriaans S, Wensing A, et al. Sources of HIV infection among men having sex with men and implications for prevention. *Sci Transl Med*. 2016;8(320):320ra2.
75. Phillips AN, Cambiano V, Nakagawa F, Brown AE, Lampe F, Rodger A, et al. Increased HIV incidence in men who have sex with men despite high levels of ART-induced viral suppression: analysis of an extensively documented epidemic. *PloS one*. 2013;8(2):e55312.
76. Suthar AB, Granich RM, Kato M, Nsanzimana S, Montaner JS, Williams BG. Programmatic Implications of Acute and Early HIV Infection. *J Infect Dis*. 2015;212(9):1351-60.
77. National STD/AIDS Control Programme. Integrated biological and behavioural surveillance (IBBS) survey among key populations at higher risk of HIV in Sri Lanka. Colombo, Sri Lanka: National STD/AIDS Control Programme 2018.

78. National AIDS Control Program. Integrated biological and behavioural surveillance in Pakistan 2016 - 2017. Islamabad, Pakistan: National AIDS Control Program 2017.
79. National Centre for HIV/AIDS DaS. Integrated biological and behavioural survey among transgender women in Cambodia, 2016. Phnom Pehn: National Centre for HIV/AIDS, Dermatology and STD; 2016.
80. Control NCfAaS. Integrated biological and behavioural surveillance (IBBS) survey among men who have sex with men and transgender women in Kathmandu Valley. Kathmandu, Nepal: Ministry of Health 2017.
81. Saw TN, Yasuoko J, Saw YM, Than TM, Win EM, Aung ZZ, et al. Factors associated with concurrent sexual partnerships among men who have sex with men in Yangon, Myanmar. *Nagoya journal of medical science*. 2018;80(4):505-18.
82. Garcia MC, Duong QL, Meyer SB, Ward PR. Multiple and concurrent sexual partnerships among men who have sex with men in Viet Nam: results from a National Internet-based Cross-sectional Survey. *Health promotion international*. 2016;31(1):133-43.
83. Ma Q, Zeng S, Xia S, Pan X, Wang D, Zhu H, et al. Risky sexual networks and concentrated HIV epidemics among men who have sex with men in Wenzhou, China: a respondent-driven sampling study. *BMC public health*. 2015;15:1246-.
84. Wirtz AL, Walker DG, Bollinger L, Sifakis F, Baral S, Johns B, et al. Modelling the impact of HIV prevention and treatment for men who have sex with men on HIV epidemic trajectories in low- and middle-income countries. *International journal of STD & AIDS*. 2013;24(1):18-30.
85. van Griensven F, Guadamuz TE, de Lind van Wijngaarden JW, Phanuphak N, Solomon SS, Lo YR. Challenges and emerging opportunities for the HIV prevention, treatment and care cascade in men who have sex with men in Asia Pacific. *Sexually transmitted infections*. 2017;93(5):356-62.
86. Koirala S, Deuba K, Nampaisan O, Marrone G, Ekstrom AM. Facilitators and barriers for retention in HIV care between testing and treatment in Asia-A study in Bangladesh, Indonesia, Lao, Nepal, Pakistan, Philippines and Vietnam. *PloS one*. 2017;12(5):e0176914.
87. Centers for Disease Control and Prevention. Vital signs: HIV prevention through care and treatment--United States. *MMWR Morbidity and mortality weekly report*. 2011;60(47):1618-23.
88. Logie CH, Newman PA, Weaver J, Roungraphon S, Tepjan S. HIV-Related Stigma and HIV Prevention Uptake Among Young Men Who Have Sex with Men and Transgender Women in Thailand. *AIDS patient care and STDs*. 2016;30(2):92-100.
89. Beyrer C, Baral SD, Weir BW, Curran JW, Chaisson RE, Sullivan PS. A call to action for concentrated HIV epidemics. *Current opinion in HIV and AIDS*. 2014;9(2):95-100.
90. Altman D, Aggleton P, Williams M, Kong T, Reddy V, Harrad D, et al. Men who have sex with men: stigma and discrimination. *Lancet*. 2012;380(9839):439-45.
91. UNDP. Legal environments, human rights and HIV responses among men who have sex with men and transgender people in Asia and the Pacific: an agenda for action. Bangkok: UNDP; 2010.
92. Han E, O'Mahoney J. British colonialism and the criminalization of homosexuality. *Cambridge Review of International Affairs*. 2014;27(2):268-88.
93. UNDP. HIV and the law in South-east Asia. Bangkok: UNDP; 2015.
94. Pachankis JE, Hatzenbuehler ML, Hickson F, Weatherburn P, Berg RC, Marcus U, et al. Hidden from health: structural stigma, sexual orientation concealment, and HIV across 38 countries in the European MSM Internet Survey. *Aids*. 2015;29(10):1239-46.
95. Fay H, Baral SD, Trapence G, Motimedi F, Umar E, Ipinge S, et al. Stigma, health care access, and HIV knowledge among men who have sex with men in Malawi, Namibia, and Botswana. *AIDS and behavior*. 2011;15(6):1088-97.

REFERENCES

96. Wei C, Cheung DH, Yan H, Li J, Shi LE, Raymond HF. The Impact of Homophobia and HIV Stigma on HIV Testing Uptake among Chinese Men Who Have Sex with Men: A Mediation Analysis. *Journal of acquired immune deficiency syndromes*. 2015.
97. Ayala G, Makofane K, Santos GM, Beck J, Do TD, Hebert P, et al. Access to Basic HIV-Related Services and PrEP Acceptability among Men Who Have sex with Men Worldwide: Barriers, Facilitators, and Implications for Combination Prevention. *Journal of sexually transmitted diseases*. 2013;2013:953123.
98. Johnston LG, Steinhaus MC, Sass J, Sirinirund P, Lee C, Benjarattanaporn P, et al. Recent HIV Testing Among Young Men Who Have Sex with Men in Bangkok and Chiang Mai: HIV Testing and Prevention Strategies Must Be Enhanced in Thailand. *AIDS and behavior*. 2016;20(9):2023-32.
99. Han L, Wei C, Muessig KE, Bien CH, Meng G, Emch ME, et al. HIV test uptake among MSM in China: Implications for enhanced HIV test promotion campaigns among key populations. *Global public health*. 2017;12(1):31-44.
100. Bowring AL, Pasomsouk N, Higgs P, Sychareun V, Hellard M, Power R. Factors Influencing Access to Sexual Health Care Among Behaviorally Bisexual Men in Vientiane, Laos: A Qualitative Exploration. *Asia-Pacific journal of public health / Asia-Pacific Academic Consortium for Public Health*. 2015;27(8):820-34.
101. Dhingra PBVCDDMRN. Hard-to-reach men who have sex with men (MSM) in India: sexual subjectivities and the social construction of HIV prevention: findings and recommendations from community-based research XIX International AIDS Conference; Washington DC, USA2012.
102. Philbin MM, Hirsch JS, Wilson PA, Ly AT, Giang LM, Parker RG. Structural barriers to HIV prevention among men who have sex with men (MSM) in Vietnam: Diversity, stigma, and healthcare access. *PloS one*. 2018;13(4):e0195000.
103. Joore IK, Geerlings SE, Brinkman K, van Bergen JE, Prins JM. The importance of registration of sexual orientation and recognition of indicator conditions for an adequate HIV risk-assessment. *BMC infectious diseases*. 2017;17(1):178.
104. Adia AC, Bermudez ANC, Callahan MW, Hernandez LI, Imperial RH, Operario D. "An Evil Lurking Behind You": Drivers, Experiences, and Consequences of HIV-Related Stigma Among Men Who Have Sex With Men With HIV in Manila, Philippines. *AIDS education and prevention : official publication of the International Society for AIDS Education*. 2018;30(4):322-34.
105. Li X, Lu H, Ma X, Sun Y, He X, Li C, et al. HIV/AIDS-related stigmatizing and discriminatory attitudes and recent HIV testing among men who have sex with men in Beijing. *AIDS and behavior*. 2012;16(3):499-507.
106. UNDP U. The right(s) evidence: sex work, violence and HIV in Asia. Bangkok: UNFPA; 2015.
107. Operario D, Soma T, Underhill K. Sex work and HIV status among transgender women: systematic review and meta-analysis. *Journal of acquired immune deficiency syndromes*. 2008;48(1):97-103.
108. Johnston LG, Mon MM, Steinhaus M, Sass J. Correlates of Forced Sex Among Young Men Who Have Sex With Men in Yangon and Monywa, Myanmar. *Archives of sexual behavior*. 2016:1-10.
109. UNAIDS. 90- 90-90: An ambitious treatment target to help end the AIDS epidemic. Geneva, Switzerland: UNAIDS; 2014.
110. Baggaley R, Dalal S, Johnson C, Macdonald V, Mameletzis I, Rodolph M, et al. Beyond the 90-90-90: refocusing HIV prevention as part of the global HIV response. *Journal of the International AIDS Society*. 2016;19(1):21348-.
111. Isbell MT, Kilonzo N, Mugurungi O, Bekker LG. We neglect primary HIV prevention at our peril. *The lancet HIV*. 2016;3(7):e284-5.
112. UNAIDS. Combination HIV Prevention: Tailoring and coordinating biomedical, behavioural and structural strategies to reduce new HIV infections: A UNAIDS discussion paper. Geneva: UNAIDS 2010.

113. WHO. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations. Geneva: WHO; 2014.
114. Hoos D, El-Sadr WM, Dehne K-L. Getting the balance right: Scaling-up treatment and prevention. *Global public health*. 2017;12(4):483-97.
115. Johnson WD, Diaz RM, Flanders WD, Goodman M, Hill AN, Holtgrave D, et al. Behavioral interventions to reduce risk for sexual transmission of HIV among men who have sex with men. *The Cochrane database of systematic reviews*. 2008(3).
116. Sullivan PS, Carballo-Diéguez A, Coates T, Goodreau SM, McGowan I, Sanders EJ, et al. Successes and challenges of HIV prevention in men who have sex with men. *Lancet*. 380(9839):388-99.
117. Coates TJ, Richter L, Caceres C. Behavioural strategies to reduce HIV transmission: how to make them work better. *Lancet*. 2008;372(9639):669-84.
118. Higa DH, Crepaz N, Marshall KJ, Kay L, Vosburgh HW, Spikes P, et al. A systematic review to identify challenges of demonstrating efficacy of HIV behavioral interventions for gay, bisexual, and other men who have sex with men (MSM). *AIDS and behavior*. 2013;17(4):1231-44.
119. Lu H, Liu Y, Dahiya K, Qian HZ, Fan W, Zhang L, et al. Effectiveness of HIV risk reduction interventions among men who have sex with men in China: a systematic review and meta-analysis. *PloS one*. 2013;8(8):e72747.
120. Huang Z, Wang M, Fu L, Fang Y, Hao J, Tao F, et al. Intervention to increase condom use and HIV testing among men who have sex with men in China: a meta-analysis. *AIDS research and human retroviruses*. 2013;29(3):441-8.
121. Herbst JH, Sherba RT, Crepaz N, DeLuca JB, Zohrabayan L, Stall RD, et al. A Meta-Analytic Review of HIV Behavioral Interventions for Reducing Sexual Risk Behavior of Men Who Have Sex With Men. *J Acquir Immune Def Syndr*. 2005;39(2):228-41.
122. Nugroho A, Erasmus, V., Zomer, T.P., Wu, Q., Richardus, J.H. Behavioral interventions to reduce HIV risk behavior for MSM in Southeast Asia: a systematic review *AIDS care*. 2016.
123. Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, et al. Global epidemiology of HIV infection in men who have sex with men. *Lancet*. 2012;380(9839):367-77.
124. Pickles M, Boily MC, Vickerman P, Lowndes CM, Moses S, Blanchard JF, et al. Assessment of the population-level effectiveness of the Avahan HIV-prevention programme in South India: a preplanned, causal-pathway-based modelling analysis. *The Lancet Global health*. 2013;1(5):e289-99.
125. Connor EM, Sperling RS, Gelber R, Kiselev P, Scott G, O'Sullivan MJ, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment. *Pediatric AIDS Clinical Trials Group Protocol 076 Study Group*. *N Engl J Med*. 1994;331(18):1173-80.
126. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, et al. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med*. 2011;365(6):493-505.
127. Rodger AJ, Cambiano V, Bruun T, Vernazza P, Collins S, van Lunzen J, et al. Sexual Activity Without Condoms and Risk of HIV Transmission in Serodifferent Couples When the HIV-Positive Partner Is Using Suppressive Antiretroviral Therapy. *Jama*. 2016;316(2):171-81.
128. Bavinton BR, Pinto AN, Phanuphak N, Grinsztejn B, Prestage GP, Zablotska-Manos IB, et al. Viral suppression and HIV transmission in serodiscordant male couples: an international, prospective, observational, cohort study. *The lancet HIV*. 2018;5(8):e438-e47.
129. WHO. Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. Geneva: WHO; 2015.
130. The Lancet H. U=U taking off in 2017. *The lancet HIV*. 2017;4(11):e475.
131. Kato M, Granich R, Bui DD, Tran HV, Nadol P, Jacka D, et al. The potential impact of expanding antiretroviral therapy and combination prevention in Vietnam: towards elimination of HIV transmission. *J Acquir Immune Def Syndr*. 2013;63(5):e142-e9.

REFERENCES

132. Tao L, Liu M, Li S, Liu J, Wang N. Condom use in combination with ART can reduce HIV incidence and mortality of PLWHA among MSM: a study from Beijing, China. *BMC infectious diseases*. 2018;18(1):124-.
133. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure Chemoprophylaxis for HIV Prevention in Men Who Have Sex with Men. *N Engl J Med*. 2010;363(27):2587-99.
134. McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, et al. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet*. 2016;387(10013):53-60.
135. Grant RM, Anderson PL, McMahan V, Liu A, Amico KR, Mehrotra M, et al. Uptake of pre-exposure prophylaxis, sexual practices, and HIV incidence in men and transgender women who have sex with men: a cohort study. *The Lancet Infectious diseases*. 2014;14(9):820-9.
136. Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, et al. On-Demand Preexposure Prophylaxis in Men at High Risk for HIV-1 Infection. *N Engl J Med*. 2015;373(23):2237-46.
137. WHO. Policy brief: WHO expands recommendation on oral pre-exposure prophylaxis (PrEP) of HIV infection Geneva: WHO; 2015.
138. Choopanya K, Martin M, Suntharasamai P, Sangkum U, Mock PA, Leethochawalit M, et al. Antiretroviral prophylaxis for HIV infection in injecting drug users in Bangkok, Thailand (the Bangkok Tenofovir Study): a randomised, double-blind, placebo-controlled phase 3 trial. *Lancet*. 2013;381(9883):2083-90.
139. Kung V, Pattanasin S, Ungsedhapand C, Wimonsate W, Thigpen M, Dunne E. 1292. HIV Pre-Exposure Prophylaxis (PrEP) Implementation at Silom Community Clinic in Bangkok, Thailand, 2016–2018. *Open forum infectious diseases*. 2018;5(Suppl 1):S394-S5.
140. Wheelock A, Eisingerich AB, Ananworanich J, Gomez GB, Hallett TB, Dybul MR, et al. Are Thai MSM willing to take PrEP for HIV prevention? An analysis of attitudes, preferences and acceptance. *PloS one*. 2013;8(1):e54288-e.
141. Chakrapani V, Newman PA, Shunmugam M, Mengle S, Varghese J, Nelson R, et al. Acceptability of HIV Pre-Exposure Prophylaxis (PrEP) and Implementation Challenges Among Men Who Have Sex with Men in India: A Qualitative Investigation. *AIDS patient care and STDs*. 2015;29(10):569-77.
142. Oldenburg CE, Le B, Toan T, Thien DD, Huyen HT, Friedman MR, et al. HIV Pre-exposure Prophylaxis Indication and Readiness Among HIV-Uninfected Transgender Women in Ho Chi Minh City, Vietnam. *AIDS and behavior*. 2016;20(Suppl 3):365-70.
143. Lim SH, Mburu G, Bourne A, Pang J, Wickersham JA, Wei CKT, et al. Willingness to use pre-exposure prophylaxis for HIV prevention among men who have sex with men in Malaysia: Findings from an online survey. *PloS one*. 2017;12(9):e0182838-e.
144. Wang Z, Lau JTF, Fang Y, Ip M, Gross DL. Prevalence of actual uptake and willingness to use pre-exposure prophylaxis to prevent HIV acquisition among men who have sex with men in Hong Kong, China. *PloS one*. 2018;13(2):e0191671-e.
145. Ongwande S, Lertpiriyasuwat C, Khawcharoenporn T, Chetchotisak P, Thiansukhon E, Leerattanapetch N, et al. Implementation of a Test, Treat, and Prevent HIV program among men who have sex with men and transgender women in Thailand, 2015-2016. *PloS one*. 2018;13(7):e0201171-e.
146. Deutsch MB, Glidden DV, Sevelius J, Keatley J, McMahan V, Guanira J, et al. HIV pre-exposure prophylaxis in transgender women: a subgroup analysis of the iPrEx trial. *The lancet HIV*. 2015;2(12):e512-9.
147. Sevelius JM, Keatley J, Calma N, Arnold E. 'I am not a man': Trans-specific barriers and facilitators to PrEP acceptability among transgender women. *Global public health*. 2016;11(7-8):1060-75.

148. Li J, Peng L, Gilmour S, Gu J, Ruan Y, Zou H, et al. A mathematical model of biomedical interventions for HIV prevention among men who have sex with men in China. *BMC infectious diseases*. 2018;18(1):600-.
149. Macklin R, Cowan E. Given financial constraints, it would be unethical to divert antiretroviral drugs from treatment to prevention. *Health Aff (Millwood)*. 2012;31(7):1537-44.
150. Solomon SS, Mehta SH, McFall AM, Srikrishnan AK, Saravanan S, Laeyendecker O, et al. Community viral load, antiretroviral therapy coverage, and HIV incidence in India: a cross-sectional, comparative study. *The lancet HIV*. 2016;3(4):e183-e90.
151. Das M, Chu PL, Santos GM, Scheer S, Vittinghoff E, McFarland W, et al. Decreases in community viral load are accompanied by reductions in new HIV infections in San Francisco. *PloS one*. 2010;5(6):e11068.
152. He L, Yang J, Ma Q, Zhang J, Xu Y, Xia Y, et al. Reduction in HIV community viral loads following the implementation of a "Treatment as Prevention" strategy over 2 years at a population-level among men who have sex with men in Hangzhou, China. *BMC infectious diseases*. 2018;18(1):62.
153. Kroon E, Phanuphak N, Shattock AJ, Fletcher JLK, Pinyakorn S, Chomchey N, et al. Acute HIV infection detection and immediate treatment estimated to reduce transmission by 89% among men who have sex with men in Bangkok. *Journal of the International AIDS Society*. 2017;20(1):1-9.
154. Fox J, White PJ, Macdonald N, Weber J, McClure M, Fidler S, et al. Reductions in HIV transmission risk behaviour following diagnosis of primary HIV infection: a cohort of high-risk men who have sex with men. *HIV medicine*. 2009;10(7):432-8.
155. Steward WT, Remien RH, Higgins JA, Dubrow R, Pinkerton SD, Sikkema KJ, et al. Behavior change following diagnosis with acute/early HIV infection-a move to serosorting with other HIV-infected individuals. The NIMH Multisite Acute HIV Infection Study: III. *AIDS and behavior*. 2009;13(6):1054-60.
156. Camoni L, Dal Conte I, Regine V, Colucci A, Chiriotto M, Vullo V, et al. Sexual behaviour reported by a sample of Italian MSM before and after HIV diagnosis. *Annali dell'Istituto superiore di sanita*. 2011;47(2):214-9.
157. Khosropour CM, Dombrowski JC, Kerani RP, Katz DA, Barbee LA, Golden MR. Changes in Condomless Sex and Serosorting Among Men Who Have Sex With Men After HIV Diagnosis. *Journal of acquired immune deficiency syndromes*. 2016;73(4):475-81.
158. Colfax GN, Buchbinder SP, Cornelisse PG, Vittinghoff E, Mayer K, Celum C. Sexual risk behaviors and implications for secondary HIV transmission during and after HIV seroconversion. *Aids*. 2002;16(11):1529-35.
159. Poon CM, Wong NS, Kwan TH, Wong HTH, Chan KCW, Lee SS. Changes of sexual risk behaviors and sexual connections among HIV-positive men who have sex with men along their HIV care continuum. *PloS one*. 2018;13(12):e0209008.
160. Guadamuz TE, Cheung DH, Wei C, Koe S, Lim SH. Young, Online and in the Dark: Scaling Up HIV Testing among MSM in ASEAN. *PloS one*. 2015;10(5):e0126658.
161. Beyrer C, Sullivan P, Sanchez J, Baral SD, Collins C, Wirtz AL, et al. The increase in global HIV epidemics in MSM. *Aids*. 2013;27(17):2665-78.
162. Beyrer C, Baral SD, Collins C, Richardson ET, Sullivan PS, Sanchez J, et al. The global response to HIV in men who have sex with men. *Lancet*. 2016;388(10040):198-206.
163. Arreola S, Santos GM, Beck J, Sundararaj M, Wilson PA, Hebert P, et al. Sexual stigma, criminalization, investment, and access to HIV services among men who have sex with men worldwide. *AIDS and behavior*. 2015;19(2):227-34.
164. de Lind van Wijngaarden JW, Ojanen TT. Identity management and sense of belonging to gay community among young rural Thai same-sex attracted men: implications for HIV prevention and treatment. *Culture, health & sexuality*. 2016;18(4):377-90.

REFERENCES

165. WHO. Regional assessment of HIV, STI and other health needs of transgender people in Asia and the Pacific Geneva, Switzerland: WHO; 2013.
166. Yi S, Tuot S, Chhoun P, Brody C, Pal K, Oum S. Factors associated with recent HIV testing among high-risk men who have sex with men: a cross-sectional study in Cambodia. *BMC public health*. 2015;15(1):743.
167. Wei C, Yan H, Yang C, Raymond HF, Li J, Yang H, et al. Accessing HIV testing and treatment among men who have sex with men in China: a qualitative study. *AIDS care*. 2014;26(3):372-8.
168. de Lind van Wijngaarden JW, Ching AD, Settle E, van Griensven F, Cruz RC, Newman PA. "I am not promiscuous enough!": Exploring the low uptake of HIV testing by gay men and other men who have sex with men in Metro Manila, Philippines. *PloS one*. 2018;13(7):e0200256.
169. Gioia F. Peer effects on risk behaviour: the importance of group identity. *Experimental economics*. 2017;20(1):100-29.
170. Tomé G, Matos M, Simões C, Diniz JA, Camacho I. How can peer group influence the behavior of adolescents: explanatory model. *Global journal of health science*. 2012;4(2):26-35.
171. Qiao S, Li X, Stanton B. Social support and HIV-related risk behaviors: a systematic review of the global literature. *AIDS and behavior*. 2014;18(2):419-41.
172. Latkin CA, Knowlton AR. Micro-social structural approaches to HIV prevention: a social ecological perspective. *AIDS care*. 2005;17 Suppl 1:S102-13.
173. UNFPA M, UNDP, WHO, USAID & WB. Implementing comprehensive HIV and STI programmes with men who have sex with men: practical guidance for collaborative interventions. New York, USA: UNFPA; 2015.
174. WHO. Consolidated guidelines on HIV testing services. 5Cs: consent, confidentiality, counseling, correct results and connection Geneva, Switzerland WHO; 2015.
175. Zhang D, Lu H, Zhuang M, Wu G, Yan H, Xu J, et al. Enhancing HIV Testing and Treatment among Men Who Have Sex with Men in China: A Pilot Model with Two-Rapid Tests, Single Blood Draw Session, and Intensified Case Management in Six Cities in 2013. *PloS one*. 2016;11(12):e0166812-e.
176. Yan H, Zhang R, Wei C, Li J, Xu J, Yang H, et al. A peer-led, community-based rapid HIV testing intervention among untested men who have sex with men in China: an operational model for expansion of HIV testing and linkage to care. *Sexually transmitted infections*. 2014;90(5):388-93.
177. Cambiano V, Ford D, Mabugu T, Napierala Mavedzenge S, Miners A, Mugurungi O, et al. Assessment of the Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries. *J Infect Dis*. 2015.
178. Zhang C, Li X, Brecht M-L, Koniak-Griffin D. Can self-testing increase HIV testing among men who have sex with men: A systematic review and meta-analysis. *PloS one*. 2017;12(11):e0188890-e.
179. Linas BP. Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries. *Journal of Infectious Diseases*. 2015.
180. Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. *AIDS and behavior*. 2015;19(11):1949-65.
181. Wirtz A, Clouse, E., Veronese, V., Kaung Htet Thu., Soe Naing., Baral, S., Beyrer, C. New HIV testing technologies in a concentrated epidemic and evolving HIV prevention: Qualitative research on HIV self-testing among men who have sex with men and transgender women in Yangon, Myanmar. *Journal of the International AIDS Society*. 2017.
182. Pal K, Ngin C, Tuot S, Chhoun P, Ly C, Chhim S, et al. Acceptability Study on HIV Self-Testing among Transgender Women, Men who Have Sex with Men, and Female Entertainment Workers in Cambodia: A Qualitative Analysis. *PloS one*. 2016;11(11):e0166129-e.
183. Ren XL, Wu ZY, Mi GD, McGoogan J, Rou KM, Zhao Y. Uptake of HIV Self-testing among Men Who have Sex with Men in Beijing, China: a Cross-sectional Study. *Biomedical and environmental sciences : BES*. 2017;30(6):407-17.

184. UNAIDS. On the Fast-Track to end AIDS. Geneva: UNAIDS; 2016.
185. Purnomo J, Coote, K., Mao, L., Fan, L., Gold, J., Ahmad, R., Zhang, L. Using eHealth to engage and retain priority populations in the HIV treatment and care cascade in the Asia-Pacific region: a systematic review of literature. *BMC infectious diseases*. 2018;18(1):82.
186. Bien CH, Best JM, Muessig KE, Wei C, Han L, Tucker JD. Gay Apps for Seeking Sex Partners in China: Implications for MSM Sexual Health. *AIDS and behavior*. 2015;19(6):941-6.
187. Cao B, Liu C, Stein G, Tang W, Best J, Zhang Y, et al. Faster and Riskier? Online Context of Sex Seeking Among Men Who Have Sex With Men in China. *Sexually transmitted diseases*. 2017;44(4):239-44.
188. Tang W, Best J, Zhang Y, Liu FY, Tso LS, Huang S, et al. Gay mobile apps and the evolving virtual risk environment: a cross-sectional online survey among men who have sex with men in China. *Sexually transmitted infections*. 2016.
189. Weiss KM, Jonas KJ, Guadamuz TE. Playing and Never Testing: Human Immunodeficiency Virus and Sexually Transmitted Infection Testing Among App-Using MSM in Southeast Asia. *Sexually transmitted diseases*. 2017;44(7):406-11.
190. Schnall R, Travers J, Rojas M, Carballo-Diequez A. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review. *Journal of medical Internet research*. 2014;16(5):e134.
191. Cao B, Gupta S, Wang J, Hightow-Weidman LB, Muessig KE, Tang W, et al. Social Media Interventions to Promote HIV Testing, Linkage, Adherence, and Retention: Systematic Review and Meta-Analysis. *Journal of medical Internet research*. 2017;19(11):e394.
192. Zou H, Wu Z, Yu J, Li M, Ablimit M, Li F, et al. Internet-Facilitated, Voluntary Counseling and Testing (VCT) Clinic-Based HIV Testing among Men Who Have Sex with Men in China. *PloS one*. 2013;8(2).
193. Anand T, Nitpolprasert C, Kerr SJ, Apornpong T, Ananworanich J, Phanuphak P, et al. Implementation of an online HIV prevention and treatment cascade in Thai men who have sex with men and transgender women using Adam's Love Electronic Health Record system. *Journal of virus eradication*. 2017;3(1):15-23.
194. Allison SM, Adams D, Klindera KC, Poteat T, Wolf RC. Innovative uses of communication technology for HIV programming for men who have sex with men and transgender persons. *Journal of the International AIDS Society*. 2014;17:19041.
195. Rhodes S, Vissman A, Stowers J, Miller C, McCoy T, Hergenrather K, et al. A CBPR partnership increases HIV testing among men who have sex with men (MSM): outcome findings from a pilot test of the CyBER/testing internet intervention. *Health education & behavior : the official publication of the Society for Public Health Education*. 2011;38(3):311-20.
196. Lelutiu-Weinberger C, Pachankis JE, Gamarel KE, Surace A, Golub SA, Parsons JT. Feasibility, Acceptability, and Preliminary Efficacy of a Live-Chat Social Media Intervention to Reduce HIV Risk Among Young Men Who Have Sex With Men. *AIDS and behavior*. 2015;19(7):1214-27.
197. UNAIDS. Expanding access to HIV services for men who have sex with men through mobile and web-based platforms in Myanmar: a policy brief Yangon, Myanmar: UNAIDS 2017.
198. Gustafson K, Lwin, M., Ko, H., Oo, T., Kelly, R, editor Quadrupling HIV case finding: social media improves HIV testing and HIV case finding among key populations in Myanmar. 22nd International AIDS Conference 2018 23 - 27 July 2018; Amsterdam.
199. Beyrer C, Lee TJ. Responding to infectious diseases in Burma and her border regions. *Confl Health*. 2008;2:2.
200. Williams B, Baker D, Bühler M, Petrie CJC. Increase coverage of HIV and AIDS services in Myanmar. 2008;2(1):3.

REFERENCES

201. HIV/AIDS UNETGo. Joint Programme for HIV/AIDS: Myanmar 2003 - 2005. Myanmar: UNAIDS; 2003.
202. WHO. Review of the Myanmar National AIDS Programme. New Delhi: WHO; 2006.
203. National AIDS Programme. Response to HIV& AIDS in Myanmar: Progress Report 2005. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2005.
204. Myanmar UNETGoHA. Joint Programme for HIV: Myanmar 2003 - 2005 mid-term review Yangon; 2005.
205. National AIDS Programme. Mid term review of Progress on the Ten Targets in Myanmar. In: National AIDS Programme MoHaS, editor. Yangon, Myanmar 2013.
206. Oo HN, Hone S, Fujita M, Maw-Naing A, Boonto K, Jacobs M, et al. Evolution of the health sector response to HIV in Myanmar: progress, challenges and the way forward. *Journal of virus eradication*. 2016;2(Suppl 4):20-6.
207. The Global Fund to fight AIDS TaM. Myanmar: funding overview 2019 [Available from: <https://www.theglobalfund.org/en/portfolio/country/?loc=MMR&k=b3d59122-9d71-4df9-ae0e-9e4b1b315de8>].
208. Sabapathy K, Ford N, Chan KN, Kyaw MK, Elema R, Smithuis F, et al. Treatment outcomes from the largest antiretroviral treatment program in Myanmar (Burma): a cohort analysis of retention after scale-up. *Journal of acquired immune deficiency syndromes*. 2012;60(2):e53-62.
209. Minn AC, Kyaw NTT, Aung TK, Mon OM, Htun T, Oo MM, et al. Attrition among HIV positive children enrolled under integrated HIV care programme in Myanmar: 12 years cohort analysis. *Global health action*. 2018;11(1):1510593.
210. National AIDS Programme. Guidelines for the clinical management of HIV infection in Myanmar (5th edition). Yangon: National AIDS Programme, Ministry of Health and Sports; 2017.
211. WHO. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach. Geneva, Switzerland: WHO; 2016.
212. Pham MD, Aung PP, Paing AK, Pasricha N, Agius PA, Tun W, et al. Factors associated with HIV testing among young men who have sex with men in Myanmar: a cross-sectional study. *Journal of the International AIDS Society*. 2017;20(3):e25026.
213. Wirtz AL NS, Mon HH, Paing AZ, Clouse E, Mon EK, Baral, S, Beyrer, C, editor HIV self testing among men who have sex with men and transgender women in Myanmar Conference on retroviruses and opportunistic infections (CROI); 2018 March 4 - 7, 2018; Boston, USA.
214. van Griensven F, Thienkrua W, McNicholl J, Wimonasate W, Chaikummao S, Chonwattana W, et al. Evidence of an explosive epidemic of HIV infection in a cohort of men who have sex with men in Thailand. *Aids*. 2013;27(5):825-32.
215. Group TISS. Initiation of Antiretroviral Therapy in Early Asymptomatic HIV Infection. *N Engl J Med*. 2015;373(9):795-807.
216. Fisher M, Pao D, Brown AE, Sudarshi D, Gill ON, Cane P, et al. Determinants of HIV-1 transmission in men who have sex with men: a combined clinical, epidemiological and phylogenetic approach. *Aids*. 2010;24(11):1739-47.
217. Ratmann O, van Sighem A, Bezemer D, Gavryushkina A, Jurriaans S, Wensing A, et al. Sources of HIV infection among men having sex with men and implications for prevention. *Sci Transl Med*. 2016;8(320):320ra2-ra2.
218. National AIDS Programme. Myanmar Global AIDS Response Program Report 2015. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2015.
219. Oo ZM. 2017.
220. Population Council. An integrated peer outreach and clinic-based intervention to improve the sexual health of young men who have sex with men in Myanmar: A Link Up Evaluation Washington, DC: Population Council 2016.

221. Draper BL, Oo ZM, Thein ZW, Aung PP, Veronese V, Ryan C, et al. Willingness to use HIV pre-exposure prophylaxis among gay men, other men who have sex with men and transgender women in Myanmar. *Journal of the International AIDS Society*. 2017;20(1):1-10.
222. Liu Y, Qian HZ, Ruan Y, Wu P, Osborn CY, Jia Y, et al. Frequent HIV Testing: Impact on HIV Risk Among Chinese Men Who Have Sex with Men. *Journal of acquired immune deficiency syndromes*. 2016;72(4):452-61.
223. Fujita M, Poudel KC, Green K, Wi T, Abeyewickreme I, Ghidinelli M, et al. HIV service delivery models towards 'Zero AIDS-related Deaths': a collaborative case study of 6 Asia and Pacific countries. *BMC Health Serv Res*. 2015;15:176.
224. Aung NM, Hanson J, Kyi TT, Htet ZW, Cooper DA, Boyd MA, et al. HIV care in Yangon, Myanmar; successes, challenges and implications for policy. *AIDS research and therapy*. 2017;14(1):10.
225. McDaid LM, Aghaizu A, Frankis J, Riddell J, Nardone A, Mercey D, et al. Frequency of HIV testing among gay and bisexual men in the UK: implications for HIV prevention. *HIV medicine*. 2016;17(9):683-93.
226. Katz DA, Swanson F, Stekler JD. Why do men who have sex with men test for HIV infection? Results from a community-based testing program in Seattle. *Sexually transmitted diseases*. 2013;40(9):724-8.
227. World Bank. Gross national income by capita 2015 (atlas method and PPP): World Bank; 2015 [Available from: <http://databank.worldbank.org/data/download/GNIPC.pdf>.
228. National AIDS Programme. Global AIDS Response Progress Report Myanmar. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2015.
229. UNESCO Bangkok & Department of Medical Research MoH, Myanmar. Multi-level risk and protective factors and HIV-related risk behaviours among young men who have sex with men (YMSM) in Myanmar. Paris, France: UNESCO Bangkok and Department of Medical Research, Ministry of Health, Myanmar; 2015.
230. Veronese V, Clouse E, Wirtz AL, Thu KH, Naing S, Baral SD, et al. "We are not gays... don't tell me those things": engaging 'hidden' men who have sex with men and transgender women in HIV prevention in Myanmar. *BMC public health*. 2019;19(1):63.
231. Veronese V, Oo ZM, Thein ZW, Aung PP, Draper BL, Hughes C, et al. Acceptability of Peer-Delivered HIV Testing and Counselling Among Men Who Have Sex with Men (MSM) and Transgender Women (TW) in Myanmar. *AIDS and behavior*. 2018;22(8):2426-34.
232. National AIDS Programme. Integrated Bio-Behavioural Survey. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2009.
233. Hargreaves JR, Mtetwa S, Davey C, Dirawo J, Chidiya S, Benedikt C, et al. Implementation and Operational Research: Cohort Analysis of Program Data to Estimate HIV Incidence and Uptake of HIV-Related Services Among Female Sex Workers in Zimbabwe, 2009-2014. *Journal of acquired immune deficiency syndromes*. 2016;72(1):e1-8.
234. Stahlman S, Lyons C, Sullivan PS, Mayer KH, Hosein S, Beyrer C, et al. HIV incidence among gay men and other men who have sex with men in 2020: where is the epidemic heading? *Sex Health*. 2017;14(1):5-17.
235. Magnani R, Sabin K, Saidel T, Heckathorn D. Review of sampling hard-to-reach and hidden populations for HIV surveillance. *Aids*. 2005;19 Suppl 2:S67-72.
236. Liu G, Lu H, Wang J, Xia D, Sun Y, Mi G, et al. Incidence of HIV and Syphilis among Men Who Have Sex with Men (MSM) in Beijing: An Open Cohort Study. *PloS one*. 2015;10(10):e0138232.
237. Zhao Y, Ma Y, Chen R, Li F, Qin X, Hu Z. Non-disclosure of Sexual Orientation to Parents Associated with Sexual Risk Behaviors Among Gay and Bisexual MSM in China. *AIDS and behavior*. 2016;20(1):193-203.

REFERENCES

238. Kelley CF, Kahle E, Siegler A, Sanchez T, del Rio C, Sullivan PS, et al. Applying a PrEP Continuum of Care for Men Who Have Sex With Men in Atlanta, Georgia. *CID*. 2015;61(10):1590-7.
239. National AIDS Programme. Global AIDS Response Progress Report 2014. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2015.
240. Tun W, Aung, P.P., Bajracharya, A., Yam, E., Ryan, C., Oo, S.M., Thein, Z.W., Paing, A.K., Pasricha, N., Willenberg, L., Aguis, P., Sein, T.T., Htun, S., Latt, N.Z., Luchters, S, editor Does sexual identity matter in accessing services? Risk profiles and sexual behaviours of different sexual identity types of young men who have sex with men in Myanmar. International AIDS Conference 2016; Durban, South Africa.
241. Ramakrishnan L, Ramanathan S, Chakrapani V, Goswami P, Deshpande S, Yadav D, et al. Comparison of Sexual Risk, HIV/STI Prevalence and Intervention Exposure Among Men Who Have Sex with Men and Women (MSMW) and Men Who Have Sex with Men Only (MSMO) in India: Implications for HIV Prevention. *AIDS and behavior*. 2015;19(12):2255-69.
242. Wirtz AL, Naing S, Clouse E, Thu KH, Mon SHH, Tun ZM, et al. The Parasol Protocol: An Implementation Science Study of HIV Continuum of Care Interventions for Gay Men and Transgender Women in Burma/Myanmar. *JMIR research protocols*. 2017;6(5):e90.
243. National AIDS Programme. National Guidelines: A Core package for HIV prevention amongst key populations in Myanmar Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2014.
244. Huang ZJ, He N, Nehl EJ, Zheng T, Smith BD, Zhang J, et al. Social network and other correlates of HIV testing: findings from male sex workers and other MSM in Shanghai, China. *AIDS and behavior*. 2012;16(4):858-71.
245. Kaplan RL, Sevelius J, Ribeiro K. In the name of brevity: The problem with binary HIV risk categories. *Global public health*. 2016;11(7-8):824-34.
246. Garcia J, Parker RG, Parker C, Wilson PA, Philbin M, Hirsch JS. The limitations of 'Black MSM' as a category: Why gender, sexuality, and desire still matter for social and biomedical HIV prevention methods. *Global public health*. 2016;11(7-8):1026-48.
247. Parker R, Aggleton P, Perez-Brumer AG. The trouble with 'Categories': Rethinking men who have sex with men, transgender and their equivalents in HIV prevention and health promotion. *Global public health*. 2016;11(7-8):819-23.
248. Tomori C, Srikrishnan AK, Ridgeway K, Solomon SS, Mehta SH, Solomon S, et al. Perspectives on Sexual Identity Formation, Identity Practices, and Identity Transitions Among Men Who Have Sex With Men in India. *Archives of sexual behavior*. 2016:1-10.
249. Gibson BA, Brown SE, Rutledge R, Wickersham JA, Kamarulzaman A, Altice FL. Gender identity, healthcare access, and risk reduction among Malaysia's mak nyah community. *Global public health*. 2016;11(7-8):1010-25.
250. Mitchell KM, Foss AM, Prudden HJ, Mukandavire Z, Pickles M, Williams JR, et al. Who mixes with whom among men who have sex with men? Implications for modelling the HIV epidemic in southern India. *Journal of theoretical biology*. 2014;355:140-50.
251. Boellstorff T. But do not identify as gay: A proleptic genealogy of the MSM category *Cultural Anthropology*. 2011;26(2):287 - 312.
252. Thomann M. HIV vulnerability and the erasure of sexual and gender diversity in Abidjan, Cote d'Ivoire. *Global public health*. 2016;11(7-8):994-1009.
253. BBC. A pride with no parade for Burma's first gay festival. BBC News [Internet]. 2012 02/02/2018. Available from: <http://www.bbc.com/news/world-asia-18106018>.
254. On Device Research. Myanmar: the final frontier for the mobile internet <https://ondeviceresearch.com/blog/myanmar-mobile-internet-report>: On Device Research 2014 [

255. Khine Soe Lin VdP, M. Identities in Motion: Cyberspace and Myanmar men have sex with men Research on Humanities and Social Science 2012;2(4).
256. Lampkin D, Crawley A, Lopez TP, Mejia CM, Yuen W, Levy V. Reaching Suburban Men Who Have Sex With Men for STD and HIV Services Through Online Social Networking Outreach: A Public Health Approach. *J Acquir Immune Def Syndr*. 2016;72(1):73-8.
257. Blas MM, Alva IE, Carcamo CP, Cabello R, Goodreau SM, Kimball AM, et al. Effect of an online video-based intervention to increase HIV testing in men who have sex with men in Peru. *PloS one*. 2010;5(5):e10448.
258. Lau JTF, Lau M, Cheung A, Tsui HY. A randomized controlled study to evaluate the efficacy of an Internet-based intervention in reducing HIV risk behaviors among men who have sex with men in Hong Kong. *AIDS care*. 2008;20(7):820-8.
259. Sharma M, Ying R, Tarr G, Barnabas R. Systematic review and meta-analysis of community and facility-based HIV testing to address linkage to care gaps in sub-Saharan Africa. *Nature*. 2015;528(7580):S77-S85.
260. INSIGHT START Study Group Initiation of Antiretroviral Therapy in Early Asymptomatic HIV Infection. *N Engl J Med*. 2015;373(9):795-807.
261. Strategic Information and Monitoring and Evaluation Working Group Technical and Strategy Group on AIDS. HIV Estimates and Projections: Asian Epidemiological Model Myanmar 2010-2015. Myanmar: Department of Health
262. Scott HM, Pollack L, Rebchook GM, Huebner DM, Peterson J, Kegeles SM. Peer Social Support is Associated with Recent HIV Testing Among Young Black Men Who Have Sex with Men. *AIDS and behavior*. 2014;18(5):913-20.
263. Young SD, Cumberland WG, Nianogo R, Menacho LA, Galea JT, Coates T. The HOPE Social Media Intervention for Global HIV Prevention: A Cluster Randomized Controlled Trial in Peru. *The lancet HIV*. 2015;2(1):e27-e32.
264. Williamson LM, Hart GJ, Flowers P, Frankis JS, Der GJ. The Gay Men's Task Force: the impact of peer education on the sexual health behaviour of homosexual men in Glasgow. *Sexually transmitted infections*. 2001;77(6):427-32.
265. Trapence G, Collins C, Avrett S, Carr R, Sanchez H, Ayala G, et al. From personal survival to public health: community leadership by men who have sex with men in the response to HIV. *Lancet*. 2012;380(9839):400-10.
266. Adebajo S, Eluwa G, Njab J, Oginni A, Ukwuije F, Ahonsi B, et al. Evaluating the effect of HIV prevention strategies on uptake of HIV counselling and testing among male most-at-risk-populations in Nigeria; a cross-sectional analysis. *Sexually transmitted infections*. 2015;91(8):555-60.
267. Minas BC, Giele CM, Laing SC, Bastian L, Burry AW, Sales KJ, et al. Early diagnosis of HIV among men who have sex with men in Western Australia: impact of a peer-led sexually transmissible infection testing service. *Sex Health*. 2015.
268. Lorente N, Preau M, Vernay-Vaisse C, Mora M, Blanche J, Otis J, et al. Expanding Access to Non-Medicalized Community-Based Rapid Testing to Men Who Have Sex with Men: An Urgent HIV Prevention Intervention (The ANRS-DRAG Study). *PloS one*. 2013;8(4):e61225.
269. National AIDS Programme. Joint Rapid Assessment of HIV Treatment in Myanmar: Final Report September 2013. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2013.
270. Pawa D, Firestone R, Ratchasi S, Dowling O, Jittakoat Y, Duke A, et al. Reducing HIV Risk among Transgender Women in Thailand: A Quasi-Experimental Evaluation of the Sisters Program. *PloS one*. 2013;8(10):e77113.
271. USAID. Linkages Thailand: Using peer mobilizers to increase uptake of HIV testing and counseling [Available from: <https://www.usaid.gov/what-we-do/global-health/hiv-and-aids/success-stories/linkages-thailand-using-peer-mobilizers>.

REFERENCES

272. Ti L, Hayashi K, Kaplan K, Suwannawong P, Wood E, Montaner J, et al. Willingness to access peer-delivered HIV testing and counseling among people who inject drugs in Bangkok, Thailand. *J Community Health*. 2013;38(3):427-33.
273. Njau B, Ostermann J, Brown D, Muhlbacher A, Reddy E, Thielman N. HIV testing preferences in Tanzania: a qualitative exploration of the importance of confidentiality, accessibility, and quality of service. *BMC public health*. 2014;14:838.
274. Repper J, Carter T. A review of the literature on peer support in mental health services. *Journal of mental health (Abingdon, England)*. 2011;20(4):392-411.
275. Pedrana A, Koester, K., Stewart, W., Gibson, S., Powell, S., Stooove, M, editor Community-based rapid HIV point-of-care testing with contrasting health systems: A tale of two cities from San Francisco and Melbourne. 20th International AIDS Conference 2014 July 20 - 25, 2014; Melbourne, Australia
276. WHO. Service delivery approaches to HIV testing and counselling (HTC): a strategic HTC policy framework. Geneva, Switzerland: WHO; 2012.
277. Zhang DP, Han L, Li CM, Meng SN, Leng ZW, Li F, et al. The impact of community-based organizations in HIV testing mobilization among men who have sex with men. *Zhonghua Yu Fang Yi Xue Za Zhi*. 2013;47(5):431-4.
278. Ryan KE, Wilkinson AL, Leitinger D, El-Hayek C, Ryan C, Pedrana A, et al. Characteristics of gay, bisexual and other men who have sex with men testing and retesting at Australia. *Sex Health*. 2016.
279. Bowring AL, Veronese V, Doyle JS, Stooove M, Hellard M. HIV and Sexual Risk Among Men Who Have Sex With Men and Women in Asia: A Systematic Review and Meta-Analysis. *AIDS and behavior*. 2016;20(10):2243-65.
280. Churcher S. Stigma related to HIV and AIDS as a barrier to accessing health care in Thailand: a review of recent literature. *WHO South East Asia Journal of Public Health* 2013;2(2):12 - 22.
281. Chan KY, Yang Y, Li ZR, Stooove MA, Reidpath DD. Interrelationships between HIV/AIDS and risk behavior prejudice among medical students in Southern China. *Current HIV research*. 2009;7(6):601-11.
282. Chan KY, Stooove MA, Reidpath DD. Stigma, social reciprocity and exclusion of HIV/AIDS patients with illicit drug histories: a study of Thai nurses' attitudes. *Harm reduction journal*. 2008;5:28.
283. Meehan SA, Leon N, Naidoo P, Jennings K, Burger R, Beyers N. Availability and acceptability of HIV counselling and testing services. A qualitative study comparing clients' experiences of accessing HIV testing at public sector primary health care facilities or non-governmental mobile services in Cape Town, South Africa. *BMC public health*. 2015;15:845.
284. Wei C, Muessig KE, Bien C, Yang L, Meng R, Han L, et al. Strategies for Promoting HIV Testing Uptake: Willingness to Receive Couple-based and Collective HIV Testing among a Cross-sectional Online Sample of Men Who Have Sex with Men in China. *Sexually transmitted infections*. 2014;90(6):469-74.
285. Rhodes SD, Vissman AT, Stowers J, Miller C, McCoy TP, Hergenrather KC, et al. A CBPR partnership increases HIV testing among men who have sex with men (MSM): outcome findings from a pilot test of the CyBER/testing internet intervention. *Health education & behavior : the official publication of the Society for Public Health Education*. 2011;38(3):311-20.
286. UNDP. Towards Universal Access: Examples of Municipal HIV programming for men who have sex with men and transgender people in six Asian cities. Bangkok, Thailand: HIV, Health and Development Programme for Asia and the Pacific; 2011.
287. Lorenc T, Marrero-Guillamón I, Llewellyn A, Aggleton P, Cooper C, Lehmann A, et al. HIV testing among men who have sex with men (MSM): systematic review of qualitative evidence. *Health Educ Res*. 2011;26(5):834-46.

288. Deblonde J, De Koker, P., Hamers, FF et al. Barriers to HIV testing in Europe: a systematic review. *Eur J Public Health* 2010;20:422 - 32.
289. Simoni JM, Nelson KM, Franks JC, Yard SS, Lehavot K. Are Peer Interventions for HIV Efficacious? A Systematic Review. *AIDS and behavior*. 2011;15(8):1589-95.
290. Peterson JL, Rothenberg R, Kraft JM, Beeker C, Trotter R. Perceived condom norms and HIV risks among social and sexual networks of young African American men who have sex with men. *Health Educ Res*. 2009;24(1):119-27.
291. Choi K-H, Ning Z, Gregorich SE, Pan Q-c. The Influence of Social and Sexual Networks in the Spread of HIV and Syphilis Among Men Who Have Sex With Men in Shanghai, China. *J Acquir Immune Def Syndr*. 2007;45(1):77-84.
292. Flowers P, Duncan B, Frankis J. Community, responsibility and culpability: HIV risk-management amongst Scottish gay men. 2000;10(4):285-300.
293. Sempe S, Coquelin, V., Rios, L., Pelletier, V., Stranz, R, editor Peer testing: how queer! How satisfying? Evaluating the immediate satisfaction and self-perceived effects of peer prevention interventions, including HIV rapid testing, in gay cruising areas and sex clubs. 19th International AIDS Conference 2012; Washington D.C., USA.
294. Vaughan M. MSM community's perception of HTC service models for MSM 2015.
295. National AIDS Programme. Global AIDS Response Progress Report. Yangon, Myanmar: National AIDS Programme, Ministry of Health and Sports; 2014.
296. Adam PCG, de Wit JBF, Toskin I, Mathers BM, Nashkhoev M, Zablotska I, et al. Estimating Levels of HIV Testing, HIV Prevention Coverage, HIV Knowledge, and Condom Use Among Men Who Have Sex With Men (MSM) in Low-Income and Middle-Income Countries. *J Acquir Immune Def Syndr*. 2009;52:S143-S51.
297. UNAIDS. Global AIDS Update 2016. Geneva, Switzerland: UNAIDS; 2016.
298. Sullivan PS, Hamouda O, Delpech V, Geduld JE, Prejean J, Semaille C, et al. Reemergence of the HIV epidemic among men who have sex with men in North America, Western Europe, and Australia, 1996-2005. *Annals of epidemiology*. 2009;19(6):423-31.
299. Schwartz SR, Nowak RG, Orazulike I, Keshinro B, Ake J, Kennedy S, et al. The immediate effect of the Same-Sex Marriage Prohibition Act on stigma, discrimination, and engagement on HIV prevention and treatment services in men who have sex with men in Nigeria: analysis of prospective data from the TRUST cohort. *The lancet HIV*. 2015;2(7):e299-306.
300. UNAIDS. Prevention Gap Report 2016. Geneva, Switzerland: UNAIDS; 2016.
301. Nelson KM, Pantalone DW, Gamarel KE, Carey MP, Simoni JM. Correlates of Never Testing for HIV Among Sexually Active Internet-Recruited Gay, Bisexual, and Other Men Who Have Sex with Men in the United States. *AIDS patient care and STDs*. 2018;32(1):9-15.
302. Marcus U, Gassowski M, Drewes J. HIV risk perception and testing behaviours among men having sex with men (MSM) reporting potential transmission risks in the previous 12 months from a large online sample of MSM living in Germany. *BMC public health*. 2016;16(1):1111.
303. Bolsewicz K, Vallely A, Debattista J, Whittaker A, Fitzgerald L. Factors impacting HIV testing: a review--perspectives from Australia, Canada, and the UK. *AIDS care*. 2015;27(5):570-80.
304. Berg RC. Predictors of never testing for HIV among a national online sample of men who have sex with men in Norway. *Scandinavian journal of public health*. 2013;41(4):398-404.
305. Conway DP, Holt M, Couldwell DL, Smith DE, Davies SC, McNulty A, et al. Barriers to HIV testing and characteristics associated with never testing among gay and bisexual men attending sexual health clinics in Sydney. *Journal of the International AIDS Society*. 2015;18:20221.
306. Race K. Speculative pragmatism and intimate arrangements: online hook-up devices in gay life. *Culture, health & sexuality*. 2015;17(4):496-511.

REFERENCES

307. Sun CJ, Reboussin B, Mann L, Garcia M, Rhodes SD. The HIV Risk Profiles of Latino Sexual Minorities and Transgender Persons Who Use Websites or Apps Designed for Social and Sexual Networking. *Health education & behavior : the official publication of the Society for Public Health Education*. 2016;43(1):86-93.
308. Zou H, Fan, Song. Characteristics of men who have sex with men who use smartphone geosocial networking applications and implications for HIV interventions: A systematic review and meta-analysis. *Archives of sexual behavior*. 2016.
309. Garofalo R, Herrick A, Mustanski BS, Donenberg GR. Tip of the Iceberg: young men who have sex with men, the Internet, and HIV risk. *American journal of public health*. 2007;97(6):1113-7.
310. Phillips G, 2nd, Magnus M, Kuo I, Rawls A, Peterson J, Jia Y, et al. Use of geosocial networking (GSN) mobile phone applications to find men for sex by men who have sex with men (MSM) in Washington, DC. *AIDS and behavior*. 2014;18(9):1630-7.
311. Pachankis J, Lelutiu-Weinberger C, Golub S, Parsons J. Developing an Online Health Intervention for Young Gay and Bisexual Men. *AIDS and behavior*. 2013;17(9):2986-98.
312. Muessig KE, Pike EC, Fowler B, LeGrand S, Parsons JT, Bull SS, et al. Putting prevention in their pockets: developing mobile phone-based HIV interventions for black men who have sex with men. *AIDS patient care and STDs*. 2013;27(4):211-22.
313. Holloway IW, Rice E, Gibbs J, Winetrobe H, Dunlap S, Rhoades H. Acceptability of Smartphone Application-Based HIV Prevention Among Young Men Who Have Sex With Men. *AIDS and behavior*. 2014;18(2):285-96.
314. Bowen AM, Williams ML, Daniel CM, Clayton S. Internet based HIV prevention research targeting rural MSM: feasibility, acceptability, and preliminary efficacy. *Journal of behavioral medicine*. 2008;31(6):463-77.
315. Young SD, Jaganath D. Online social networking for HIV education and prevention: a mixed-methods analysis. *Sexually transmitted diseases*. 2013;40(2):162-7.
316. Rawat S, Wilkerson JM, Lawler SM, Patankar P, Rosser BRS, Shukla K, et al. Recommendations for the Development of a Mobile HIV Prevention Intervention for Men Who Have Sex With Men and Hijras in Mumbai: Qualitative Study. *JMIR public health and surveillance*. 2018;4(2):e46.
317. Liao A, Millett G, Marks G. Meta-analytic examination of online sex-seeking and sexual risk behavior among men who have sex with men. *Sexually transmitted diseases*. 2006;33(9):576-84.
318. Landovitz RJ, Tseng CH, Weissman M, Haymer M, Mendenhall B, Rogers K, et al. Epidemiology, sexual risk behavior, and HIV prevention practices of men who have sex with men using GRINDR in Los Angeles, California. *Journal of urban health : bulletin of the New York Academy of Medicine*. 2013;90(4):729-39.
319. Beymer MR, Weiss RE, Bolan RK, Rudy ET, Bourque LB, Rodriguez JP, et al. Sex on demand: geosocial networking phone apps and risk of sexually transmitted infections among a cross-sectional sample of men who have sex with men in Los Angeles County. *Sexually transmitted infections*. 2014;90(7):567-72.
320. Lehmler JJ, Iloerger M. Social networking smartphone applications and sexual health outcomes among men who have sex with men. *PloS one*. 2014;9(1):e86603.
321. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097.
322. Effective Public Health Practice Project. Quality Assessment Tool For Quantitative Studies. Ontario, Canada: Public Health Practice Project; 1998.
323. Bauermeister JA, Pingel ES, Jadwin-Cakmak L, Harper GW, Horvath K, Weiss G, et al. Acceptability and preliminary efficacy of a tailored online HIV/STI testing intervention for young men who have sex with men: the Get Connected! program. *AIDS and behavior*. 2015;19(10):1860-74.

324. Blas MM, Menacho, L., Alva, I, editor Randomized controlled trial to evaluate the effect of a combined web-based intervention to increase HIV testing in men who have sex with men in Peru. 20th International AIDS Conference; 2014; Melbourne, Australia
325. Hirshfield S, Chiasson MA, Joseph H, Scheinmann R, Johnson WD, Remien RH, et al. An online randomized controlled trial evaluating HIV prevention digital media interventions for men who have sex with men. *PloS one*. 2012;7(10):e46252.
326. Ko NY, Hsieh CH, Wang MC, Lee C, Chen CL, Chung AC, et al. Effects of Internet popular opinion leaders (iPOL) among Internet-using men who have sex with men. *Journal of medical Internet research*. 2013;15(2):e40.
327. Patel VV. CHALO! A social media based peer-delivered intervention increases HIV testing in men who have sex with men in Mumbai, India: a randomized trial. International AIDS Society AIDS Conference; Durban, South Africa 2016.
328. Rhodes SD, McCoy TP, Tanner AE, Stowers J, Bachmann LH, Nguyen AL, et al. Using Social Media to Increase HIV Testing Among Gay and Bisexual Men, Other Men Who Have Sex With Men, and Transgender Persons: Outcomes From a Randomized Community Trial. *Clinical infectious diseases* : an official publication of the Infectious Diseases Society of America. 2016;62(11):1450-3.
329. Tang W, Han L, Best J, Zhang Y, Mollan K, Kim J, et al. Crowdsourcing HIV Test Promotion Videos: A Noninferiority Randomized Controlled Trial in China. *Clinical infectious diseases* : an official publication of the Infectious Diseases Society of America. 2016;62(11):1436-42.
330. Washington TA, Applewhite S, Glenn W. Using Facebook as a Platform to Direct Young Black Men Who Have Sex With Men to a Video-Based HIV Testing Intervention: A Feasibility Study. *Urban social work*. 2017;1(1):36-52.
331. Wang Z, Lau JTF, Ip M, Ho SPY, Mo PKH, Latkin C, et al. A Randomized Controlled Trial Evaluating Efficacy of Promoting a Home-Based HIV Self-Testing with Online Counseling on Increasing HIV Testing Among Men Who Have Sex with Men. *AIDS and behavior*. 2018;22(1):190-201.
332. Young SD, Cumberland WG, Lee S-J, Jaganath D, Szekeres G, Coates T. Social networking technologies as an emerging tool for HIV prevention: a cluster randomized trial. *Annals of internal medicine*. 2013;159(5):318-24.
333. Young SD, Cumberland WG, Nianogo R, Menacho LA, Galea JT, Coates T. The HOPE social media intervention for global HIV prevention in Peru: a cluster randomised controlled trial. *The lancet HIV*. 2015;2(1):e27-32.
334. World Bank country and lending groups [Internet]. The World Bank Group. 2018 [cited 05/12/2018]. Available from: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>.
335. Khosropour CM, Lake JG, Sullivan PS. Are MSM willing to SMS for HIV prevention? *Journal of health communication*. 2014;19(1):57-66.
336. Czarny HN, Broaddus MR. Acceptability of HIV Prevention Information Delivered Through Established Geosocial Networking Mobile Applications to Men Who Have Sex With Men. *AIDS and behavior*. 2017.
337. Qiao S, Zhou G, Li X. Disclosure of Same-Sex Behaviors to Health-care Providers and Uptake of HIV Testing for Men Who Have Sex With Men: A Systematic Review. *American journal of men's health*. 2018;12(5):1197-214.
338. Johnson C, Baggaley R, Forsythe S, van Rooyen H, Ford N, Napierala Mavedzenge S, et al. Realizing the potential for HIV self-testing. *AIDS and behavior*. 2014;18 Suppl 4:S391-5.
339. Ryan KE, Wilkinson AL, Leitingner D, El-Hayek C, Ryan C, Pedrana A, et al. Characteristics of gay, bisexual and other men who have sex with men testing and retesting at Australia's first shop-front rapid point-of-care HIV testing service. *Sex Health*. 2016;13(6):560-7.

REFERENCES

340. Wilkinson AL, Pedrana AE, El-Hayek C, Vella AM, Asselin J, Batrouney C, et al. The Impact of a Social Marketing Campaign on HIV and Sexually Transmissible Infection Testing Among Men Who Have Sex With Men in Australia. *Sexually transmitted diseases*. 2016;43(1):49-56.
341. Katz DA, Dombrowski JC, Swanson F, Buskin SE, Golden MR, Stekler JD. HIV intertest interval among MSM in King County, Washington. *Sexually transmitted infections*. 2013;89(1):32-7.
342. Strecher VJ, McClure J, Alexander G, Chakraborty B, Nair V, Konkel J, et al. The role of engagement in a tailored web-based smoking cessation program: randomized controlled trial. *Journal of medical Internet research*. 2008;10(5):e36.
343. Neiger BL, Thackeray R, Burton SH, Giraud-Carrier CG, Fagen MC. Evaluating social media's capacity to develop engaged audiences in health promotion settings: use of Twitter metrics as a case study. *Health promotion practice*. 2013;14(2):157-62.
344. Bailey JV, Murray E, Rait G, Mercer CH, Morris RW, Peacock R, et al. Interactive computer-based interventions for sexual health promotion. *Cochrane Database of Systematic Reviews*. 2010(9).
345. Goldenberg T, McDougal SJ, Sullivan PS, Stekler JD, Stephenson R. Preferences for a Mobile HIV Prevention App for Men Who Have Sex With Men. *JMIR mHealth uHealth*. 2014;2(4):e47-e.
346. Gold J, Pedrana AE, Sacks-Davis R, Hellard ME, Chang S, Howard S, et al. A systematic examination of the use of online social networking sites for sexual health promotion. *BMC public health*. 2011;11:583.
347. Jones J, Salazar LF. A Review of HIV Prevention Studies that Use Social Networking Sites: Implications for Recruitment, Health Promotion Campaigns, and Efficacy Trials. *AIDS and behavior*. 2016;20(11):2772-81.
348. Mowlabocus S, Haslop C, Dasgupta RK. From Scene to Screen: The challenges and opportunities of commercial digital platforms for HIV community outreach. 2016;2(4):2056305116672886.
349. Norman D. *The design of everyday things*. New York: Doubleday; 1988.
350. Thomas K, Linderoth C, Bendtsen M, Bendtsen P, Mussener U. Text Message-Based Intervention Targeting Alcohol Consumption Among University Students: Findings From a Formative Development Study. *JMIR Mhealth Uhealth*. 2016;4(4):e119.
351. Duff O, Walsh D, Malone S, McDermott L, Furlong B, O'Connor N, et al. MedFit App, a Behavior-Changing, Theoretically Informed Mobile App for Patient Self-Management of Cardiovascular Disease: User-Centered Development. *JMIR formative research*. 2018;2(1):e8-e.
352. Henny KD, Wilkes AL, McDonald CM, Denson DJ, Neumann MS. A Rapid Review of eHealth Interventions Addressing the Continuum of HIV Care (2007-2017). *AIDS and behavior*. 2018;22(1):43-63.
353. Simoni JM, Ronen K, Aunon FM. Health Behavior Theory to Enhance eHealth Intervention Research in HIV: Rationale and Review. *Current HIV/AIDS reports*. 2018;15(6):423-30.
354. Magee JC, Bigelow L, Dehaan S, Mustanski BS. Sexual health information seeking online: a mixed-methods study among lesbian, gay, bisexual, and transgender young people. *Health education & behavior : the official publication of the Society for Public Health Education*. 2012;39(3):276-89.
355. WHO. *Priority HIV and sexual health interventions in the health sector for men who have sex with men and transgender people in the Asia Pacific region* Geneva: WHO; 2010.
356. Federation MC. *ICT statistics: current status and trends 2019* [Available from: <http://mcf.org.mm/useful-statistics.html>].
357. Anonymous. *Secrets and dangers: gay Yangon's online dating scene*. Myanmar Times. 2017 01 June 2017.
358. UNAIDS. *Situational analysis of the HIV response among sex workers in Myanmar*. Yangon: UNAIDS 2016.

359. Shangani S, Escudero D, Kirwa K, Harrison A, Marshall B, Operario D. Effectiveness of peer-led interventions to increase HIV testing among men who have sex with men: a systematic review and meta-analysis. *AIDS care*. 2017;29(8):1003-13.
360. Leiting D, Ryan KE, Brown G, Pedrana A, Wilkinson AL, Ryan C, et al. Acceptability and HIV Prevention Benefits of a Peer-Based Model of Rapid Point of Care HIV Testing for Australian Gay, Bisexual and Other Men Who Have Sex with Men. *AIDS and behavior*. 2018;22(1):178-89.
361. Wongkanya R, Pankam T, Wolf S, Pattanachaiwit S, Jantarapakde J, Pengnongyang S, et al. HIV rapid diagnostic testing by lay providers in a key population-led health service programme in Thailand. *Journal of virus eradication*. 2018;4(1):12-5.
362. Suthar AB, Ford N, Bachanas PJ, Wong VJ, Rajan JS, Saltzman AK, et al. Towards universal voluntary HIV testing and counselling: a systematic review and meta-analysis of community-based approaches. *PLoS Med*. 2013;10(8):e1001496.
363. Jamil MS, Prestage G, Fairley CK, Grulich AE, Smith KS, Chen M, et al. Effect of availability of HIV self-testing on HIV testing frequency in gay and bisexual men at high risk of infection (FORTH): a waiting-list randomised controlled trial. *The lancet HIV*. 2017;4(6):e241-e50.
364. Zhang C, Li X, Brecht ML, Koniak-Griffin D. Can self-testing increase HIV testing among men who have sex with men: A systematic review and meta-analysis. *PloS one*. 2017;12(11):eo188890.
365. Wang C, Tucker JD, Liu C, Zheng H, Tang W, Ling L. Condom use social norms and self-efficacy with different kinds of male partners among Chinese men who have sex with men: results from an online survey. *BMC public health*. 2018;18(1):1175.
366. Li H, Xue L, Tucker JD, Wei C, Durvasula M, Hu W, et al. Condom use peer norms and self-efficacy as mediators between community engagement and condom use among Chinese men who have sex with men. *BMC public health*. 2017;17(1):641.
367. Subramanian T, Ramakrishnan L, Aridoss S, Goswami P, Kanguswami B, Shajan M, et al. Increasing condom use and declining STI prevalence in high-risk MSM and TGs: evaluation of a large-scale prevention program in Tamil Nadu, India. *BMC public health*. 2013;13:857.
368. Ramanathan S, Deshpande S, Gautam A, Pardeshi DB, Ramakrishnan L, Goswami P, et al. Increase in condom use and decline in prevalence of sexually transmitted infections among high-risk men who have sex with men and transgender persons in Maharashtra, India: Avahan, the India AIDS Initiative. *BMC public health*. 2014;14:784.
369. Kumar GA, Dandona R, Poluru R, Chandran SA, Alary M, Dandona L. Patterns of condom use by men who have sex with men before and after the Avahan intervention in Andhra Pradesh state of India. *BMC public health*. 2014;14:64.
370. Foundation BaMG. Avahan—The India AIDS Initiative: The business of HIV prevention at sca. New Dehli, India: Bill and Melinda Gates Foundation; 2008.
371. Zhao P, Cao B, Bien-Gund CH, Tang W, Ong JJ, Ding Y, et al. Identifying MSM-competent physicians in China: a national online cross-sectional survey among physicians who see male HIV/STI patients. *BMC Health Serv Res*. 2018;18(1):964.
372. Hankins C, Macklin R, Warren M. Translating PrEP effectiveness into public health impact: key considerations for decision-makers on cost-effectiveness, price, regulatory issues, distributive justice and advocacy for access. *Journal of the International AIDS Society*. 2015;18(4 Suppl 3):19973.
373. Cáceres CF, O'Reilly KR, Mayer KH, Baggaley R. PrEP implementation: moving from trials to policy and practice. *Journal of the International AIDS Society*. 2015;18(4 Suppl 3):20222-.
374. Cáceres CF, Borquez A, Klausner JD, Baggaley R, Beyrer C. Implementation of pre-exposure prophylaxis for human immunodeficiency virus infection: progress and emerging issues in research and policy. *Journal of the International AIDS Society*. 2016;19(7(Suppl 6)):21108.
375. Aung ZZ, Oo MM, Tripathy JP, Kyaw NTT, Hone S, Oo HN, et al. Are death and loss to follow-up still high in people living with HIV on ART after national scale-up and earlier treatment initiation? A

REFERENCES

- large cohort study in government hospital-based setting, Myanmar: 2013-2016. *PloS one*. 2018;13(9):e0204550-e.
376. Bermúdez-Aza EH, Shetty S, Ousley J, Kyaw NTT, Soe TT, Soe K, et al. Long-term clinical, immunological and virological outcomes of patients on antiretroviral therapy in southern Myanmar. *PloS one*. 2018;13(2):e0191695-e.
377. Mburu G, Paing AZ, Myint NN, Di W, Thu KH, Ram M, et al. Retention and mortality outcomes from a community-supported public-private HIV treatment programme in Myanmar. *Journal of the International AIDS Society*. 2016;19(1):20926-.
378. Thida A, Tun STT, Zaw SKK, Lover AA, Cavailler P, Chunn J, et al. Retention and Risk Factors for Attrition in a Large Public Health ART Program in Myanmar: A Retrospective Cohort Analysis. *PLOS ONne*. 2014;9(9):e108615.
379. Fujita M, Poudel KC, Do Thi N, Bui Duc D, Nguyen Van K, Green K, et al. A new analytical framework of 'continuum of prevention and care' to maximize HIV case detection and retention in care in Vietnam. 2012;12(1):483.
380. Ministry of Health and Sports. Strategic action plan for strengthening health information 2017 - 2020. Yangon, Myanmar: Ministry of Health and Sports; 2017.
381. Goldenberg T., McDougal, S., Sullivan, P, Stekler, J, et al. P. Preferences for a Mobile HIV Prevention App for Men Who Have Sex With Men. *JMIR Mhealth Ulhealth*. 2014; 2(4);47
382. Zhou, L., Bao, J., Watzlaf, V., Parmanto, B. Barriers to and Facilitators of the Use of Mobile Health Apps From a Security Perspective: Mixed-Methods Study. *JMIR Mhealth Ulhealth*. 2019; 7 (4);e11223
383. Mitchell JW, Torres MB, Joe J, Danh T, Gass B, Horvath KJ. Formative Work to Develop a Tailored HIV Testing Smartphone App for Diverse, At-Risk, HIV-Negative Men Who Have Sex With Men: A Focus Group Study. *JMIR Mhealth Ulhealth* 2016; 4 (4):128

APPENDICES

1. **Veronese V**, Oo ZM, Thein ZW, Aung PP, Draper BL, Hughes C, Thant M., Stoové M. Characteristics of men who have sex with men and transgender women who test frequently for HIV in Myanmar. *J Glob Health Rep* 2018;2(e2018040).
2. **Veronese V**, Clouse E, Wirtz AL, Thu KH, Naing S, Baral SD, Beyrer C, Stoové M. “We are not gays... don’t tell me those things”: engaging ‘hidden’ men who have sex with men and transgender women in HIV prevention in Myanmar. *BMC Public Health*. 2019; 19(1):63.
3. **Veronese V**, Oo ZM, Thein ZW, Aung PP, Draper BL, Hughes C, Thant M., Stoové M. Acceptability of peer-delivered HIV testing and counselling among men who have sex with men and transgender women in Myanmar. *AIDS Behav*, 2018. 22:p. 2426 – 2434

Characteristics of men who have sex with men and transgender women in Myanmar who test frequently for HIV

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Background HIV prevalence among men who have sex with men (MSM) and transgender women (TW) in Myanmar is increasing and less than half report having a HIV test in the past 12 months. The promotion of regular testing among this group has been identified as a key priority of the national HIV response, yet there remains limited information on HIV testing patterns and frequency among MSM and TW.

Methods A cross-sectional quantitative survey was conducted among self-identifying MSM and TW in November 2015 recruited from known hot-spot locations in Yangon and Mandalay to characterise the self-reported HIV testing frequencies among MSM and TW and explore factors associated with high frequency HIV testing.

Results Among 353 HIV negative or unknown MSM and TW, more than half were identified as high frequency testers based on their regular HIV testing routine and date of last HIV test; this was significantly associated with reporting recent sex with regular male partners and location of last HIV test.

Conclusion Our findings contrast with national data suggesting sub-optimal testing uptake and support HIV testing delivered through community-based, tailored HIV testing services and the role of such models in establishing and maintaining regular HIV testing behaviours among MSM and TW in Myanmar.

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Men who have sex with men (MSM) and transgender women (TW) in Asia are more than 18 times more likely to acquire HIV compared to the general population (1). Despite a general decline in HIV prevalence in the region, new and re-emerging epidemics have been observed among MSM and TW in some Asian countries, including the Philippines, Thailand and Myanmar (2-4). In Myanmar, HIV prevalence among MSM and TW nationally is estimated at 11.6% with higher concentrations in the major urban areas of Yangon (27%) and Mandalay (22%) (2).

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Regular HIV testing and timely diagnoses are important components of global HIV prevention and AIDS elimination strategies (5) and are prominent within the Myanmar HIV National Strategic Plan (2). Early detection of HIV facilitates timely access to HIV treatment and viral suppression, reducing the probability of forward transmission (6), and also affords opportunities for risk reduction practices (7). Undiagnosed HIV is identified as a key driver of HIV transmission in many countries, (8, 9); in the context of ongoing sexual risk behaviours among MSM and TW (10) delayed diagnoses of HIV are also likely to be a key factor in ongoing transmissions in Myanmar.

However, recent self-reported data indicates that less than half of all MSM and TW in Myanmar have tested for HIV in the past 12 months, while estimated coverage of HIV prevention programmes among MSM and TW is around 50% (2). Access to HIV testing and prevention services is limited by considerable stigma and discrimination experienced by MSM and TW in Myanmar (11–13). Sex between men remains criminalised, and alongside certain cultural and religious mores, this criminalisation contributes to an environment in which sexual minorities experience ongoing harassment and decreased access to HIV services (14, 15).

Regular and routine HIV testing among MSM and TW is crucial to meaningfully impact the HIV epidemic and has been identified as a key component of Myanmar's national response to HIV. While national guidelines for HIV testing are currently being developed in Myanmar, HIV testing services currently encourage a three-monthly HIV testing schedule for MSM and TW clients who report high-risk behaviours (16). Only one study in Myanmar to date has reported on recent HIV testing, finding that around one third of MSM and TW reported having an HIV test in the past three months (17). There remains limited information on HIV testing patterns and frequency among MSM and TW in Myanmar to help inform local HIV strategies.

This study explores the self-reported histories of HIV testing among MSM and TW recruited through outreach activities in Yangon and Mandalay. To help inform strategies to enhance frequent HIV testing behaviours, we aimed to: 1) characterise the self-reported HIV testing frequency among MSM and TW; and 2) explore factors associated with MSM and TW reporting high frequency HIV testing.

METHODS

The methods for this study have been described in detail elsewhere (18). Briefly, a cross-sectional survey was administered among self-identifying MSM and TW in Yangon and Mandalay between November and December 2014. Participants were recruited by peer educators from the Myanmar Business Coalition on AIDS (MBCA), a non-governmental organisation (NGO) providing community-based HIV education and prevention services across Myanmar, who received training in research methodology. These peer researchers recruited MSM and TW using snow-ball and time-venue-based sampling in known MSM and TW 'hotspots'. Participants were provided with non-identifying study cards that provided information on when and where they could participate in surveys and up to three additional cards were given if participants indicated they knew peers who would be interested and eligible for participation. Eligibility criteria for survey participation included being biologically male, aged 18 and over, reporting anal sex with a male partner in the past 12 months, being willing and able to provide informed consent and no previous participation in the study.

Data collection

Surveys were peer-researcher administered in the local language using secure, electronic tablets. Surveys explored factors related to socio-demographic characteristics, sexual risk behaviours, HIV prevention practices, knowledge, attitudes and use of HIV/STI risk reduction strategies and self-perceived HIV risk among MSM and TW. Variables included in this analyses were: location of recruitment (Yangon, Mandalay), age, gender identity (male, TW), highest level of education (primary, middle, high school, tertiary), median monthly income in Myanmar Kyat (MMK), male sex partners during past three months (casual only, regular only, both casu-

al and regular), location of last test (government hospital or clinic, private hospital or clinic, international/non-government organisation (i/NGO)), primary reason for undertaking last HIV test (concern/ interest in knowing status, part of regular testing pattern, suggestion from sexual partner or friend, symptoms of HIV, other) and self-perceived likelihood of future HIV acquisition (very unlikely, unlikely, neutral, likely, very likely). Barriers to HIV testing were assessed using Likert scales responses (strongly disagree, disagree, neutral, agree, strongly agree) to statements about being worried about stigma when attending a HIV testing clinic, being afraid of disclosing HIV test results to others, not being able to afford HIV testing costs, not having the time to test for HIV, finding it generally difficult to access HIV testing services, and having to wait a long time to test for HIV. Proportions of participants reporting specific barriers to were determined by dichotomising level of agreement (strongly agree/agree versus neutral/disagree/strongly disagree).

Analysis

Our outcome of interest was high frequency testing behaviour, defined as reporting typically testing for HIV every three months and reporting receiving a HIV test within the past six months. We created a dichotomous (yes, no), composite variable to classify HIV undiagnosed MSM and TW as high frequency testers using the following variables: usual frequency of HIV testing (<3 months, every 3-6 months, every 6-12 months, every 12-24 months, >24 months) and; time since last HIV test (past month, 1-6 months, 7-12 months, 1-2 years ago, >2 years/never).

Descriptive statistics were used to characterise high frequency testers across socio-demographics, sexual risk behaviours, and self-reported barriers to testing and perceived HIV risk. Analysis was restricted to participants who were HIV-negative or status unknown and who provided data on HIV status and the two testing variables used to make the composite outcome variable; Pearson's chi-square was used to assess any significant differences between HIV undiagnosed participants included and excluded in the analysis on the basis of missing data across socio-demographic variables. Univariable and multivariable logistic regression identified variables significantly associated with high frequency testing; variables significant in univariable analyses ($P<0.1$) were retained in the multivariable model. Analyses were conducted using Stata (Version 13, Stata Corp., College Station, TX, USA). Statistical significance in multivariable model was set at $P<0.05$.

Ethics

Ethics approval was granted by the Department of Medical Research Ethics Review Committee, Myanmar and Alfred Hospital Human Research Ethics Committee, Melbourne, Australia (Project number 445/14).

RESULTS

In total, 520 MSM and TW participants were recruited in Yangon ($n=227$) and Mandalay ($n=293$). Participants with a known HIV positive status ($n=66$), or with missing data on HIV status ($n=10$) or the two HIV testing variables used to classify high frequency testing behaviour ($n=91$) were excluded from analyses. Participants whose data was excluded on the basis of missing data HIV testing variables were significantly more likely to be older, report lower income and educational attainment ($P<0.05$) compared to included participants (data not shown).

Among the remaining 353 HIV-negative and undiagnosed participants, just over half were recruited from Mandalay, were aged under 25 years and educated to tertiary or high school level. One in five participants identified as TW, while the rest identified as male gender. The median monthly income was 150,000 MMK (US\$ 109; interquartile range IQR 100,000-200,000 MMK).

Over one third of participants reported both regular and casual sex partners in the past three months, while 34% and 28% reported exclusively casual and regular sex partners, respectively. The most commonly reported barriers to HIV testing included not having enough time to test

Table 1. Socio-demographic characteristics, sexual behaviour and HIV testing patterns among MSM and TW in Myanmar (n=353)

VARIABLE	N (%)
Location:	
Yangon	151 (42.8)
Mandalay	202 (57.2)
Age:	
Median (IQR)	23 years (20-28 years)
<25	197 (56.0)
25-29	93 (26.4)
30>	62 (17.6)
Self-reported gender:	
Male	284 (80.7)
TW	68 (19.3)
Highest level of education achieved:	
Tertiary level	110 (31.3)
High school	133 (37.8)
Middle school	86 (24.4)
Primary school or below	23 (6.5)
Monthly income:	
Median monthly amount in MMK (IQR)	150,000 (100,000-200,000)
Above median (>150,000 MMK)	125 (35.7)
Below median (<150,000 MMK)	225 (63.7)
Sexual partners in past three months:	
Both regular and casual partners	127 (37.6)
Regular partner(s) only	96 (28.4)
Casual partner(s) only	115 (34.0)
Self-reported likelihood of acquiring HIV in the future:	
Likely/very likely	170 (50.2)
Very unlikely/Unlikely/Neutral	169 (49.9)
Perceived barriers to HIV testing:	
<i>I worry about stigma if seen attending a HIV testing clinic</i>	
Agree	78 (23.8)
Disagree	250 (76.2)
<i>I am afraid of letting people know my HIV test result</i>	
Agree	120 (36.5)
Disagree	209 (63.5)
<i>I cannot afford the costs associated with HIV testing</i>	
Agree	87 (26.5)
Disagree	241 (73.5)
<i>I don't have time to test for HIV</i>	
Agree	158 (48.0)
Disagree	171 (52.0)
<i>I find it difficult to access services HIV testing service</i>	
Agree	116 (35.3)
Disagree	213 (64.7)
<i>I have to wait a long time to test for HIV</i>	
Agree	88 (26.8)
Disagree	241 (73.2)
HIV testing behaviours:	
Reason for undertaking last HIV test*	
Concern/ interest to know status	321 (90.3)
Part of regular testing pattern	94 (26.3)
Suggestion from sexual partner or friend	63 (17.8)
Symptoms of HIV	11 (3.1)
Other	26 (7.9)

Table 1. Continued

VARIABLE	N (%)
Location of last HIV test:	
NGO/iNGO	312 (88.4)
Government hospital or clinic	18 (5.1)
Private hospital or clinic	16 (4.5)
How often do you typically attend for an HIV test?	
At least every three months	213 (60.3)
At least every six months	76 (21.5)
Every 6-12 months	18 (5.1)
Every 1-2 years	27 (6.5)
More than 24 months since my last test	19 (5.4)
Time since last HIV test:	
In the past six months	279 (79.7)
Six months-2 years	52 (14.9)
Over 2 years/ never tested	19 (5.4)
High frequency testing status:	
Yes	197 (55.8)
No	156 (44.2)

IQR – interquartile range, MSM – men who have sex with men, TW – transgender women, MMK – Myanmar Kyat, NGO – non-governmental organization, i/NGO – international non-governmental organization

*Proportions do not equal 100% as multiple answers permitted.

and fear of letting people know their HIV test results. Half of all participants considered it likely/very likely they would acquire HIV in the future.

The majority of participants identified *concern or interest to know HIV status* as a primary reason for last HIV test, while a quarter reported their last test as part of their regular testing practices. Most participants reported receiving their last HIV test at an NGO or iNGO service. Two thirds of participants reported typically testing for HIV approximately every three months and nearly 80% reported receiving an HIV test in the past six months (Table 1).

In total, 56% (n=197) of our sample were classified at high frequency testers on the basis of their typical testing frequency and time since their last test. In univariable analyses, high frequency testing was significantly associated with identifying as male compared to TW (OR=1.9; 95% CI=1.1–3.3), reporting sex with regular male partners only in the past three months compared to sex with casual partners (OR=2.3; 95% confidence interval CI=1.3–4.1) and receiving their last HIV test at an NGO/iNGO service compared to a government hospital or clinic (OR=3.9; 95% CI=1.4–11.2). At the multivariable level, after adjusting for age, reporting only regular sexual partners in the past three months (aOR=2.3; 95% CI=1.3–4.2), and receiving a last HIV test at an NGO/iNGO service (aOR=3.5; 95% CI=1.2–10.7) remained significantly associated with high frequency testing (Table 2).

DISCUSSION

Nearly two thirds of MSM and TW were identified as high frequency testers based on their self-reported three-monthly testing routines and having had an HIV test in the past six months; this finding contrasts with the suboptimal rates of self-reported HIV

Table 2. Associations with high frequency testing status (n=197)

	HIGH FREQUENCY TESTERS N (%)	FACTORS ASSOCIATED WITH HIGH FREQUENCY TESTING	
		OR (95% CI)	aOR (95% CI)
Location			
Yangon	89 (58.9)	1.2 (0.8-1.9)	
Mandalay	108 (53.5)	1	
Age:			
Median (IQR)	23 years (20–28 years)		
<25	116 (58.9)	1.1 (0.6-2.0)	1.1 (0.6-2.2)
25-29	46 (49.5)	0.8 (0.4-1.4)	0.8 (0.4-1.7)
30>	35 (56.5)	1	1
Self-reported gender:			
TW	46 (67.7)	1.9 (1.1-3.3)*	1.8 (1.0-3.3)
Male	150 (52.8)	1	1
Highest level of education achieved:			
Tertiary level	63 (57.3)	1.0 (0.4-2.6)	
High school	77 (57.9)	1.1 (0.4-2.6)	
Middle school	44 (51.2)	0.8 (0.3-2.0)	
Primary school or below	13 (56.5)	1	
Monthly income			
Median monthly amount in MMK (IQR)	150,000 (100,000-200,000)		
Above median (>150,000 MMK)	77 (61.6)	1.4 (0.9-2.2)	
Below median (<150,000 MMK)	119 (52.9)	1	
Sexual partners in past three months			
Both regular and casual partners	70 (55.1)	1.4 (0.7-2.4)	1.4 (0.8-2.5)
Regular partner(s) only	64 (66.7)	2.3 (1.3-4.1)**	2.3 (1.3-4.2)**
Casual partner(s) only	53 (49.1)	1	1

testing among this group nationally (2). High frequency testing was significantly associated with reporting only regular sex partners and location of last HIV test. Recent evidence demonstrating lower risk of HIV infection among frequent testers – a suspected association of risk reduction counselling provided at testing events – and the reduced risk of onward HIV transmission through the detection of acute HIV among Asian MSM (19, 20) underscores the potential role of frequent HIV testing in controlling the HIV epidemic, beyond that simply associated with early HIV diagnosis. In light of previous reports of suboptimal HIV testing rates in Myanmar, and scant data on the patterns of HIV testing among MSM and TW, these findings of factors associated with frequent testing further local understandings of testing behaviours and can inform future HIV health promotion strategies and targeting of health promotion messages and testing services.

Our sample was recruited in the context of an existing community-based, non-governmental HIV prevention program that provided HIV prevention services, including testing referrals and health education on the importance of regular testing to MSM and TW. i/NGO HIV prevention programmes in Myanmar routinely advise MSM and TW engaging in high-risk behaviour to undertake three-monthly HIV testing (16). In this study, sixty percent of MSM and TW reported a typical three-monthly testing pattern and the majority reported testing within the past six months. While HIV testing frequencies among MSM at a country-level are still reported as inadequate (2), testing patterns reported in our study are similar those reported by MSM and TW engaged with other non-governmental, peer-involved, community-based programmes in Myanmar (16). Together, these findings suggest a high degree of responsiveness among MSM and TW to HIV testing health promotion messages provided by community organisations. This view is further supported by our finding that MSM and TW who reported receiving their most recent

Table 2. Continued

	HIGH FREQUENCY TESTERS N (%)	FACTORS ASSOCIATED WITH HIGH FREQUENCY TESTING	
		OR (95% CI)	aOR (95% CI)
Location of last HIV test:			
NGO/iNGO service	187 (59.9)	3.9 (1.4-11.2)*	3.5 (1.2-10.7)*
Private hospital or clinic	5 (31.3)	1.2 (0.3-5.1)	1.1 (0.2-5.3)
Government hospital/ clinic	5 (27.8)	1	1
Self-reported likelihood of acquiring HIV in the future:			
Likely/ very likely	96 (56.5)	1.1 (0.7-1.6)	
Very unlikely/ Unlikely/ Neutral	93 (55.0)	1	
Perceived barriers to HIV testing:			
<i>I worry about stigma if seen attending a HIV testing clinic</i>			
Agree	44 (56.4)	1.0 (0.6-1.7)	
Disagree	140 (56.0)	1	
<i>I am afraid of letting people know my HIV test result</i>			
Agree	70 (58.3)	1.2 (0.7-1.8)	
Disagree	114 (54.6)	1	
<i>I cannot afford the costs associated with HIV testing</i>			
Agree	47 (54.0)	0.9 (0.5-1.5)	
Disagree	137 (56.9)	1	
<i>I don't have time to test for HIV</i>			
Agree	90 (60.0)	1.1 (0.7-1.7)	
Disagree	94 (55.0)	1	
<i>I have to wait a long time to test for HIV</i>			
Agree	52 (59.1)	1.2 (0.7-2.0)	
Disagree	132 (54.8)	1	

CI – confidence interval, aOR – adjusted odds ratio, IQR – interquartile range, MSM – men who have sex with men, TW – transgender women, MMK – Myanmar Kyat, NGO – non-governmental organization, i/NGO – international non-governmental organization

*P<0.05, **P< 0.01.

test at an i/NGO service were nearly four times more likely to be classified as high frequency testers compared to those who tested at a government service.

Myanmar has seen a rapid expansion of i/NGO-provided HIV testing and prevention services over the last decade, driven by increases in donor funding and occurring alongside the decentralisation of HIV testing services (21). These services are typically tailored to the specific needs of priority populations and increasingly utilise peers in key service delivery roles, reflecting global guidance and normative practice around HIV service provision for key populations (22, 23). Our findings speak to the importance of MSM- and TW-friendly services, particularly in a country where homosexual behaviour remains criminalised and sexual minorities face ongoing harassment and discrimination (15, 24). Widely regarded in Myanmar as safe environments where sexual minorities can speak freely about same-sex behaviours (15), i/NGO HIV services that include peers in key service-delivery roles offer an important foundation for HIV prevention services and counselling that are appropriately aligned with actual risk behaviours.

The association between high frequency testing and location of last test may also reflect MSM and TW's perceptions or past experiences of HIV testing within government services. Studies suggest that these services are seen as discriminatory towards sexual minorities and are typically avoided by MSM and TW in Myanmar due to fear of stigma and discrimination from staff (15, 16). It is somewhat concerning that the new National Strategic Plan in Myanmar supports the transfer of HIV treatment services from i/NGO providers back to the public sector (2). Despite the disproportionate representation of MSM and TW among PLHIV in Myanmar, a recent review of patients enrolled in HIV treatment at two large public hospitals in Yangon found that less than 1% reported male-to-male sexual contact as a risk factor for infection (25). This figure indicates either an underreporting of sexual risk behaviours or the limited utilisation of these centres by MSM and TW. As HIV policy in Myanmar continues to emphasise a "test and treat" prevention and care strategies, the benefits accrued from frequent HIV testing may be undermined if HIV treatment services are not perceived as friendly, safe and supportive services by those at highest risk of HIV infection.

In this study, participants reporting only regular partners were more likely to be high frequency testers compared to those with only casual partners. Recent evidence suggests that MSM and TW in Myanmar are engaging in seroadaptive behaviours (26), and our finding could illustrate the emergence of negotiated safety as a risk reduction strategy. In our sample condomless sex with regular partners was more commonly reported than with casual partners (18) and in light of the result presented in this paper, condomless sex within a regular partner may have been predicated on regular HIV testing. However, there is a limited understanding about how different sexual partnerships and assessments of risk may motivate testing behaviours among MSM and TW in Myanmar or regionally. Apart from one study which found that a sense of responsibility towards regular sexual partners was associated with regular testing among Chinese MSM (27), much of the available research on facilitators of regular testing comes from high-income settings and largely suggests HIV testing which is motivated by engagement in risk behaviours, such as multiple casual partnerships or engaging in condomless sex (28, 29). The discrepancy in testing motivations among MSM in these high-income settings with the findings of this study reinforce the importance of context-specific understanding of risk assessment among MSM and TW when shaping health promotion messages and priorities. How different sexual partnerships interact with MSM and TW's health seeking behaviours in Myanmar warrants further exploration.

Our findings should be considered with the following limitations. MSM and TW in study were recruited by peer-researchers in an outreach environment reached by a community-based HIV prevention service that provided health promotion on the importance of HIV testing and referrals to testing services. Additionally, our sample was recruited from the two largest urban areas in Myanmar with greater access to HIV prevention programmes and were also relatively well educated and remunerated (30) and their testing behaviours may not reflect MSM and TW who are economically and socially-disadvantaged or reside outside of urban areas; this is further supported by the significant differences noted among included and excluded participants who were less educated, less well-remunerated and older in age compared to included participants.

We demonstrated a rate of HIV testing that was substantially higher than the national average and findings may not reflect the broader MSM community and those residing in more isolated areas with less access to HIV services. Our description of high frequency testing behaviour relies on self-reported measures and we acknowledge the possible contribution of responder-bias, particularly given the involvement of peer outreach workers as data collectors. There is no reliable objective data on HIV testing frequencies among MSM and TW in Myanmar. Our use of the composite variable, comprising usual testing routine and time since last HIV test, was designed to help strengthen the validity of this outcome.

This study found evidence of high rates of HIV testing uptake and frequency among MSM and TW in Myanmar, despite low HIV testing rates reported nationally. High frequency testing behaviours were associated with receiving a last test at an i/NGO service and reporting only regular sexual partners. Our findings underscore the utility of community-based i/NGO services in establishing and maintaining regular engagement of MSM and TW in HIV prevention and support the expansion of health promotion messaging and strategies beyond the engagement of naïve MSM and TW testers, to the establishment and maintenance of routine HIV testing.

CONCLUSION

This study found evidence of high rates of HIV testing uptake and frequency among MSM and TW in Myanmar, despite low HIV testing rates reported nationally. High frequency testing behaviours were associated with receiving a last test at an i/NGO service and reporting only regular sexual partners. Our findings underscore the utility of community-based i/NGO services in establishing and maintaining regular engagement of MSM and TW in HIV prevention and support the expansion of health promotion messaging and strategies beyond the engagement of naïve MSM and TW testers, to the establishment and maintenance of routine HIV testing.

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Authorship contribution: ZMO, ZWT, PPA, CR, MT, CH and MS all contributed to the development of the data collection tools, training of peer educators to recruit participants, oversight of recruitment, data collection, and interpretation of results. VV, BLD and MS led the data cleaning and analysis process. VV and ZMO led the writing of the manuscript. All authors have read and approved the final manuscript.

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REFERENCES

1. Baral S, Sifakis F, Cleghorn F, Beyrer C. Elevated risk for HIV infection among men who have sex with men in low- and middle-income countries 2000–2006: a systematic review. *PLoS Med.* 2007;4:e339. [PubMed <https://doi.org/10.1371/journal.pmed.0040339>](https://doi.org/10.1371/journal.pmed.0040339)
2. National AIDS Programme. National Strategic Plan on HIV and AIDS: Myanmar 2016–2020. 2016, Department of Health, Myanmar.
3. van Griensven F, Thienkrua W, McNicholl J, Wimonasate W, Chaikummao S, Chonwattana W, et al. Evidence of an explosive epidemic of HIV infection in a cohort of men who have sex with men in Thailand. *AIDS.* 2013;27:825–32. [PubMed <https://doi.org/10.1097/QAD.0b013e32835c546e>](https://doi.org/10.1097/QAD.0b013e32835c546e)
4. Ross AGP, Ditangco RA, Belimac JG, Olveda RM, Mercado ES, Rogers GD, et al. HIV epidemic in men who have sex with men in Philippines. *Lancet Infect Dis.* 2013;13:472–3. [PubMed \[https://doi.org/10.1016/S1473-3099\\(13\\)70129-4\]\(https://doi.org/10.1016/S1473-3099\(13\)70129-4\)](https://doi.org/10.1016/S1473-3099(13)70129-4)

5. UNAIDS. 90-90-90: An ambitious treatment target to help end the AIDS epidemic. New York, NY: Joint United Nations Programme on HIV/AIDS (UNAIDS); 2014.
6. The INSIGHT START Study Group; Lundgren JD, Babiker AG, Gordin F, Emery S, Grund B, Sharma S, et al. Initiation of antiretroviral therapy in early asymptomatic HIV infection. *N Engl J Med*. 2015; 373:795–807. [PubMed https://doi.org/10.1056/NEJMoa1506816](https://doi.org/10.1056/NEJMoa1506816)
7. Fox J, White PJ, Macdonald N, Weber J, McClure M, Fidler S, et al. Reductions in HIV transmission risk behaviour following diagnosis of primary HIV infection: a cohort of high-risk men who have sex with men. *HIV Med*. 2009;10:432–8. [PubMed https://doi.org/10.1111/j.1468-1293.2009.00708.x](https://doi.org/10.1111/j.1468-1293.2009.00708.x)
8. Fisher M, Pao D, Brown AE, Sudarshi D, Gill ON, Cane P, et al. Determinants of HIV-1 transmission in men who have sex with men: a combined clinical, epidemiological and phylogenetic approach. *AIDS*. 2010;24:1739–47. [PubMed https://doi.org/10.1097/QAD.0b013e32833ac9e6](https://doi.org/10.1097/QAD.0b013e32833ac9e6)
9. Ratmann O, van Sighem A, Bezemer D, Gavryushkina A, Jurriaans S, Wensing A, et al. Sources of HIV infection among men having sex with men and implications for prevention. *Sci Transl Med*. 2016;8: 320ra2. [PubMed https://doi.org/10.1126/scitranslmed.aad1863](https://doi.org/10.1126/scitranslmed.aad1863)
10. Aung T, McFarland W, Paw E, Hetherington J. Reaching men who have sex with men in Myanmar: population characteristics, risk and preventive behavior, exposure to health programs. *AIDS Behav*. 2013;17:1386–94. [PubMed https://doi.org/10.1007/s10461-012-0232-z](https://doi.org/10.1007/s10461-012-0232-z)
11. Ayala G, Makofane K, Santos GM, Beck J, Do TD, Hebert P, et al. Access to basic HIV-related services and PrEP acceptability among men who have sex with men worldwide: barriers, facilitators, and implications for combination prevention. *J Sex Transm Dis*. 2013;2013:953123. [PubMed https://doi.org/10.1155/2013/953123](https://doi.org/10.1155/2013/953123)
12. Arreola S, Santos GM, Beck J, Sundararaj M, Wilson PA, Hebert P, et al. Sexual stigma, criminalization, investment, and access to HIV services among men who have sex with men worldwide. *AIDS Behav*. 2015;19:227–34. [PubMed https://doi.org/10.1007/s10461-014-0869-x](https://doi.org/10.1007/s10461-014-0869-x)
13. Logie CH, Newman PA, Weaver J, Roungrakphon S, Tepjan S. HIV-related stigma and HIV prevention uptake among young men who have sex with men and transgender women in Thailand. *AIDS Patient Care STDS*. 2016;30:92–100. [PubMed https://doi.org/10.1089/apc.2015.0197](https://doi.org/10.1089/apc.2015.0197)
14. National AIDS Programme. Myanmar Global AIDS Response Program Report 2015. 2015, Department of Health Myanmar.
15. UNAIDS. Situational Analysis of the HIV response among men who have sex with men and transgendered persons in Myanmar. Yangon, Myanmar: UNAIDS; 2015.
16. Aung PP, Ryan C, Bajracharya A, Pasricha N, Thein ZW, Agius PA, et al. Effectiveness of an integrated community- and clinic-based intervention on HIV testing, HIV knowledge, and sexual risk behavior of young men who have sex with men in Myanmar. *J Adolesc Health*. 2017;60:S45–S53. [PubMed https://doi.org/10.1016/j.jadohealth.2016.09.006](https://doi.org/10.1016/j.jadohealth.2016.09.006)
17. Population Council. An integrated peer outreach and clinic-based intervention to improve the sexual health of young men who have sex with men in Myanmar: A Link Up Evaluation. Washington DC: Population Council; 2016.
18. Draper BL, Oo ZM, Thein ZW, Aung PP, Veronese V, Ryan C, et al. Willingness to use HIV pre-exposure prophylaxis among gay men, other men who have sex with men and transgender women in Myanmar. *J Int AIDS Soc*. 2017;20:21885. [PubMed https://doi.org/10.7448/IAS.20.1.21885](https://doi.org/10.7448/IAS.20.1.21885)
19. Liu Y, Qian HZ, Ruan Y, Wu P, Osborn CY, Jia Y, et al. Frequent HIV testing: impact on HIV risk among Chinese men who have sex with men. *J Acquir Immune Defic Syndr*. 2016;72:452–61. [PubMed https://doi.org/10.1097/QAI.0000000000001001](https://doi.org/10.1097/QAI.0000000000001001)
20. Kroon ED, Phanuphak N, Shattock AJ, Fletcher JLK, Pinyakorn S, Chomchey N, et al. Acute HIV infection detection and immediate treatment estimated to reduce transmission by 89% among men who have sex with men in Bangkok. *J Int AIDS Soc*. 2017;20:21708. [PubMed https://doi.org/10.7448/IAS.20.1.21708](https://doi.org/10.7448/IAS.20.1.21708)
21. Fujita M, Poudel KC, Green K, Wi T, Abeyewickreme I, Ghidinelli M, et al. HIV service delivery models towards 'Zero AIDS-related Deaths': a collaborative case study of 6 Asia and Pacific countries. *BMC Health Serv Res*. 2015;15:176. [PubMed https://doi.org/10.1186/s12913-015-0804-5](https://doi.org/10.1186/s12913-015-0804-5)
22. UNFPA, UNDP, WHO, USAID, World Bank. Implementing comprehensive HIV and STI programmes with men who have sex with men: practical guidance for collaborative interventions. New York, NY: UNFPA; 2015.
23. World Health Organization. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations. Geneva: World Health Organization; 2014.
24. Chua LJG. Sexual orientation and gender identity minorities in transition: LGBT rights and activism in Myanmar. *Hum Rights Q*. 2015;37:1–28. <https://doi.org/10.1353/hrq.2015.0016>

25. Aung NM, Hanson J, Kyi TT, Htet KZ, Cooper DA, Boyd MA, et al. HIV care in Yangon, Myanmar; successes, challenges and implications for policy. *AIDS Res Ther.* 2017;14:10. [PubMed https://doi.org/10.1186/s12981-017-0137-z](https://doi.org/10.1186/s12981-017-0137-z)
26. Aung T, Thein ST, McFarland W. Seroadaptive behaviors of men who have sex with Men in Myanmar. *AIDS Behav.* 2016;20:2827–33. [PubMed https://doi.org/10.1007/s10461-015-1216-6](https://doi.org/10.1007/s10461-015-1216-6)
27. Wei C, Yan H, Yang C, Raymond HF, Li J, Yang H, et al. Accessing HIV testing and treatment among men who have sex with men in China: a qualitative study. *AIDS Care.* 2014;26:372–8. [PubMed https://doi.org/10.1080/09540121.2013.824538](https://doi.org/10.1080/09540121.2013.824538)
28. McDaid LM, Aghaizu A, Frankis J, Riddell J, Nardone A, Mercey D, et al. Frequency of HIV testing among gay and bisexual men in the UK: implications for HIV prevention. *HIV Med.* 2016;17:683–93. [PubMed https://doi.org/10.1111/hiv.12373](https://doi.org/10.1111/hiv.12373)
29. Katz DA, Swanson F, Stekler JD. Why do men who have sex with men test for HIV infection? Results from a community-based testing program in Seattle. *Sex Transm Dis.* 2013;40:724–8. [PubMed https://doi.org/10.1097/01.olq.0000431068.61471.af](https://doi.org/10.1097/01.olq.0000431068.61471.af)
30. World Bank. Gross national income by capita 2015 (atlas method and PPP). 2015. Available: <http://databank.worldbank.org/data/download/GNIPC.pdf>. Accessed: 14 September 2016.

RESEARCH ARTICLE

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“We are not gays... don’t tell me those things”: engaging ‘hidden’ men who have sex with men and transgender women in HIV prevention in Myanmar

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Abstract

Background: In Myanmar, HIV is concentrated among key populations, yet less than half of the estimated 250,000 men who have sex with men (MSM) and transgender women (TW) report recent HIV testing. As many as 50% of MSM and TW may conceal their same-sex preferences and behaviors, yet little is known about the barriers faced by those who are locally regarded as ‘hidden’ – that is, MSM who do not disclose same-sex preferences and/or identify as gay. This study explored specific barriers to accessing HIV testing and other prevention services among ‘hidden’ MSM to inform appropriate models of service delivery.

Methods: In-depth interviews with MSM ($n = 12$) and TW ($n = 13$) and focus group discussions (FGD) with MSM and TW community members, leaders and key informants ($n = 35$) were undertaken in Yangon during June – September 2015. Participants were recruited by word-of-mouth by trained peer data collectors. Responses to questions from semi-structured guides were transcribed and coded using Atlas Ti. Codes were based on key domains in the guides and applied to transcripts to identify and analyze emerging themes.

Results: Fear of stigma and discrimination and the need to meet gender expectations were key reasons for non-disclosure of same-sex preferences and behaviors; this typically manifested as avoidance of other MSM and settings in which sexual identity might be implicated. These concerns influenced preference and interaction with HIV services, with many avoiding MSM-specific services or eschewing HIV testing services entirely. The difficulties of engaging hidden MSM in HIV prevention was strongly corroborated by service providers.

Conclusion: Hidden MSM face multiple barriers to HIV testing and prevention. Strategies cognizant of concerns for anonymity and privacy, such as One-Stop Shop services and online-based health promotion, can discretely provide services appropriate for hidden MSM. Enhanced capacity of peer-service providers and mainstream health staff to identify and respond to the psychosocial challenges reported by hidden MSM in this study may further encourage service engagement. Overarching strategies to strengthen the enabling environment, such as legal reform and LGBTI community mobilisation, can lessen stigma and discrimination and increase hidden MSM’s comfort and willingness to discuss same-sex behavior and access appropriate services.

Keywords: Men who have sex with men, Myanmar, HIV testing, Stigma and discrimination, Sexual orientation concealment

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Background

Against a background of low and decreasing global HIV prevalence, men who have sex with men (MSM) and transgender women (TW) continue to be disproportionately affected by HIV [1, 2]. In Asia, HIV prevalence greater than 10% has been observed in some MSM and TW communities [1, 3–5], while emergent epidemics in countries as diverse as Thailand [6], India [7] and the Philippines [8] have been recently noted. This ongoing vulnerability of MSM and TW to HIV acquisition may suggest limitations in both the scale and effectiveness of current HIV prevention responses in the region. This includes Myanmar, where the estimated HIV prevalence among MSM and TW is over 11% nationally, and the concentrations reported in major urban cities comprise some of the highest rates seen across Asia [4]. Despite known risks, less than half of all MSM and TW in Myanmar reported receiving an HIV test in the past 12 months and coverage of HIV prevention programs remains suboptimal [4].

Global elimination targets suggest that ending AIDS by 2030 will require 90% of people living with HIV knowing their status [9]. As well as facilitating early initiation of HIV treatment, HIV testing provides an important entry point to bio-medical HIV prevention strategies such as PrEP [10]. Controlling the HIV epidemic requires regular engagement of MSM and TW at risk of or living with HIV in prevention, treatment and care; this includes those that do not or are unwilling to identify as MSM or TW and may be out of reach of specific HIV programs targeting these groups. In Myanmar, as in other Asian countries, a number of indigenous and diverse gender and sexual identities exist among same-sex attracted men. Unlike typical Western characterizations that utilize separate categories to define sexual and gender identities, one set of labels are often used across Asia to characterize both sexual and gender identities, such as *Kothis* in India and *Bóng l* in Vietnam [11, 12]. These labels typically encompass sexual positioning, power dynamics, and gender expression and are reflective of one's willingness to disclose their sexual preferences, behaviors and gender identity [4, 13].

There are three main local terms used to classify sexual and gender identity among MSM and TW in Myanmar. *Apwint* are commonly regarded as transgender women, and locally understood as individuals with male assignation at birth but who openly identify as female and attracted to men. Conversely, *Apone* are males that typically have a masculine presentation, are sexually oriented towards other men yet conceal their sexual preferences in most social spheres or circumstances and are often locally referred to as 'hidden, or 'hider' for their presentation as 'men' in public and certain social environments. *Apwint*

and *Apone* are thought to share the same 'feminine' inner self, but differ in their outward gender expression [14]. Lastly, *Thange* are males with masculine presentations who also engage in sex with other men, yet do so sporadically or incidentally while also maintaining a heterosexual identity and relationships with women [14–18]. There are an estimated 250,000 MSM and TW in Myanmar (estimates not disaggregated by gender identity) and as many as 50% are thought to conceal same-sex preferences and behaviors [18].

In Myanmar, sexual and gender identity has been associated with differences in sexual positioning, age of sexual debut, experiences of forced sex, condom use at last sex and access to HIV-related services among MSM and TW and is therefore an important consideration for understanding HIV risk and vulnerability [4, 17, 19, 20]. While in the scientific literature, the term MSM is utilized to reflect behavioral characteristics among male-identified individuals with the intention of respecting individual sexual identity, in Myanmar TW do not consider the term MSM to be restricted only to male-identified individuals and participate in and lead many MSM programs and activities [14]. Additionally, much of the research conducted with MSM and TW is not representative or inclusive of the diversity among sexual minorities in Myanmar. In one of the only published studies on characteristics and risk behaviors among MSM and TW, the majority of participants reported their occupation as beautician or *Nat Kadaw* (spiritual dancer), roles typically assumed by TW [15, 16]. While some literature is beginning to emerge that disaggregates findings by sexual and gender identity [21], very little specifically addresses subgroups of MSM in Myanmar who are locally regarded as 'hidden': those that do not disclose same-sex preference or behaviour or identify as gay. Performance of gender and expression of sexuality among same-sex attracted men in Myanmar is further complicated by the legal environment in which they exist; under Myanmar law, homosexual sex remains criminalised and sexual minorities continue to report ongoing discrimination and harassment [22].

Myanmar's National Strategic Plan for HIV and AIDS 2016–2020 includes a target of reaching 90% of MSM and TW with combination HIV prevention services and prioritizes the engagement of non-disclosing, or 'hidden' MSM [4]. A growing body of evidence from the region highlights the ways in which non-disclosure of sexual identity affects HIV service utilization [11, 23, 24], yet much remains unknown about the barriers faced by hidden MSM in Myanmar in accessing HIV services, hindering the development of culturally-relevant and responsive HIV prevention approaches. This formative research was undertaken to better understand the challenges and experiences of MSM and TW in accessing HIV testing, prevention and care and was conducted as part of a broader implementation science

Table 1 Characteristics of in-depth interviews and focus group discussion participants held in Yangon

In-depth interview participants	n (n = 25)	%
Median age, years (range)	23	(18–42)
18–25 years	16	64
26–35 years	5	20
36 years and above	2	8
Sexual identity		
TW	13	52%
MSM	12	48%
Current relationship status		
Single	10	40
Casual partner(s)	4	16
Regular male partner (s)	7	28
Sex worker	3	12
HIV status		
HIV positive	8	32
HIV negative	16	64
HIV unknown/not disclosed	1	4
Focus group discussion participants (n)	Characteristics	
FGD 1: MSM and TW Community leaders (n = 9)	MSM and TW Outreach workers, peer educators and supervisors, volunteers and community workers; both HIV positive and negative participants	
FGD 2: Hidden MSM (n = 6)	Hidden MSM, both HIV positive and negative participants, low and middle income status	
FGD 3: Service providers (n = 8)	MSM Outreach worker, Peer educators and supervisors, HIV testing counsellors	
FGD 4: Service providers (n = 6)	General Practitioners, Sexual Reproductive health educator, Peer educators, Outreach worker	
FGD 5: Transgender women (n = 6)	Transgender women, both HIV positive and negative, sex work	

study to improve MSM and TW's access and retention in the HIV Care Cascade in Myanmar [25, 26]. This paper presents a secondary analysis that explores these issues as they specifically relate to hidden MSM and seeks to further our understanding of the characteristics of this group and the barriers and challenges to engaging with HIV

prevention services. We consider the perspectives of hidden MSM, the broader MSM and TW community and the service providers and community leaders who seek to engage hidden MSM in HIV prevention. We have included the perspectives of TW in relation to the experiences of hidden MSM in light of the fluidity of sexual and gender identity in Myanmar (i.e., individuals may move between MSM and transgender identities, often depending of social contexts), the common experiences of TW and MSM (e.g., stigma and marginalisation) and the social and physical spaces TW and MSM share in Myanmar.

Methods

Data were originally collected as a formative study to inform a trial to develop and test novel approaches to HIV testing and engagement in HIV care among MSM and TW in Myanmar led by Johns Hopkins University [25, 26]. In-depth interviews (IDI) were conducted with MSM and TW community members to explore personal information and perspectives related to the following domains: characteristics of MSM and TW; social context for MSM and TW including experiences of stigma; availability and accessibility of HIV testing services; knowledge and perceptions on HIV self-testing; preferences for HIV testing, treatment and care models, and; issues related to operational implementation. Eligibility criteria for IDIs was defined as: biologically male, aged 18 years and above, reported anal sex with a male in the past 12 months, resident of greater Yangon and spoke Myanmar. Focus group discussions (FGDs) were also conducted with MSM and TW community leaders and service providers to explore HIV prevention, treatment and care availability and delivery, and participant experiences related to service provision. Those who reportedly engaged in providing services to MSM and TW for 1 year or more, were aged 18 years and over, and spoke Myanmar were eligible for FGDs.

IDIs and FGDs were recorded, transcribed and translated into English. English transcripts were checked for accuracy by local study staff and subsequently entered into Atlas. Ti (Cincom Systems, Berlin). Data from IDIs and FGDs were analyzed collectively using open interpretive coding. Research team members (AW, EC, VV) independently coded transcripts after establishing consistency in the use of codes across team members. Codes were developed based on key domains in the interview guides and openly applied to transcripts to identify and analyze emerging themes. Regular meetings were held to ensure ongoing consistency of coding. A community validation workshop was held in September 2016 in Yangon during which the preliminary findings and analysis were shared with community interviewers and facilitators from the study to verify and validate authors' interpretations.

A secondary analysis of this data was undertaken to better understand the characteristics of hidden MSM in Myanmar and the barriers and challenges to engaging them in HIV prevention. Specific domains used for this paper include: experiences related to the MSM and TW community; knowledge, preference and perceptions related to HIV prevention, treatment and care services; experiences of stigma and discrimination and access to HIV-related services.

While government literature utilizes the term 'non-disclosing' MSM to characterize MSM who do not openly identify their sexual or gender identity, in this paper we utilise the term 'hidden' to reflect local parlance and ensure consistency with participant data. The term 'hidden MSM' is therefore applied to participants who were purposively recruited to the 'hidden MSM' FGD or who identified as hidden or *Apone*, or those who described concealing behaviors in their interview narratives. Our reference to local identity labels throughout this paper is done with fidelity to the way in which they were utilized by participants throughout the study to convey local understanding and interpretation of these labels and identities.

We compare and contrast the barriers and experiences of hidden MSM to other MSM and TW and to the perspectives of the services providers and community leaders who seek to engage them in services, in order to highlight the implications for service provision. The analysis of data in this light resulted in the identification of three broad themes which have been used to organize and discuss our data below. Overall participant characteristics are described in Table 1.

Ethics approval was granted by the Johns Hopkins School of Public Health Institutional Review Board and the Myanmar Department of Medical Research, Ethical Review Committee.

Results

In-depth interviews were conducted with 25 participants, 12 of whom identified as MSM (48%) and 13 as TW (52%). The median age of IDI participants was 23 years (range 18–42) and 16 (64%) were aged between 18 and 25. The majority of participants were single ($n = 10$), while 4 and 7 participants reported a current relationship with a casual and regular partner(s) respectively. Sixteen participants were HIV negative (64%), eight were HIV positive (32%) and one was HIV status unknown or undisclosed (4%). Five FGDs were also held with 35 participants; two with service providers ($n = 8$ and 6), one with MSM and TW community leaders ($n = 9$), one with hidden MSM community leaders ($n = 6$) and one with TW community leaders ($n = 6$) (Table 1).

"I HAVE NEVER ADMITTED I'M A MSM BECAUSE I AM HIDDEN": CHARACTERIZING THE LIVED EXPERIENCE OF HIDDEN MSM IN MYANMAR

Participant responses highlighted the perceived interconnectedness between sexual and gender identities in Myanmar, with participants expressing a belief that men who are sexually oriented towards other men share an inherent desire to dress and present in a feminine form:

When we become gays ... also the hidden who become gays... we want to look or behave like girls. Forget about the rules. As soon as we realize we are not straight, we want to look/behave like girls...

- Participant 1, FGD 2, Hidden MSM

Transgender women were therefore regarded as those who successfully embraced this desire while those who repudiated it were typically regarded as 'hidden' due to their efforts to maintain heteronormative behavior and presentation. As the following participant notes, expression of gender and sexual identity was often related to the external environment:

There are environments where hidden MSM cannot dress like *Apwints*... So they take hidden forms...

- Participant 3, FGD 2, Hidden MSM

These 'hidden forms' enabled MSM to conceal their sexual preferences by maintaining gender-confirming appearances and behaviors. As the above participant suggests, disclosure and concealment of sexuality was often contextual and tied to specific environments. This quote, and the one that follows, points to a fluidity of sexual and gender expression among MSM and TW in Myanmar:

Interviewer: First, have you heard of the words *Apone*, *Apwint*, etc?

Participant: Yes, I know

Interviewer: Which type would you identify yourself with?

Participant: I am more like *Apwint*

Interviewer: More *Apwint*?

Participant: Yes, because I am no longer *Apone*.

- IDI 34, TW, age 36.

A key influence on the disclosure of sexual and gender identity was the perception or expectation of stigma and discrimination. Participants directly connected the degree of anticipated or experienced stigma and discrimination to the extent to which sexuality was publicly disclosed or observed. For example, participants who were more 'visible' as sexual minorities, such as TW, or MSM who openly had relationships with male partners, more commonly experienced stigma from both significant others and the community. Consequently, concealment of their sexual identity and gender-conforming presentation enabled hidden MSM to avoid similar experiences to those described by this TW participant:

Of course, there are challenges. As I have a husband (long term male partner), I have to face more problems in my neighbourhood. I have to face things like that... Since I started identifying myself as a gay, there has been discrimination from my siblings and community.

- IDI 23, TW, age 22

The extent to which MSM felt the need to conform to traditional gender roles, including in the context of meeting family expectations to marry and have children, also had significant bearing on disclosure of sexuality. Underscoring the primacy of preserving good family relationships was an assumption that families would be disapproving of same-sex orientation. The following quote illustrates a possible consequence of disclosure to families:

To admit openly... that he is MSM, it will be difficult for him to be accepted by his family and community. There is a concern that the family will find out and abandon him.

- IDI 11, MSM, age 22

Participants engaged in a range of negotiated identity practices in order to conceal their sexuality from their family and community and avoid anticipated stigma and discrimination. Many described their general avoidance of other MSM and TW and their beliefs that any association would enable others to identify them as part of the MSM or TW community. While some avoided other MSM and TW all together, others restricted their socialization only to other hidden MSM:

I deny it when my family asked me. I have never admitted I'm a MSM either in the past and now because I am a hidden MSM and not an open type... I don't know whether they pretend they don't know

about me. But they don't like my *Apwint* friends and I choose *Apone* as my friends

- IDI 26, Hidden MSM, age 23

Other participants described a careful demarcation between their family and social lives, in order to maintain concealment of their sexuality around family, while selectively disclosing in certain social settings:

When I was in 8th or 9th Standard, I met some gays in the neighborhood. They told me "Hey ... Here. You have to dress like this." and "A gay has to live like this." ...My family did not allow me to live in a gay (feminine) appearance. Even my hair was short like a boy and I wore a *longyi* (sarong typically worn by men in Myanmar). So, I had to meet them secretly at night.

- IDI 27, MSM, age 24

Selective disclosure also meant that participants' sexual identity and gender presentation was not static; many participants described a fluidity of sexual and gender performance which highlights the situational and contextual nature and application of sexual identity labels in Myanmar. This participant shares their experience of moving between transgender and male forms:

Although I was a gay, I still wanted to live like a boy. I mean – I wanted to dress like a boy. Others dressed like women at night. I did it sometimes. Also these days, as I am working as a dancer in a *Zat* band (traditional dance band), I dress like a woman. For the time being, as our team disbands for the season ... I stay with friends, in places where there are MSM.

- IDI 27, MSM, 24 years old

"HIDDEN MSM DO NOT TRY TO LEARN MUCH [ABOUT HIV] THINKING PEOPLE MIGHT FIND OUT THEIR MSM STATUS": BARRIERS TO ACCESSING HIV PREVENTION SERVICES AMONG HIDDEN MSM

The behaviors and concerns of potential discrimination and stigma among hidden MSM described above presented a range of barriers to their engagement with HIV prevention services. Most notably, many participants described the perceived threat of disclosure of their sexual identity associated with HIV testing services – either related to the need to disclose or discuss potential sexual risk behaviours, or questions that may be raised following a possible HIV diagnosis:

With hidden MSM, most families don't know them. Since they are MSM, it will be a bit more difficult for them to test (in case) somebody finds out while he is testing. (Also) If he is hidden and he has it [HIV] and people don't know his orientation, I think it can hurt him mentally.

- IDI 26, Hidden MSM, age 23

The priority given to concealing sexuality by hidden MSM shaped their preferences for HIV testing locations and providers. Many described the paramount importance of maintaining privacy and confidentiality in relation to their sexual orientation. While many MSM and TW participants expressed a preference for tailored HIV services, hidden MSM tended to weigh the perceived suitability of such MSM and TW-specific services against the threats to their confidentiality that these services were seen to pose. This ambivalence among hidden MSM towards MSM- and TW specific services was compounded by their avoidance of other MSM and TW. This participant describes an example of such avoidance from a fellow MSM waiting for HIV testing:

When I took a blood test in June, there was another *Apone* and I recognized him as an *Apone* at a glance. He was using the umbrella with anti-discrimination day label. I knew he was *Apone*. And he most probably recognized me as well. But he didn't want me to know he came there for a blood test. He was sitting in a corner silently. He didn't want me to notice him.

- IDI 24, Hidden MSM, aged 30

Government-provided services were viewed unfavourably by most MSM and TW, often related to past experiences or expectations of stigmatization and discrimination by government staff. This was particularly felt by TW participants and more 'open' MSM:

With the NGOs, since we are MSM, they do counselling regarding sexual disease if we have it. They treated us warmly without discrimination. That is the difference. It is difficult for MSM to enter government clinic. They don't go there. There are many MSM staffs at NGOs. We just go where we are comfortable.

- IDI 33, TW, age 22

While both 'open' MSM and TW, and hidden MSM shared this fear of stigmatization by health staff, for hidden MSM, the specific requirements of government services, as described below, and the inherent

risk of indiscretion that these requirements carried presented additional barriers to accessing HIV testing at government services:

If an *Apone* like me went to NAP [National AIDS Programme], there would be a lot of challenges. They insist we bring one family member to their counseling session. And they don't do history taking and counseling sessions individually. They ask about sexual issues in front of several doctors and female nurses. And they tell us to bring our male partners for blood test.

- IDI 24, Hidden MSM, age 30

In general, health-seeking behavior among hidden MSM was largely influenced by the extent to which services could offer anonymity. Below describes a participant's recent visit to a HIV testing clinic that served MSM and TW clients as well as the broader community. Service satisfaction was related to the relative anonymity provided by this clinic, coupled with the skill and sensitivity of the service provider towards MSM and TW clients:

Although it was a general clinic, many MSM went there. It was good for me as there were not too many MSMs. Hidden ones can also visit. All kinds of them. It was good because there was an MSM project (also at the clinic) ... I felt more secure and safe. It is better for the clients.

- IDI 24, Hidden MSM, aged 30

The need for anonymity also held important implications for hidden MSM diagnosed with HIV. As this participant describes, hidden MSM may choose to prioritize the concealment of their sexuality over their own health and well-being. For some, a HIV diagnosis would be regarded as an unwelcome intrusion of their private 'hidden' life, into their daily, more 'visible' lives, such as the need to take daily treatment for example.

I think *Apones* will face more challenges (with HIV testing). They are hiding themselves and when they get a positive result, they can have more worries and emotional problems. Some don't want to disclose even if they get a positive result. And you know? They might think "Why should I care about a positive result? I am not going to seek medical care." *Apwints* have more guts to disclose and discuss. They will seek medical care if they get a positive result. I think they have more knowledge than *Apones* do; compared to *Apones*, many *Apwints* know about HIV. *Apones* do

not try to learn much (about HIV) thinking people might find out their MSM status.

- IDI 16, MSM, age 23

The need to navigate between these two worlds likely impacts the perceived suitability and appropriateness of HIV treatment and support. The following participant describes the differentiated perspectives of home-based peer-support - a service commonly provided by NGOs to promote adherence to HIV treatment and ensure ongoing psychosocial wellbeing - among hidden MSM and TW:

Interviewer: Was it okay when there were visitors at home?

Participant: For transgender, they mostly spend time outside the home. And those who are accepted by their families, home visits are okay. For hidden MSMs, home visits are not okay.

Interviewer: So, you make appointments and meet him/her in a convenient place?

Participant: They (hidden MSM) just don't want people around.

- IDI 24, Hidden MSM, age 30

"WE ARE PEERS AND WE KNOW WHAT HIDDEN MSM DO BUT, AT THE COUNSELING SESSION, THEY WOULD SAY THEY ARE NOT THAT KIND OF PERSON ... WHAT DO WE DO THEN?" SERVICE PROVIDER AND COMMUNITY LEADER PERCEPTIONS OF BARRIERS TO ENGAGING HIDDEN MSM IN HIV PREVENTION

Data from service providers and community leaders highlighted the ways in which characteristics of hidden MSM presented barriers to effectively engaging this group in HIV prevention. In discussing the challenges, service providers demonstrated an awareness of concerns and inner struggles faced by hidden MSM and recognized the impact this had on their approaches to service provision, as this service provider demonstrates:

Interviewer: How do you identify open and hidden type?

Participant: Hidden type hides himself. It is quite difficult to persuade him to do blood test. The thought is that what if someone sees him if he comes here?

- Participant, FGD 3, Service Provider

Some service providers observed that hidden MSM had low levels of HIV prevention knowledge and were less likely to engage in protective behaviors compared to other MSM and TW:

Hidden MSM don't admit it (that they have sex with men). They don't always use condoms. Even if they use condoms, they sometimes don't know if they are wearing the condoms correctly or inside-out.

- Participant, FGD 1, MSM Community leader

This behaviour may be a result of a deliberate avoidance of the purchase of or access to condoms in order to conceal sexual behaviours, or reflect the limited knowledge of HIV prevention and safe sex practices due to minimal engagement with HIV prevention services and providers. For example, this service provider describes their experience encountering MSM who deny their sexual orientation and therefore their need for HIV-related health promotion during community-based outreach and health promotion:

In hidden types, they don't even want to be known among themselves. They live with their pride. When you look at them, they look like real men... When you tell them to do blood test, they are scared to death. When you tell them about health education, they told (us) "We are not gays. Since I don't think of myself as gay, don't tell me those things."

- Participant, FGD 3, Service provider

Some participants believed that the constant need among hidden MSM to hide their same-sex preferences and behaviors resulted in negative psychological effects such as feelings of internalized stigma and homophobia. In some cases, these negative feelings led to a sense of antipathy towards other MSM and TW. This hidden MSM reflects on these feelings arising from self-stigma and an ongoing need to conceal their sexual identity:

They (hidden MSM) can't let the community know at all. And they can't let their families know at all. So, finally they develop an attitude that they can't even accept themselves as MSM....They have a gay instinct but they hide themselves so much and try so hard to prove they are not gays .. and then they gradually begin to hate gays.

- Participant 5, FGD 2, Hidden MSM community leader

The denial of same-sex behavior by hidden MSM was seen as a strategy to distance themselves from other MSM and TW as part of their broader attempts to conceal their sexuality. This behavior persisted even in situations where MSM sought HIV testing. Service providers noted how the reluctance of hidden MSM to discuss same-sex behaviors limited the ability of HIV testing staff to accurately assess risk and provide appropriate counseling. As this service provider notes, prevarication from hidden clients during HIV testing was a common experience:

We are peers and we know what hidden MSM do. But, at the counseling session, they would say they are not that kind of person ... What do we do then? As we are peers, we know who is doing what. And things were okay when they first talked to us... Then, when they faced the counselor, and when the counselor started explaining, they said "I'm not that kind of person" and come out of the counseling room.

- Participant, FGD 1, MSM Community leader

Service providers also acknowledged the negative ways non-disclosure of sexuality intersected with HIV diagnosis and the impact this had on HIV treatment. As this following quote highlights, the need to keep sexual and family lives separate prevented some HIV-positive MSM from accessing family support. This quote also illustrates the contextualized nature of disclosure of sexuality among MSM as well as the potential impact - such as delayed or disrupted treatment - on access to HIV prevention and care services:

Interviewer: Are there conditions where MSM cannot come for HIV treatment all?

Participant: I have seen one... He is only 22. He lives with his aunt. She discriminates him because he is MSM. He came to our clinic and said he wants to test. He is "out of the closet" type but he lives like "in the closet" type at home in front of his aunt. When tested, his HIV test was positive. When I showed him the long-term plan (for treatment and care) he said that his aunt does not agree with him being an MSM (so) he has to live like a man. She does not like him going out.... The aunt will be worse if he has HIV because she doesn't like him being MSM.

- Participant, FGD 3, Service provider

In response to these complexities, service providers described the different approaches they adopt to engage hidden MSM, demonstrating an understanding of the characteristics of this group and a level of empathy for their struggles. In particular, many service providers were cognizant of hidden MSM's need for privacy and discretion. This service provider reflects on how these priorities are reflected in their professional practice:

The one who is doing prevention knows them (hidden MSM). However, they hide. I know I cannot approach them like they are gay. I call them big brother or little brother. They liked to be called like that.

- Participant, FGD 3, Service provider

Conversely, while many service providers and community leaders expressed understanding and empathy towards hidden MSM, others expressed feelings of frustration and impatience in the face of the difficulties they experienced working with this group. Underpinning this frustration was an expectation of responsibility among MSM and TW to prevent the spread of HIV. The following quote assumes a sense of community that underpins this sense of responsibility, however this sentiment is unlikely to extend to hidden MSM. This quote also speaks to the importance of rapport- and trust-building in the HIV prevention work carried out by peers - which is often developed over time and through repeated interactions - and is typically a precursor to longer-term engagement of MSM and TW with HIV prevention services. This community leader reflects on the challenges to engaging with hidden MSM and conveys a sense of frustration:

We want to help them understand such things as HIV prevention. It's not that we have left the hidden ones out but they have left us. There will be no discrimination if they have open discussions with us... They need to cooperate by doing their part.... They are not interested in how to use condoms to prevent HIV and how to take treatment. We don't leave them out but they have left us.

- Participant, FGD 1, MSM Community leader

Responses from some service providers and community leaders also conveyed a sense of powerlessness against the numerous influences that prevented MSM from more freely disclosing their sexual preferences and behaviors. These responses also displayed their recognition of the need for supportive and enabling environments if such behaviors were to change:

What can we do when hidden people from the community don't disclose? ... Rather than tell them to take HIV tests, they don't even know what HIV is and what AIDS is. To face this thing (HIV testing) is something which comes later. From the very beginning, their parents did not accept them being gays. If these problems (like a positive HIV diagnosis) are added, a lot of them will be dead.

- Participant, FGD 1, MSM Community Leader

This quote also hints at recognition by some community leaders and service providers of a hierarchy of priorities for hidden MSM that may supersede the need for HIV testing and prevention. For example, denying or concealing same-sex orientation may enable hidden MSM to maintain family relationships and support, which may be disrupted by an HIV diagnosis that may force hidden MSM to reveal their sexuality and potentially upset family dynamics.

Discussion

Increasing the reach of HIV prevention programs among hidden MSM has been identified as a national priority for HIV control efforts in Myanmar [27], yet much remains unknown about this group. This study furthers our understanding of the characteristics of hidden MSM and how they influence levels of engagement with HIV prevention services. This study identified a number of barriers to HIV service access and uptake which largely stemmed from hidden MSM's preference to conceal same-sex behaviour and orientation; for example, through avoidance of other MSM and TW, reluctance to attend HIV prevention services, denial of same-sex behaviors and adopting gender-conforming behaviors and presentations, particularly around family. Additionally, fear of stigma and discrimination and a need for privacy and confidentiality were key factors in shaping preferences for HIV prevention services among hidden MSM. Service providers and community leaders corroborated the experiences and characterizations of hidden MSM and noted the unique ways in which these barriers impacted their ability to engage hidden MSM in HIV prevention. Taken together, these findings provide some context for the low rates of HIV testing currently observed among MSM and TW in Myanmar [4] and carry important implications for the enhancing service demand through the development of culturally-relevant HIV prevention programs that are acceptable and can adequately address the specific needs and concerns of hidden MSM in Myanmar.

In this study, we found that non-disclosure of same-sex behaviour and preferences was commonly

employed by MSM as a strategy to avoid stigma and discrimination from their families and communities. In Myanmar, although rarely enforced, homosexual sex remains constitutionally illegal and contributes to an environment in which sexual minorities continue to report ongoing harassment and discrimination [15]. The criminalization of homosexual sex has also been associated with reduced levels of access to HIV services among MSM and TW [28]. Service providers in Myanmar have noted how the current legal environment complicates the delivery of HIV prevention services by preventing community-based organizations from official state registration [18]. Anti-homosexual legislation works to legitimize discrimination and negatively impacts the acceptance of sexual minorities, promoting concealment of sexual identity and behaviors among MSM. Across Asia, non-disclosure of sexuality has been associated with higher rates of condomless sex [29] and lower rates of HIV testing among MSM [30, 31]. Similarly, in this study, we found that the requirement to disclose same-sex behaviors in order to receive appropriate HIV services and commodities effectively inhibited hidden MSM's access to these services; this reluctance hinders the provision of appropriate and tailored care, including specific risk-reduction counseling. Current WHO guidelines for example, recommend the provision of condoms and lubricant and the opportunity for anal cancer screening for all MSM [32], however these services are unlikely to be offered if same-sex behaviors are not revealed.

This study found that many hidden MSM engage in negotiated identity practices in order to carefully manage the concealment and disclosure of their sexual identity. Often this behaviour was tied to environment, with many hidden MSM describing adoption of gender-conforming behaviors and presentation around family and the careful demarcation of social/sexual lives and family/community contexts. This demarcation often involved the public avoidance of other MSM and TW and underscores the importance of privacy and confidentiality as a key determinant of health seeking behaviours and preferences for HIV prevention services among hidden MSM.

Peer-based outreach and health promotion is a fundamental component of Myanmar's national response to HIV [27] and has been identified as a key strategy to drive up rates of HIV testing among MSM [4]. Yet the demonstrated reluctance among hidden MSM to publicly engage with peer outreach workers may undermine the potential effectiveness of national HIV prevention strategies and programs in Myanmar. While some peer workers adopted inconspicuous approaches to engaging hidden MSM in outreach, and in doing so, demonstrated an awareness of this group's preference for privacy (for example, using more generic terms to

address hidden MSM such as “friend” or “brother”), others indicated a sense of frustration at the difficulty of engaging hidden MSM that suggested limited empathy for the psychosocial struggles they experienced. There is an opportunity to strengthen community-based HIV prevention programs by ensuring all peer staff are comprehensively trained to both recognize and deal with these psychosocial struggles, including internal stigma and homonegativity, experienced specifically by men unwilling or unable to disclose same-sex preferences.

In general, responses to HIV are often based on easily identifiable risk categories, including “MSM” and “TW”, which many have argued detract from properly appreciating the complexity of gender and sexual expression and the way this shapes HIV vulnerability and risk [33–35], including in the Asian context [36–38]. Yet, the reappropriation of the term ‘MSM’ as an identity category has been noted, signalling the transformation of ‘MSM’ from epidemiological term to subject position [39]. In this study, numerous participants used the term ‘MSM’ as an identity label, parallel to local parlance as has been noted in other settings among same-sex attracted men [40]. Neither continued reliance on the binary MSM/TW categories alone, nor the wholesale integration of local terminology in HIV programing would be sufficient; as argued by Thomann [40], the key to more responsive HIV programing is the recognition of the diverse lived experiences contained within local identities and how this intersects with other local and social realities to shape vulnerability to HIV. Indeed, the differing experiences and perspectives among the various sexual and gender identities, even within the same identity group, documented in this study highlights the importance of service provision that can appropriately cater for different groups and their heterogeneous needs. In Laos, for example, behaviorally bisexual men demonstrated reluctance to attend MSM-specific services [23], underscoring the importance of identifying as the intended recipient of HIV services. In this study, attendance at MSM-specific services was believed to present a high risk of association with the MSM community. Yet, while general testing clinics were viewed as providing greater anonymity, these clinics also presented barriers for hidden and disclosing MSM and TW including experiences of stigmatization and discrimination from health care staff. Owing to similar concerns for confidentiality, recent research found that hidden MSM were more likely to seek treatment from public clinics, general practitioners or self-medicate compared to other MSM [18] or may simply eschew HIV services all together [20]. In such contexts, generic Men’s Clinics staffed by MSM-friendly providers who can discretely provide

services appropriate for this group’s sexual risk behaviors may be an appealing option for hidden MSM. The latest National Strategic plans identifies ‘One stop shops’ as a potential strategy to increase HIV testing rates among MSM [4]; the findings from this study suggest that such an approach would be well-received by this group, provided staff were appropriately trained and aware of specific barriers encountered by hidden MSM. Delivery of comprehensive training for staff in mainstream HIV services and other government health services, and inclusion into medical and nursing curricula, to enhance both sensitivity and capacity to provide appropriate and tailored services to sexual minorities would also increase the ability of providers in these settings to more comprehensively address the specific needs of MSM.

Myanmar is currently experiencing a period of significant transition and development, which has included an evolving interpretation of homosexuality (including the adoption of more ‘Western’ terminology such as ‘homo’, ‘gay’ and ‘queer’, particularly among younger, urban individuals and/or those connected to the NGO sector as demonstrated by some study participants; [14, 18, 41]). This ongoing development has also led to changing social and political environments, characterized by an emergent LGBTI community and an increasing number of civil society groups and social networks for sexual minorities, many of which are actively engaging in policy discussions and highlighting issues in their communities [18]. In 2012, Myanmar held its first gay pride parade [42], a sign of the shifting attitudes and growing tolerance towards sexual minorities in Myanmar. However the prevailing legal environment sustains a sense of fear of discrimination and possible arrest among some MSM and TW whose desire to avoid both may supersede the importance of HIV testing and engagement with HIV prevention services, particularly those that pose a risk of disclosure, and should be recognized as a key barrier to service access. The expanding availability of information and communication technology (ICT) and infrastructure [43] in Myanmar, including a growing ubiquity of cyber networks among MSM communities [44], offers opportunities to engage MSM and TW in HIV prevention who may otherwise be reluctant to do so. ICT-based approaches have demonstrated some positive results in engaging MSM in HIV testing [45–48], including among non-gay identified MSM [49], and are increasingly used to engage hard-to-reach and hidden MSM populations across Asia [50, 51]. The evolving social and political context offers opportunities to reduce some of the identified barriers to engaging MSM through increasing the social acceptance of sexual minorities in Myanmar, while technological advances can be used to enhance the reach

of hidden MSM in HIV prevention through the innovative use of online and new technologies. Together, this new landscape can promote an enabling environment in which some of the barriers to engaging hidden MSM in HIV prevention services described in this study are reduced.

This study has several limitations that should be considered alongside the results. Study participants were recruited from partner NGO organizations and their views and perspectives may not represent MSM and TW who are harder to reach or not currently connected to services. Additionally, this study did not specifically ask participants to identify their sexual identity a priori using the locally accepted terms described in this paper and we cite them insofar as they were used by participants themselves during FGDs and IDIs. Therefore, it is possible that some of the references to hidden MSM may be in relation to *Thange* participants, who are also considered 'hidden' but who are likely to face unique barriers related to their specific sexual identity. More research is warranted to explore how the barriers faced by hidden MSM described in this study may be uniquely and variedly experienced by *Thange* and *Apone* MSM respectively. Lastly, our sample was recruited from Yangon, the largest city in Myanmar and may not reflect the lived experiences of MSM and TW in rural or remote areas where access to HIV services and tolerance towards gender non-conformity may be lower. However, we believe the findings are relevant to other urban locations in Myanmar which are typically characterized by larger populations of MSM and TW compared to peri-urban and rural areas [4].

Conclusion

As highlighted by this study, MSM in Myanmar who are unwilling or unable to disclose their sexual behavior and preferences face multiple and overlapping barriers to accessing HIV testing and other prevention services. Strategies such as building the capacity of peer service providers to identify and respond to psychosocial challenges experienced by non-disclosing MSM, sensitivity training to reduce discriminatory attitudes and practices among mainstream health providers and government workers, and innovative approaches such as one stop shop services and ICT-based health promotion that can discretely provide services tailored to the distinct needs of MSM and TW, while ensuring their privacy, may help circumvent some of the barriers identified in this study. Such activities should be considered as part of an overarching HIV prevention strategy that also addresses the broader structural barriers related to stigma and discrimination in the general community to improve the social

acceptability of sexual minorities and create an environment in which hidden MSM can comfortably discuss same-sex behaviour and access services appropriate for their risk behaviors.

Abbreviations

FGD: Focus group discussion; ICT: Information and communication technology; IDI: In-depth interviews; MSM: Men who have sex with men; NGO: Non-governmental organisation; TW: Transgender women

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. The data in this paper was generated as part of a formative study designed to inform the development and implementation of a broader implementation science trial; at the completion of this trial, all datasets generated and analysed throughout this study will be made publicly available through the data repository maintained by Johns Hopkins University.

Authors' contributions

CB, SN, EC, AW, and SB collaborated in the design and oversight of the overall study. AW, EC, and VV contributed to the design and analysis of qualitative research. AW and KHT led trainings of qualitative interviewers and KHT oversaw qualitative data collection. VV wrote the initial drafts of this manuscript with assistance and guidance from MS. All authors had full access to the data, reviewed and edited the manuscript, and all take responsibility for its integrity as well as the accuracy of the analysis. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Ethics approval was granted by Johns Hopkins University Institutional Review Board and the Myanmar Department of Medical Research. Written informed consent was obtained from all individual participants included in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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References

- Beyrer C, et al. Global epidemiology of HIV infection in men who have sex with men. *Lancet*. 2012;380(9839):367–77.
- Baral S, et al. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *Lancet Infect Dis*. 2013;13(3):214–22.
- van Griensven F, de Lind van Wijngaarden JW. A review of the epidemiology of HIV infection and prevention responses among MSM in Asia. *AIDS*. 2010;24(Suppl 3):S30–40.
- National AIDS Programme. National Strategic Plan on HIV and AIDS: Myanmar 2016–2020. Myanmar: Department of Health; 2016.
- Baral S, et al. Elevated risk for HIV infection among men who have sex with men in low- and middle-income countries 2000–2006: a systematic review. *PLoS Med*. 2007;4(12):e339.
- van Griensven F, et al. Evidence of an explosive epidemic of HIV infection in a cohort of men who have sex with men in Thailand. *AIDS*. 2013;27(5):825–32.
- Solomon SS, et al. High HIV prevalence and incidence among MSM across 12 cities in India. *Aids*. 2015;29(6):723–31.
- Ross AGP, et al. HIV epidemic in men who have sex with men in Philippines. *Lancet Infect Dis*. 2013;13(6):472–3.
- UNAIDS. 90–90–90: An ambitious treatment target to help end the AIDS epidemic. Geneva: UNAIDS; 2014.
- Kelley CF, et al. Applying a PrEP continuum of Care for men who Have sex with men in Atlanta, Georgia. *Clin Infect Dis*. 2015;61(10):1590–7.
- Philbin MM, et al. Structural barriers to HIV prevention among men who have sex with men (MSM) in Vietnam: diversity, stigma, and healthcare access. *PLoS One*. 2018;13(4):e0195000.
- Phillips AE, et al. Sexual identity and its contribution to MSM risk behavior in Bangaluru (Bangalore), India: the results of a two-stage cluster sampling survey. *J LGBT Health Res*. 2008;4(2–3):111–26.
- National AIDS Programme. Global AIDS Response Progress Report 2014. Yangon: National AIDS Programme; 2015.
- Gilbert D. Categorizing Gender in Queer Yangon. *SOJOURN: J Soc Issues Southeast Asia*. 2013;28(2):241–71.
- Chua LG, Gilbert D. Sexual orientation and gender identity minorities in transition: LGBT rights and activism in Myanmar. *Hum Rights Q*. 2015;37:1–28.
- Aung T, et al. Reaching men who have sex with men in Myanmar: population characteristics, risk and preventive behavior, exposure to health programs. *AIDS Behav*. 2013;17(4):1386–94.
- UNESCO Bangkok & Department of Medical Research, M.o.H., Myanmar. Multi-level risk and protective factors and HIV-related risk behaviours among young men who have sex with men (YMSM) in Myanmar. Paris: UNESCO Bangkok and Department of Medical Research, Ministry of Health, Myanmar; 2015.
- UNAIDS. Situational Analysis of the HIV response among men who have sex with men and transgendered persons in Myanmar. Yangon: UNAIDS; 2015.
- Tun W, Aung PP, Bajracharya A, Yam E, Ryan C, Oo SM, Thein ZW, Paing AK, Pasricha N, Willenberg L, Aguis P, Sein TT, Htun S, Latt NZ, Luchters S. Does sexual identity matter in accessing services? Risk profiles and sexual behaviours of different sexual identity types of young men who have sex with men in Myanmar. International AIDS Conference. Durban; 2016.
- Population Council. An integrated peer outreach and clinic-based intervention to improve the sexual health of young men who have sex with men in Myanmar: A Link Up Evaluation. Washington, DC: Population Council; 2016.
- Johnston LG, et al. Correlates of Forced Sex Among Young Men Who Have Sex With Men in Yangon and Monywa, Myanmar. *Arch Sex Behav*. 2017; 46(4):1001–10.
- UNAIDS. Situational Analysis on Drug Use, HIV and the Response in Myanmar: Looking forward. Yangon: UNAIDS; 2015.
- Bowering AL, et al. Factors influencing access to sexual health care among behaviorally bisexual men in Vientiane, Laos: a qualitative exploration. *Asia Pac J Public Health*. 2015;27(8):820–34.
- Ramakrishnan L, et al. Comparison of sexual risk, HIV/STI prevalence and intervention exposure among men who have sex with men and women (MSMW) and men who have sex with men only (MSMO) in India: implications for HIV prevention. *AIDS Behav*. 2015;19(12):2255–69.
- Wirtz AL, et al. New HIV testing technologies in the context of a concentrated epidemic and evolving HIV prevention: qualitative research on HIV self-testing among men who have sex with men and transgender women in Yangon, Myanmar. *J Int AIDS Soc*. 2017;20(1):21796.
- Wirtz AL, et al. The parasol protocol: an implementation science study of HIV continuum of care interventions for gay men and transgender women in Burma/Myanmar. *JMIR Res Protoc*. 2017;6(5):e90.
- National AIDS Programme. National Guidelines: A Core package for HIV prevention amongst key populations in Myanmar: Yangon: National AIDS Programme; 2014.
- Arreola S, et al. Sexual stigma, criminalization, investment, and access to HIV services among men who have sex with men worldwide. *AIDS Behav*. 2015; 19(2):227–34.
- Zhao Y, et al. Non-disclosure of sexual orientation to parents associated with sexual risk behaviors among gay and bisexual MSM in China. *AIDS Behavior*. 2016;20(1):193–203.
- Ayala G, et al. Access to basic HIV-related services and PrEP acceptability among men who have sex with men worldwide: barriers, facilitators, and implications for combination prevention. *J Sex Transm Dis*. 2013;2013:953123.
- Huang ZJ, et al. Social network and other correlates of HIV testing: findings from male sex workers and other MSM in Shanghai, China. *AIDS Behav*. 2012;16(4):858–71.
- WHO. Consolidated guidelines on the HIV prevention, diagnosis, treatment and care for key populations. Geneva: WHO; 2014.
- Kaplan RL, Sevelius J, Ribeiro K. In the name of brevity: the problem with binary HIV risk categories. *Glob Public Health*. 2016;11(7–8):824–34.
- Garcia J, et al. The limitations of 'Black MSM' as a category: why gender, sexuality, and desire still matter for social and biomedical HIV prevention methods. *Glob Public Health*. 2016;11(7–8):1026–48.
- Parker R, Aggleton P, Perez-Brumer AG. The trouble with 'Categories': rethinking men who have sex with men, transgender and their equivalents in HIV prevention and health promotion. *Glob Public Health*. 2016;11(7–8):819–23.
- Tomori C, et al. Perspectives on Sexual Identity Formation, Identity Practices, and Identity Transitions Among Men Who Have Sex With Men in India. *Arch Sex Behav*. 2018;47(1):235–44.
- Gibson BA, et al. Gender identity, healthcare access, and risk reduction among Malaysia's mak nyah community. *Glob Public Health*. 2016;11(7–8):1010–25.
- Mitchell KM, et al. Who mixes with whom among men who have sex with men? Implications for modelling the HIV epidemic in southern India. *J Theor Biol*. 2014;355:140–50.
- Boellstorff T. But do not identify as gay: a proleptic genealogy of the MSM category. *Cult Anthropol*. 2011;26(2):287–312.
- Thomann M. HIV vulnerability and the erasure of sexual and gender diversity in Abidjan, Cote d'Ivoire. *Glob Public Health*. 2016;11(7–8):994–1009.
- Gilbert, D., G. Cho. Going to Pagan: Gay slang in Burma New Mandala 2009; Available from: <http://asiapacific.anu.edu.au/newmandala/2009/10/20/going-to-pagan-gay-slang-in-burma/>.
- BBC. A pride with no parade for Burma's first gay festival: BBC News; 2012; Available from <https://www.bbc.com/news/world-asia-18106018>.
- On Device Research. Myanmar: the final frontier for the mobile internet 2014. [cited 21 Mar 2015].
- Lin KS, Van der Putten M. Identities in Motion: Cyberspace and Myanmar men have sex with men. *Res Humanit Soc Sci*. 2012;2(4):36–48.
- Rhodes S, et al. A CBPR partnership increases HIV testing among men who have sex with men (MSM): outcome findings from a pilot test of the CyBER testing internet intervention. *Health Educ Behav*. 2011;38(3):311–20.
- Zou H, et al. Internet-Facilitated, Voluntary Counseling and Testing (VCT) Clinic-Based HIV Testing among Men Who Have Sex with Men in China. *PLoS One*. 2013;8(2):e51919.
- Lampkin D, et al. Reaching suburban men who have sex with men for STD and HIV services through online social networking outreach: a public health approach. *J Acquir Immune Def Syndr*. 2016;72(1):73–8.
- Schnall R, et al. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review. *J Med Internet Res*. 2014;16(5):e134.
- Blas MM, et al. Effect of an online video-based intervention to increase HIV testing in men who have sex with men in Peru. *PLoS One*. 2010;5(5):e10448.
- UNDP. Towards Universal Access: Examples of municipal HIV programming for men who have sex with men and transgendered people in six Asian cities. Bangkok: UNDP; 2011.
- Lau JTF, et al. A randomized controlled study to evaluate the efficacy of an Internet-based intervention in reducing HIV risk behaviors among men who have sex with men in Hong Kong. *AIDS Care*. 2008;20(7):820–8.



Acceptability of Peer-Delivered HIV Testing and Counselling Among Men Who Have Sex with Men (MSM) and Transgender Women (TW) in Myanmar

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Abstract

Men who have sex with men (MSM) and transgender women (TW) are a priority population for HIV prevention in Myanmar but report sub-optimal HIV testing frequency. Previous studies have shown that peer involvement in HIV testing can normalize stigmatized sexualities and reduce barriers to testing. We explored the acceptability of peer-delivered HIV testing among 425 undiagnosed MSM and TW in Yangon and Mandalay. An overwhelming majority of participants (86%) reported being ‘comfortable/very comfortable’ with peer-delivered HIV testing. Logistic regression identified reporting sexual identity as *Apone* [adjusted odds ratio (aOR) 3.8; 95% CI 1.2–11.7], recent HIV testing (aOR 3.1; 95% CI 1.4–6.5), reporting a high likelihood of HIV acquisition (aOR 3.6; 95% CI 1.7–7.6), and reporting ≥ 5 casual partners in the past 3 months (aOR 0.2; 95% CI 0.1–0.6) as associated with peer-delivered HIV testing acceptability. Given ongoing HIV vulnerability among MSM and TW in Myanmar, peer-delivered testing may offer prevention benefits by increasing testing rates and identifying undiagnosed infection earlier.

Keywords Men who have sex with men · Transgender women · HIV testing and counseling · Myanmar · Peer-delivered

Introduction

Ambitious UN targets to virtually eliminate AIDS by 2030 are predicated on 90% of people with undiagnosed HIV infection knowing their HIV status [1]. Achieving this target is reliant on regular HIV testing among populations at risk of HIV infection. HIV testing offers important primary prevention opportunities through pre- and post-test discussions with providers and post-diagnosis reductions in risk behaviors [2], and facilitates secondary HIV prevention through early treatment access and viral suppression [3, 4].

Men who have sex with men and transgender women (hereafter referred to as MSM and TW for brevity) are a key population in the Asian HIV epidemic and are at substantially increased risk of HIV acquisition through risk behaviors such as unprotected anal intercourse with multiple sexual partners [5, 6]. In Myanmar, HIV prevalence among MSM and TW in 2015 increased to 11.6% from an estimated 6.6% in 2009, and the concentration of HIV reported among MSM and TW in the major cities of Yangon (26.6%) and Mandalay (21.6%) are among the highest seen across Asia-Pacific [7–9]. HIV infections among MSM and TW currently account for 13% of all incident cases in Myanmar; this is estimated to increase to 27% by 2021 in the absence of adequate interventions [10]. Consequently, MSM and TW are a priority for HIV control in Myanmar’s national response [11] and this concentrated focus has seen a rise in HIV prevention programs targeting this group [12].

The new national strategic plan for HIV highlights the need to strengthen the enabling environment for HIV prevention interventions among key populations [9]. Strategies such as expanding HIV testing service (HTS) models, strengthening affected communities’ involvement in service

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delivery, and the tailoring of community-based HIV services are identified as priority activities to reach 90% of MSM and TW by 2030 [9]. In part, these activities are designed to address low rates of HIV testing among MSM and TW in Myanmar [9], where the illegality of homosexual acts and discrimination and harassment of sexual minorities act as barriers to uptake of HTS [13–16]. In such settings, the involvement of MSM and TW peers in service delivery can enhance demand and uptake of HIV and sexual health services [13, 17–19] by creating environments in which stigmatized sexual identities are normalized and where MSM and TW can talk openly about same-sex behaviors [20]. When applied specifically to HIV testing, the involvement of peers in countries as diverse as Nigeria, Australia and France has demonstrated effectiveness in increasing diagnoses of HIV and linking more HIV-positive MSM to care compared to non-peer involved models [21–23].

Recent developments in Myanmar have expanded opportunities for new models of HTS, beyond those provided by government or private providers. In particular, the introduction of decentralized HTS in 2013, the introduction of HIV rapid point-of-care (RPOC) testing and increasing provision of HIV prevention services by domestic and international NGOs [24, 25] has enabled the expansion of HIV testing for MSM and TW into community settings. While there are some examples of the positive impact of MSM and TW peer-testing [26] and peer-involvement [27] on HIV testing rates in Asia, models that include the direct provision of HIV testing by MSM and TW remain relatively uncommon in this region. Moreover, the acceptability of peer-delivered models of testing among MSM and TW in Asia is also unknown; only one study has explored acceptability among key populations in Asia, revealing a high level of acceptance for peer-delivered testing among people who inject drugs in Thailand [28]. However, factors such as the perceived professionalism and skill of peer testers [29], boundaries between personal and professional relationships [30], and concerns for confidentiality [31] may affect the acceptability of peer-delivered testing and the extent to which such models can contribute to improved service engagement and rates of HIV testing among MSM and TW.

In 2014, we conducted a study among MSM and TW in Myanmar to: (1) determine the level of acceptability of peer-delivered HIV testing; and (2) identify factors associated with peer-delivered HIV testing acceptability.

Methods

Cross-sectional surveys were completed by self-identifying MSM and TW recruited in Yangon and Mandalay in November and December 2014. Participants were recruited by 12 trained MSM and TW peer workers selected from

community-based NGO Myanmar Business Coalition on AIDS (MBCA). MBCA implements an MSM and TW-targeted outreach HIV education and prevention program which is coordinated by Burnet Institute as part of their HIV education and prevention program in Myanmar. This program has been operating since 2009 and provides condoms and lubricant distribution and HIV testing education and referral activities to MSM and TW through outreach activities and fixed-site drop in centres in five locations.

Recruitment

MSM and TW were recruited in Yangon and Mandalay. These are the two largest cities in Myanmar and were chosen based on high HIV prevalence among MSM and TW (26.6% in Yangon and 21.6% in Mandalay respectively; 9) and their subsequent centrality in Myanmar's HIV prevention response.

Trained peer workers recruited participants using convenience and snowball sampling at known MSM/TW-hotspot locations. Following a short study description, MSM and TW expressing interest in participating were provided with a non-study identifying participation card containing a list of times and locations where they could participate in surveys. Participants that indicated they knew others in their peer network that might be interested in participating were provided with up to three participation cards to give to their peers. Eligible participants were biologically male, aged over 18 years, self-reported anal sex with another male in the past 1 year and had not previously participated in the study. We estimate that approximately 15% of eligible MSM and TW provided with a study card did not present at the agreed time and place for interview. All participants were required to provide informed written consent prior to participation and received 3000 Myanmar Kyat (MMK; approximately USD\$2.20) for their time and travel expenses at the completion of the survey.

Data Collection

Surveys were researcher-administered using electronic, password-protected tablets at fixed-site locations selected on the basis of their confidentiality and safety. These included established drop in centres, the Burnet Institute office in Yangon, and locations where MSM and TW gather such as teahouses. Given the sensitivity of same-sex behaviors in Myanmar, no personally-identifying information was collected or recorded from participants during interviews. The survey was designed to inform ongoing HIV prevention and testing services for MSM and TW in Myanmar. The survey was conducted in the local language and explored a range of socio-demographic factors, sexual risk behaviors, HIV prevention practices, knowledge, attitudes and

use of HIV/STI risk reduction strategies and self-perceived HIV risk among MSM and TW. Factors included in this analysis were: age, sexual identity (*Apone*, *Apwint* and *Tha Nge*; see below), highest level of education (primary, middle, secondary, tertiary), monthly income (equal or below median, above median), number of regular (none, 1, > 1) and casual (none, 1–5, > 5) male partners in past 3 months, condom use by partner type during the past 3 months (never, occasionally, often, always), any sex with female partners in past 3 months (yes, no), self-perceived risk of acquiring HIV (very unlikely, unlikely, neither unlikely or likely, likely, very likely), how serious participants considered HIV (not at all serious, not serious, neither serious nor unserious, serious, extremely serious), lifetime history of testing for HIV (yes, no) and time since last HIV test (past 6 months, 6 months–2 years, > 2 years, never).

Sexuality was defined using locally accepted the labels *Apone*, *Apwint* and *Tha Nge* that are commonly used in Myanmar to describe sub-groups of MSM and TW and have typically been indicative of sexual positioning, sexual behavior and power dynamics [32]. However these labels are equivocally defined [33, 34] and continue to evolve [34], particularly in response to increasing exposure to Western media and acceptance of sexual minorities in Myanmar. To reflect current understandings of male sexual identities in Myanmar we operationalized these terms in the following way: *Apwint* are biological males who are typically disclosing of same-sex preferences, and have a feminine presentation and/or may be regarded as transgendered. *Apone* are men who have a masculine presentation, and in some spheres or circumstances may disclose same-sex behavior and identify as gay, while in others are likely to conceal, or deny their same-sex preferences and are often referred to as ‘hidden’. *Apwint* and *Apone* are typically receptive partners in sexual positioning. *Tha Nge* are masculine, heterosexual-identifying men who conform to heteronormative expectations, and may engage in sexual relationships with women, while also engaging in incidental sex with other men and may also be referred to as ‘hidden’. *Tha Nge* typically partner with *Apwint*, often commercially, as well as *Apone*, and assume the insertive role in sexual partnerships [9, 13, 32, 33].

Analysis

The primary outcome of interest was acceptability of peer-delivered HIV testing. Participants were asked to respond to the following question: “How comfortable would you be with an appropriately trained peer counsellor providing you with HIV testing and counseling?” Those that reported being *very comfortable* or *comfortable* were classified as ‘accepting’ of peer-delivered HIV testing while those who reported being *neither comfortable nor uncomfortable*,

uncomfortable, *very uncomfortable* were classified as ‘not accepting’ of peer-delivered testing. Analyses were restricted to those who provided a valid response to the primary outcome and who self-reported being HIV undiagnosed (either through reporting their last HIV test as negative or reporting their HIV status as unknown). Exposures were chosen a priori based on previous research on factors associated with testing uptake and knowledge of the local context. Socio-demographic characteristics, sexual risk behaviors, HIV prevention practices, barriers to HIV testing and self-perceived HIV risk were analyzed descriptively. Univariable and multivariable logistic regression identified significant associations between these variables and acceptability of HIV testing delivered by peers. A multivariable model was constructed retaining all variables analyzed in univariable analyses. Analyses were conducted using Stata (Version 13, Stata Corp., College Station, TX, USA). Statistical significance in all analysis was set at $p \leq 0.05$.

Ethics

Ethics approval was granted by the Alfred Hospital Ethics Committee (Australia; #445/14) and the Department of Medical Research (Lower Myanmar) Ethical Review Committee (761 Ethics 2004).

Results

520 MSM and TW were recruited for this study. Ninety-five participants (18.3%) were excluded from analysis based on missing data on the primary outcome ($n = 19$) or HIV status ($n = 10$) or who self-reported an HIV-positive status ($n = 66$). Among the remaining 425 HIV-undiagnosed participants, 173 (40.7%) were recruited in Yangon and 252 (59.3%) in Mandalay. Three hundred and fifty four (83.5%) identified as male and 70 (16.5%) as TW. Two hundred and forty seven (58.3%) MSM and TW were aged under 25 and 210 (49.9%) identified as *Tha Nge*. Thirty seven percent of MSM and TW had completed secondary level education (equivalent to 11 years of schooling). The median monthly income was MMK 150,000 (approximately USD \$190; IQR: 90,000–200,000).

Most MSM and TW reported anal sex with a regular male partner; 174 (40.9%) and 81 (19.1%) participants reported one, and more than one regular partner in the past 3 months, respectively. Among these 255 participants, 160 (69.9%) reported inconsistent condom use with their regular partner(s) during the past 3 months. Recent sex with casual partners was also common, with 199 (48.3%) and 88 (21.4%) participants reporting sex with 1–5 and more than 5 casual partners in the past 3 months, over half of whom (56.9%) reported inconsistent use of condoms. Thirty three percent

of all participants reported both regular and casual partner(s) in the past 3 months. Sex with female partners was rare and reported by 64 (15.1%) participants.

One hundred and ninety (46.0%) MSM and TW considered it ‘*likely*’ or ‘*very likely*’ they would acquire HIV in the future and 246 (58.7%) considered HIV ‘*very serious*’. HIV testing within the past 6 months was reported by 282 (66.8%) of participants. Three hundred and sixty-six (86.1%) indicated they were ‘comfortable/very comfortable’ with the idea of receiving HIV testing from a trained peer and classified as accepting of peer-delivered HIV testing (Table 1).

In unadjusted analyses, participants who identified as *Apone* (OR 3.6; 95% CI 1.5–8.9), who considered their risk of HIV acquisition as ‘*likely/very likely*’ (OR 3.0; 95% CI 1.6–5.7), who perceived HIV as ‘*very serious*’ (OR 2.3; 95% CI 1.3–4.1), and who reported their last HIV test within the past 6 months (OR 3.3; 95% CI 1.8–6.0) or between 6 months and 2 years (OR 4.6; 95% CI 1.5–14.1) were significantly more likely to find peer-delivered HIV testing acceptable. MSM and TW with more than five casual partners in the past 3 months were significantly less likely to accept peer-delivered HIV testing (OR 0.5; 95% CI 0.2–1.0) (Table 1).

In multivariable analysis, self-identifying as *Apone* (aOR 3.8; 95% CI 1.2–11.7), considering the risk of HIV acquisition as ‘*likely/very likely*’ (aOR 3.6; 95% CI 1.7–7.6), reporting an HIV test in the past 6 months (aOR 3.1; 95% CI 1.4–6.5) or between 6 months and 2 years ago (aOR 4.3; 95% CI 1.2–15.4) remained positively associated with acceptability of peer-delivered HIV testing. Reporting more than 5 casual partners in the past three months (aOR 0.2; 95% CI 0.1–0.6) also remained negatively associated with acceptance of peer-delivered HIV testing (Table 1).

Discussion

This study revealed a high level of acceptance for peer-delivered HIV testing among MSM and TW in Myanmar. The acceptability of HIV peer-testing among key populations in Myanmar has not been previously investigated. Acceptability of peer-delivered HIV testing was high across all variables that characterized MSM and TW in our sample, demonstrating broad acceptability of peer-delivered HIV testing models. Acceptability of peer-delivered HIV testing was particularly high among MSM and TW identifying as *Apone*, those who reported recent HIV testing and perceived themselves as at high risk of acquiring HIV in the future. These findings have implications for future models of HTS in Myanmar and, given recent national recommendations for peer-involved models of service delivery, have immediate translational potential. Alongside new global guidelines supportive of lay HIV testing [35], MSM and TW peer-based

HTS emerging in other countries [36, 37], nascent community mobilization and the increasing availability of RPOC HIV testing enhance the feasibility of new MSM and TW peer-based HIV testing models in Myanmar.

Our finding that *Apone* were more likely to accept peer-delivered HIV testing than heteronormative MSM self-identifying as *Tha Nge* likely reflects their relative level of comfort accessing peer-involved services more obviously tailored to MSM and TW. While over 80% of *Tha Nge* still considered peer-delivered testing as acceptable, ensuring these service models appeal to *Tha Nge* who may not identify as the intended target population of MSM and TW-specific services is crucially important to increase the reach and effectiveness of HTS in Myanmar. Across Asia, men who have sex with both men and women are less likely to test for HIV compared to men with exclusively male partners [38, 39], suggesting that heteronormative MSM are not adequately reached or served by existing models of HIV testing. However, while the avoidance of heteronormative men of HIV services that manifestly cater for MSM and TW may be expected, our finding that four in five *Tha Nge* were accepting of peer-delivered HIV testing suggests potential benefits of a peer-based model for this group. Mainstream health services in Asia have been identified as locations where HIV risk populations perceive and experience significant discrimination [15, 16, 40]. Mainstream health professionals in Asia have also been shown to exhibit highly stigmatizing attitudes to people at risk or living with HIV [41, 42]. Peer-based services can minimize reluctance to test associated with service-provider stigma [43, 44] by providing environments in which same-sex behaviors can be openly discussed with other MSM and TW, thereby ensuring that clients receive counseling and testing commensurate with their actual risk behaviors.

Our sample, recruited in the context of an existing community-based HIV prevention program, demonstrated a high level of existing engagement with HIV testing services. Two thirds of MSM and TW reported an HIV test in the past 6 months and the proportion reporting an HIV test in the past 12 months was one and a half times higher than the national average [9]. We found that MSM and TW with a more recent history of HIV testing were more likely to find peer-delivered HIV testing acceptable. This result is not surprising, given that MSM and TW who routinely engage with testing services are likely to have already overcome certain barriers to accessing HTS and may therefore be more willing to consider alternative models of testing. In recent studies, Chinese MSM who recently tested were more willing to consider couple-based HIV testing [45], while people who inject drugs in Thailand who reported recent avoidance of HIV testing were around three times less likely to accept peer-delivered HIV testing compared to those that did not [28]. Taken together, these findings highlight the

Table 1 Participant characteristics and logistic regression associations with acceptability of peer-delivered HIV testing among MSM and TW

	Total (n = 425)	Accepting of peer-delivered HIV testing (n = 366)	Associations between acceptability of peer-delivered HIV testing and participant characteristics			
			OR	95% CI	AOR	95% CI
Location						
Yangon	173 (40.7)	150 (86.7)	1.1	0.6–1.9	0.6	0.3–1.3
Mandalay	252 (59.3)	216 (85.7)	1	–	1	–
Gender						
Male	354 (83.5)	305 (86.2)	1.0	0.5–2.2		
Transgender woman	70 (16.5)	60 (85.7)	1			
Age						
Median (IQR)	25 years (20–28)					
< 25 years	247 (58.3)	211 (85.4)	0.8	0.4–1.7	1.1	0.4–2.7
25–29 years	101 (23.8)	87 (86.1)	0.8	0.3–2.0	1.1	0.4–3.1
30 > years	76 (17.9)	67 (88.2)	1	–	1	–
Sexual identity						
<i>Apone</i>	108 (25.7)	102 (94.4)	3.6	1.5–8.9**	3.8	1.2–11.7*
<i>Apwint</i>	103 (24.5)	88 (85.4)	1.3	0.7–2.4	1.6	0.8–3.9
<i>Tha Nge</i>	210 (49.9)	173 (82.4)	1	–	1	–
Highest level of education achieved						
Primary school or below (< 5 years)	33 (7.8)	27 (81.8)	0.7	0.3–1.9	0.9	0.2–3.0
Middle school (6–9 years)	105 (24.8)	94 (89.5)	1.3	0.6–3.0	2.2	0.8–6.1
Secondary school (11 years)	159 (37.5)	134 (84.3)	0.8	0.4–1.6	1.0	0.4–2.2
Tertiary and above (12 > years)	127 (30.0)	110 (86.6)	1	–	1	–
Monthly income						
Median monthly (IQR)	150,000 MMK (90,000–200,000) or USD 109 (65–145)					
Above median (> 150,000 MMK; USD 110)	135 (32.1)	116 (85.9)	1.0	0.5–1.7	0.7	0.4–2.0
Below median (< 150,000 MMK; USD 109)	286 (67.9)	247 (86.4)	1	–	1	–
Number of regular male partners in past 3 months						
None	170 (40.0)	143 (84.1)	1	–	1	–
One	174 (40.9)	155 (89.1)	1.5	0.8–2.9	0.8	0.4–2.0
More than one	81 (19.1)	68 (84.0)	1.0	0.5–2.0	0.6	0.3–1.5
Consistent condom use with regular partner ^a	70 (30.4)	65 (92.9)	0.5	0.2–1.3	–	–
Inconsistent condom use with regular partner	160 (69.6)	138 (86.3)	1	–	–	–
Number of casual male partners in past 3 months						
None	125 (30.3)	111 (88.8)	1	–	1	–
1–5 casual partners	199 (48.3)	176 (88.4)	1.0	0.5–2.0	0.9	0.4–2.2
More than 5 casual partners	88 (21.4)	69 (78.4)	0.5	0.2–1.0*	0.2	0.1–0.6**
Consistent condom use with casual partners ^a	122 (43.1)	108 (88.5)	1	0.3–1.2	–	–
Inconsistent condom use with casual partners	161 (56.9)	133 (82.6)	0.6	–	–	–
Sex with both regular and casual male partners in the past 3 months ^a	139 (33.7)	118 (84.9)	–	–	–	–
Any sex with female partners in past 3 months						
Yes	64 (15.1)	54 (84.4)	0.9	0.4–1.9	1.2	0.4–2.9
No	360 (84.9)	311 (86.4)	1		1	
Self-reported likelihood of acquiring HIV in the future						
Likely/very likely	190 (46.0)	176 (92.6)	3.0	1.6–5.7**	3.7	1.7–7.8**
Very unlikely–Neutral ^b	223 (54.0)	180 (80.7)	1	–	1	–
Self-perceived seriousness of HIV						
Very serious	246 (58.7)	222 (90.2)	2.3	1.3–4.1**	2.0	1.0–3.9*

Table 1 (continued)

	Total (n = 425)	Accepting of peer-delivered HIV testing (n = 366)	Associations between acceptability of peer-delivered HIV testing and participant characteristics			
			OR	95% CI	AOR	95% CI
Not at all serious–serious ^c	173 (41.3)	138 (79.8)	1	–	1	–
Time since last HIV test						
During past 6 months	282 (66.8)	252 (89.4)	3.3	1.8–6.0**	3.1	1.5–6.6**
> 6 months and < 2 years	51 (12.1)	47 (92.2)	4.6	1.5–14.1**	4.2	1.2–14.8*
> 2 years/Never tested	89 (21.1)	64 (71.9)	1	–	1	–

^aGiven the lack of association between condom use variables at peer testing acceptability and collinearity of these variables with the number of sex partners, condom use was not included in the adjusted mode

^bIncludes ‘Very unlikely’, ‘unlikely’, ‘neither unlikely or likely’ and ‘likely’

^cIncludes ‘Not at all serious’, ‘Not serious’, ‘Neither unserious nor serious’ and ‘Serious’

* $p < 0.05$; ** $p < 0.01$

need to consider specific strategies to identify and engage naïve and infrequent HIV testers to facilitate ongoing and routine engagement with HIV prevention services, including new and novel models of HIV testing. Innovative use of online technologies, for example, have demonstrated positive results in engaging MSM for HIV testing [46–49], including non-gay identified MSM [50], and are increasingly being used across Asia to reach hard to reach and hidden MSM and TW populations [51, 52]. Such approaches could be considered in Myanmar, particularly in light of the burgeoning information, communication and technology (ICT) environment [53] and increasing use of cyber networks among MSM and TW communities [54].

MSM and TW in this study who perceived they were at a greater risk of HIV acquisition were more accepting of peer-delivered HIV testing. In other studies, fear of a positive result has been identified as a barrier to HIV testing among MSM [55, 56]. Decisions to test among people at risk of HIV may be influenced by perceptions about the availability and quality of post-diagnosis support and HIV treatment and care following a positive result [55]. Our finding suggests that expectations among MSM and TW about the nature of post-diagnosis support provided by peers may similarly influence decisions to test and reflect a preference to be diagnosed by peers or by people with whom they have an existing relationship. This finding was potentially influenced by the recruitment of a sample through an established and peer-involved HIV education and prevention service. In any case, the common experiences and characteristics between peer workers and clients has been identified as a major benefit and appeal of peer-based services [57] and may help promote better engagement with HTS, particularly among those who consider themselves at high risk of HIV.

Somewhat contradictory of the positive relationship between acceptability of peer-delivered HIV testing and

perceived risk of HIV acquisition, we found that those who reported a higher number of casual sex partners were less likely to find peer-delivered HIV testing acceptable. Others have reported peer-led models of HIV testing have attracted MSM and TW who report higher levels of sexual risk behavior compared to non-peer-based services [23, 58]. Our finding may reflect the context in which MSM and TW meet sex partners in Yangon and Mandalay mostly through a small number of public cruising areas, and concerns identified by others in relation to a potential overlap of social and sexual MSM and TW networks [59, 60]. While most MSM and TW reporting more than five sex partners in the past 3 months still found peer-delivered HIV testing acceptable, for some, concerns about privacy, confidentiality or fear of being judged by peers in relation to their risk behaviors or when receiving a positive diagnosis may present certain barriers [61]. While others have noted that peer-based models are perceived by MSM and TW as non-judgemental [31, 62], a perceived lack of confidentiality and potential for community gossip has been identified recently as a concern among MSM and TW in Myanmar regarding community-based HIV services [63].

Our sampling approach, which recruited MSM and TW engaged with an existing HIV prevention service in the two largest urban settings in Myanmar, may limit the generalizability of our findings to smaller cities or more rural locations. However, the findings are likely to be informative of attitudes among MSM and TW in the major cities of Yangon and Mandalay given that the MBICA-Burnet Institute outreach program through which the sample was recruited was among the most extensive (distributing approximately 1 million condoms per annum through outreach) of the MSM and TW peer-involved services operating in Yangon (four services) and Mandalay (three services) at the time of recruitment. MSM and TW included in this study reported

rates of HIV testing higher than the national average [7] suggesting regular engagement with HIV prevention services. This frequent exposure to HIV services and health promotion may have contributed to the high level of acceptance for peer-delivered testing. Our sample was also relatively well educated and remunerated [64] and their preferences may not reflect those of MSM and TW who are more isolated, have less access to HIV services, or who are economically and socially-disadvantaged. However, the recruitment of MSM and TW being reached by an NGO HIV education and prevention program in outreach settings in Yangon and Mandalay enhances the translation potential of findings. As noted earlier, the new national strategic plan for HIV in Myanmar [9] emphasizes an expanded role for peers in HIV models of care. To our knowledge no HIV peer-delivered testing model has yet been implemented in Myanmar, with peer roles in testing typically restricted to pre-test counselling in NGO services. Soon after data collection was completed for this study the MBCA-Burnet Institute program introduced HIV testing, with peers involved in promoting testing services and in pre-test counselling and nurses delivering the RPOC tests. These services have since delivered on average 650 and 850 HIV tests per month to MSM and TW. Our findings showing high levels of acceptability for peer-delivered testing among MSM engaged with this NGO-delivered HIV program, suggest the direct provision of tests by peers (rather than nurses) would potentially enhance demand for testing even further and expand opportunities for prevention education.

MSM and TW in South and South-east Asia have low rates of HIV testing compared to other low- and middle-income countries [65]. Our findings demonstrate that peer-delivered HIV testing is highly acceptable and, given the low national rates of HIV testing and ongoing experiences of stigma and discrimination among MSM and TW in Myanmar, may help circumvent barriers to HIV testing and increase engagement of MSM and TW in HIV treatment and care. The current policy, regulatory and community context in Myanmar is conducive to the introduction of community-based models of HIV testing and the inclusion of peer-testing models [9] and our findings provide strong support for the integration of HIV testing by peers in community-based models. Further research is needed to understand implementation barriers to integrated peer-delivered HIV testing models across a range of community and clinical settings, including those associated with potential concerns for privacy and confidentiality among more sexually-active MSM and TW.

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Author's Contribution ZMO, ZWT, PPA, CH, CR and MS all contributed to the development of the data collection tools, training of peer educators to recruit participants, oversight of recruitment, data collection, and interpretation of results. VV, BLD and MS led the data cleaning and analysis process. VV led the writing of the manuscript. All authors have read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

1. UNAIDS. 90-90-90: An ambitious treatment target to help end the AIDS epidemic. Geneva, Switzerland: UNAIDS; 2014.
2. Fox J, White PJ, Macdonald N, Weber J, McClure M, Fidler S, et al. Reductions in HIV transmission risk behaviour following diagnosis of primary HIV infection: a cohort of high-risk men who have sex with men. *HIV Med.* 2009;10(7):432–8.
3. Sharma M, Ying R, Tarr G, Barnabas R. Systematic review and meta-analysis of community and facility-based HIV testing to address linkage to care gaps in sub-Saharan Africa. *Nature.* 2015;528(7580):S77–85.
4. Insight Start Study Group. Initiation of antiretroviral therapy in early asymptomatic HIV infection. *N Engl J Med.* 2015;373(9):795–807.
5. van Griensven F, Thienkrua W, McNicholl J, Wimonasate W, Chaikummao S, Chonwattana W, et al. Evidence of an explosive epidemic of HIV infection in a cohort of men who have sex with men in Thailand. *AIDS.* 2013;27(5):825–32.
6. Baral S, Sifakis F, Cleghorn F, Beyrer C. Elevated risk for HIV infection among men who have sex with men in low- and middle-income countries 2000–2006: a systematic review. *PLoS Med.* 2007;4(12):e339.
7. National AIDS Programme. Integrated bio-behavioural survey. Myanmar: Department of Health; 2009.
8. National AIDS Programme. Myanmar global AIDS response program report 2015. Myanmar: Department of Health; 2015.
9. National AIDS Programme. National strategic plan on HIV and AIDS: Myanmar 2016–2020. Myanmar: Department of Health; 2016.

10. Strategic Information and Monitoring and Evaluation Working Group Technical and Strategy Group on AIDS. HIV estimates and projections: asian epidemiological model Myanmar 2010–2015. Myanmar: Department of Health.
11. National AIDS Programme. Myanmar National Strategic Plan on HIV and AIDS 2011–2015. Myanmar: Department of Health.
12. National AIDS Programme. Global AIDS response progress report. Myanmar: Department of Health; 2014.
13. Chua LJG, Glibert D. Sexual orientation and gender identity minorities in transition: LGBT rights and activism in Myanmar. *Hum Rights Q*. 2015;37:1–28.
14. Logie CH, Newman PA, Weaver J, Roungraphon S, Tepjan S. HIV-related stigma and HIV prevention uptake among young men who have sex with men and transgender women in Thailand. *AIDS Patient Care STDs*. 2016;30(2):92–100.
15. Wei C, Cheung DH, Yan H, Li J, Shi LE, Raymond HF. The impact of homophobia and HIV Stigma on HIV testing uptake among Chinese men who have sex with men: a mediation analysis. *J Acquir Immune Defic Syndr*. 2015;71(1):87–93.
16. Wei C, Yan H, Yang C, Raymond HF, Li J, Yang H, et al. Accessing HIV testing and treatment among men who have sex with men in China: a qualitative study. *AIDS Care*. 2014;26(3):372–8.
17. Scott HM, Pollack L, Rebchook GM, Huebner DM, Peterson J, Kegeles SM. Peer social support is associated with recent HIV testing among young black men who have sex with men. *AIDS Behav*. 2014;18(5):913–20.
18. Young SD, Cumberland WG, Nianogo R, Menacho LA, Galea JT, Coates T. The HOPE social media intervention for global HIV prevention: a cluster randomized controlled trial in Peru. *Lancet HIV*. 2015;2(1):e27–32.
19. Williamson LM, Hart GJ, Flowers P, Frankis JS, Der GJ. The Gay Men's Task Force: the impact of peer education on the sexual health behaviour of homosexual men in Glasgow. *Sex Transm Infect*. 2001;77(6):427–32.
20. Trapence G, Collins C, Avrett S, Carr R, Sanchez H, Ayala G, et al. From personal survival to public health: community leadership by men who have sex with men in the response to HIV. *Lancet*. 2012;380(9839):400–10.
21. Adebajo S, Eluwa G, Njab J, Oginni A, Ukwuije F, Ahonsi B, et al. Evaluating the effect of HIV prevention strategies on uptake of HIV counselling and testing among male most-at-risk-populations in Nigeria; a cross-sectional analysis. *Sex Transm Infect*. 2015;91(8):555–60.
22. Minas BC, Giele CM, Laing SC, Bastian L, Burry AW, Sales KJ, et al. Early diagnosis of HIV among men who have sex with men in Western Australia: impact of a peer-led sexually transmissible infection testing service. *Sex Health*. 2015;12(4):360–3.
23. Lorente N, Preau M, Vernay-Vaisse C, Mora M, Blanche J, Otis J, et al. Expanding access to non-medicalized community-based rapid testing to men who have sex with men: an urgent HIV prevention intervention (The ANRS-DRAG Study). *PLoS ONE*. 2013;8(4):e61225.
24. National AIDS Programme. Joint Rapid Assessment of HIV Treatment in Myanmar: Final Report September 2013. Myanmar: Department of Health, 2013.
25. Oo HN, Hone S, Fujita M, Maw-Naing A, Boonto K, Jacobs M, et al. Evolution of the health sector response to HIV in Myanmar: progress, challenges and the way forward. *J Virus Erad*. 2016;2(Suppl 4):20–6.
26. Pawa D, Firestone R, Ratchasi S, Dowling O, Jittakoat Y, Duke A, et al. Reducing HIV risk among transgender women in Thailand: a quasi-experimental evaluation of the sisters program. *PLoS ONE*. 2013;8(10):e77113.
27. USAID. Linkages Thailand: using peer mobilizers to increase uptake of HIV testing and counseling 3 July 2017. <https://www.usaid.gov/what-we-do/global-health/hiv-and-aids/success-stories/linkages-thailand-using-peer-mobilizers>.
28. Ti L, Hayashi K, Kaplan K, Suwannawong P, Wood E, Montaner J, et al. Willingness to access peer-delivered HIV testing and counseling among people who inject drugs in Bangkok, Thailand. *J Community Health*. 2013;38(3):427–33.
29. Njau B, Ostermann J, Brown D, Muhlbacher A, Reddy E, Thielman N. HIV testing preferences in Tanzania: a qualitative exploration of the importance of confidentiality, accessibility, and quality of service. *BMC Public Health*. 2014;14:838.
30. Reppe J, Carter T. A review of the literature on peer support in mental health services. *J Mental Health*. 2011;20(4):392–411.
31. Pedrana A, Koester K, Stewart W, Gibson S, Powell S, Stooze M. Editor Community-based rapid HIV point-of-care testing with contrasting health systems: a tale of two cities from San Francisco and Melbourne. 20th International AIDS Conference 2014 July 20–25, 2014; Melbourne, Australia.
32. Aung T, McFarland W, Paw E, Hetherington J. Reaching men who have sex with men in Myanmar: population characteristics, risk and preventive behavior, exposure to health programs. *AIDS Behav*. 2013;17(4):1386–94.
33. UNESCO Bangkok and Department of Medical Research MoH, Myanmar. Multi-level risk and protective factors and HIV-related risk behaviours among young men who have sex with men (YMSM) in Myanmar. Paris, France: UNESCO Bangkok and Department of Medical Research, Ministry of Health, Myanmar; 2015.
34. Gilbert D. Categorizing gender in queer Yangon. *Sojourn*. 2013;28(2):241–71.
35. WHO. Consolidated guidelines on HIV testing services. 5Cs: consent, confidentiality, counseling, correct results and connection Geneva, Switzerland WHO; 2015.
36. Zhang DP, Han L, Li CM, Meng SN, Leng ZW, Li F, et al. The impact of community-based organizations in HIV testing mobilization among men who have sex with men. *Zhonghua Yu Fang Yi Xue Za Zhi*. 2013;47(5):431–4.
37. Ryan KE, Wilkinson AL, Leiting D, El-Hayek C, Ryan C, Pedrana A, et al. Characteristics of gay, bisexual and other men who have sex with men testing and retesting at Australia. *Sex Health*. 2016;13(6):560–7.
38. Bowring AL, Veronese V, Doyle JS, Stooze M, Hellard M. HIV and sexual risk among men who have sex with men and women in Asia: a systematic review and meta-analysis. *AIDS Behav*. 2016;20(10):2243–65.
39. Guadamuz TE, Cheung DH, Wei C, Koe S, Lim SH. Young, online and in the dark: scaling up HIV testing among MSM in ASEAN. *PLoS ONE*. 2015;10(5):e0126658.
40. Churcher S. Stigma related to HIV and AIDS as a barrier to accessing health care in Thailand: a review of recent literature. *WHO South East Asia J Public Health*. 2013;2(2):12–22.
41. Chan KY, Yang Y, Li ZR, Stooze MA, Reidpath DD. Interrelationships between HIV/AIDS and risk behavior prejudice among medical students in Southern China. *Curr HIV Res*. 2009;7(6):601–11.
42. Chan KY, Stooze MA, Reidpath DD. Stigma, social reciprocity and exclusion of HIV/AIDS patients with illicit drug histories: a study of Thai nurses' attitudes. *Harm Reduct J*. 2008;5:28.
43. Ayala G, Makofane K, Santos GM, Beck J, Do TD, Hebert P, et al. Access to basic HIV-related services and PrEP acceptability among men who have sex with men worldwide: barriers, facilitators, and implications for combination prevention. *J Sex Transm Dis*. 2013;2013:953123.
44. Meehan SA, Leon N, Naidoo P, Jennings K, Burger R, Beyers N. Availability and acceptability of HIV counselling and testing services. A qualitative study comparing clients' experiences of accessing HIV testing at public sector primary health care

- facilities or non-governmental mobile services in Cape Town, South Africa. *BMC Public Health*. 2015;15:845.
45. Wei C, Muessig KE, Bien C, Yang L, Meng R, Han L, et al. Strategies for promoting HIV testing uptake: willingness to receive couple-based and collective HIV testing among a cross-sectional online sample of men who have sex with men in China. *Sex Transm Infect*. 2014;90(6):469–74.
 46. Rhodes SDVA, Stowers J, Miller C, McCoy TP, Hergenrath KC, Wilkin AM, Reece M, Bachmann LH, Ore A, Ross MW, Hendrix E, Eng E. A CBPR partnership increases HIV testing among men who have sex with men (MSM): outcome findings from a pilot test of the CyBER/testing internet intervention. *Health Educ Behav*. 2011;38(3):311–20.
 47. Zou H, Wu Z, Yu J, Li M, Ablimit M, Li F, et al. Internet-facilitated, voluntary counseling and testing (VCT) clinic-based HIV testing among men who have sex with men in China. *PloS ONE*. 2013;8(2):e51919.
 48. Lampkin D, Crawley A, Lopez TP, Mejia CM, Yuen W, Levy V. Reaching suburban men who have sex with men for STD and HIV services through online social networking outreach: a public health approach. *J Acquir Immune Defic Syndr*. 2016;72(1):73–8.
 49. Schnall R, Travers J, Rojas M, Carballo-Diequez A. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review. *Journal Med Internet Res*. 2014;16(5):e134.
 50. Blas MM, Alva IE, Carcamo CP, Cabello R, Goodreau SM, Kimball AM, et al. Effect of an online video-based intervention to increase HIV testing in men who have sex with men in Peru. *PLoS ONE*. 2010;5(5):e10448.
 51. UNDP. Towards universal access: examples of municipal HIV programming for men who have sex with men and transgendered people in six Asian cities Bangkok, Thailand: UNDP; 2011.
 52. Lau JTF, Lau M, Cheung A, Tsui HY. A randomized controlled study to evaluate the efficacy of an Internet-based intervention in reducing HIV risk behaviors among men who have sex with men in Hong Kong. *AIDS Care*. 2008;20(7):820–8.
 53. On device research. Myanmar: the final frontier for the mobile internet. On device research 2014. <https://ondeviceresearch.com/blog/myanmar-mobile-internet-report>
 54. Lin KS, Van der Putten M. Identities in motion: cyberspace and Myanmar men have sex with men. *Res Humaniti Soc Sci*. 2012;2(4):36–48.
 55. Lorenc T, Marrero-Guillamón I, Llewellyn A, Aggleton P, Cooper C, Lehmann A, et al. HIV testing among men who have sex with men (MSM): systematic review of qualitative evidence. *Health Educ Res*. 2011;26(5):834–46.
 56. Deblonde J, De Koker P, Hamers FF, et al. Barriers to HIV testing in Europe: a systematic review. *Eur J Public Health*. 2010;20:422–32.
 57. Simoni JM, Nelson KM, Franks JC, Yard SS, Lehavot K. Are peer interventions for HIV efficacious? A systematic review. *AIDS Behav*. 2011;15(8):1589–95.
 58. Yan H, Zhang R, Wei C, Li J, Xu J, Yang H, et al. A peer-led, community-based rapid HIV testing intervention among untested men who have sex with men in China: an operational model for expansion of HIV testing and linkage to care. *Sex Transm Infect*. 2014;90(5):388–93.
 59. Peterson JL, Rothenberg R, Kraft JM, Beeker C, Trotter R. Perceived condom norms and HIV risks among social and sexual networks of young African American men who have sex with men. *Health Educ Res*. 2009;24(1):119–27.
 60. Choi K-H, Ning Z, Gregorich SE, Pan QC. The influence of social and sexual networks in the spread of HIV and syphilis among men who have sex with men in Shanghai, China. *J Acquir Immune Defic Syndr*. 2007;45(1):77–84.
 61. Flowers P, Duncan B, Frankis J. Community, responsibility and culpability: HIV-risk management among Scottish gay men. *J Community Appl Soc Psychol*. 2000;10:285–300.
 62. Sempe S, Coquelin V, Rios L, Pelletier V, Stranz R. Editor Peer testing: how queer! How satisfying? Evaluating the immediate satisfaction and self-perceived effects of peer prevention interventions, including HIV rapid testing, in gay cruising areas and sex clubs. 19th International AIDS Conference 2012; Washington D.C., USA.
 63. Vaughan M. MSM community's perception of HTC service models for MSM 2015.
 64. World Bank. Gross national income by capita 2015 (atlas method and PPP): World Bank; 2015 <http://databank.worldbank.org/data/download/GNIPC.pdf>.
 65. Adam PCG, de Wit JBF, Toskin I, Mathers BM, Nashkoev M, Zablotska I, et al. Estimating levels of HIV testing, HIV prevention coverage, HIV knowledge, and condom use among men who have sex with men (MSM) in low-income and middle-income countries. *J Acquir Immune Defic Syndr*. 2009;52:S143–51.

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