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INTEGRATED BIOLOGICAL AND BEHAVIOURAL ASSESSMENT OF HUMAN IMMUNODEFICIENCY VIRUS AND SEXUALLY TRANSMITTED INFECTIONS AMONG TERTIARY STUDENT MEN WHO HAVE SEX WITH MEN IN NAIROBI, KENYA: PROJECT BESPOKE

Samuel Waweru Mwaniki

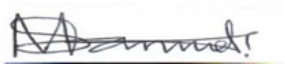
A thesis submitted to the Faculty of Health Sciences,
University of the Witwatersrand, Johannesburg, in fulfillment of the requirements for the degree of Doctor of Philosophy (PhD)



Johannesburg, South Africa, May 2023

Declaration

I, Samuel Waweru Mwaniki, declare that this thesis is my own work. Where the works of others have been used, these have been acknowledged in the text by way of citation and a comprehensive list of references. This work is being submitted for the degree of Doctor of Philosophy (PhD) at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

Signed:  **Date:** 26/05/2023

Dedication

I dedicate this work to my children, Elsie Njeri and Christian Mwaniki.

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Presentations

1. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. Prevalence of five curable STIs and associated risk factors among young gay, bisexual and other men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Poster presentation at the STI & HIV World Congress 2023 by the International Union Against STIs, to be held from 24th to 27th July in Chicago, Illinois, USA.
2. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. Prevalence of five curable STIs and associated risk factors among young gay, bisexual and other men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Included in book of abstracts of the International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-limited Settings (INTEREST 2023) by Amsterdam Institute for Global Health and Virology Education, held from 9th to 13th May in Maputo, Mozambique.
3. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young gay, bisexual and other men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Included in book of abstracts of the International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-limited Settings (INTEREST 2023) by Amsterdam Institute for Global Health and Virology Education, held from 9th to 13th May in Maputo, Mozambique.
4. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young gay, bisexual and other men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Poster presentation during the Conference on Public Health in Africa (CPHIA 2022) by Africa Centre for Disease Control, held from 12th to 16th December 2022 in Kigali, Rwanda.
5. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. Poster presentation during the African Region Global Health Conference by Stellenbosch University and the Consortium of Universities in Global Health, held from 27th to 30th October 2022 in Stellenbosch, South Africa.

Publications

1. **Mwaniki SW**, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated bio-behavioral assessment of HIV and STI among young tertiary student men who have sex with men in Nairobi, Kenya): a respondent-driven sampling survey protocol. Front Public Heal [Internet]. 2021;9:619694.
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2. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. "My friends would believe my word": appropriateness and acceptability of respondent-driven sampling in recruiting young tertiary student men who have sex with men for HIV/STI research in Nairobi, Kenya. Int J Environ Res Public Health [Internet]. 2022;19(12):7331.
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3. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi, Kenya: a respondent-driven sampling survey. AIDS Res Ther. 2023;20:7.
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5. **Mwaniki SW**, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. Res Sq [Internet]. 2022.
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Abstract

Aims: The aims of this study were to: assess the appropriateness and acceptability of using respondent-driven sampling (RDS) as a strategy for recruiting tertiary student MSM (TSMSM) in a HIV/STIs bio-behavioural survey, estimate HIV/STIs prevalence and associated risk factors among TSMSM, explore experiences of TSMSM with access and use of health services, and assess healthcare providers' (HCPs') attitudes and perspectives towards care for TSMSM.

Methods: The study was done in Nairobi, Kenya. During the first phase in September and October 2020, formative in-depth qualitative interviews were held with key personnel working in MSM-friendly health facilities (*n*=3), and TSMSM peer leaders (*n*=13), to assess the appropriateness and acceptability of using RDS to recruit TSMSM in a bio-behavioural survey. Subsequently, during the second phase in February and March 2021, six TSMSM selected from the 13 in the first phase, started off the RDS recruitment of another 242 TSMSM who participated in a cross-sectional bio-behavioural survey to estimate HIV/STIs prevalence and associated risk factors. The survey was digitally self-administered on REDCap® platform. Participants received serological testing for HIV and *Treponema pallidum*, and pooled molecular testing for *Chlamydia trachomatis, Mycoplasma genitalium, Neisseria gonorrhoeae*, and *Trichomonas vaginalis* using urethral, anorectal and oropharyngeal samples. The third phase in September 2021 involved qualitative work to assess health access and delivery for TSMSM. In-depth interviews were held with TSMSM (*n*=22) purposely selected from the TSMSM (*n*=248) who participated in the bio-behavioural survey. The interviews explored experiences of TSMSM with access and use of health services. During the same month, HCPs (*n*=36) took part in six focus group discussions to assess their attitudes and perspectives towards care for TSMSM. Qualitative data was analysed thematically using NVivo v.11 (first phase) and v.12 (third phase), and quantitative data was analysed using Stata v.15 and RDS-Analyst v0.72 (second phase).

Results: Formative qualitative work demonstrated that RDS was both appropriate and acceptable for recruiting TSMSM in the bio-behavioural survey. The median age of TSMSM who participated in the bio-behavioural survey was 21 years (interquartile range 20-22 years). RDS-adjusted prevalence of HIV, at least one of the five STIs, chlamydia, gonorrhea, *Mycoplasma genitalium* infection, trichomoniasis and latent syphilis were: 3.6%, 58.8%, 51.0%, 11.3%, 6.0%, 1.5% and

0.7%, respectively. Higher risk of HIV infection was independently associated with studying in private tertiary institutions, preferring a sex partner of any age, last sex partner being >25 years, meeting the last sex partner online and prevalent gonorrhea infection. Inconsistent condom use, and the last sex partner being a regular partner were independently associated with testing positive for at least one of the five STIs. From the qualitative work in the last phase, TSMSM vocalized experiences of prejudice, stigma and discrimination in public and institution-based health facilities, but felt they were equitably handled in community pharmacies, private and MSM-friendly health facilities. A majority of HCPs articulated positive attitudes towards care for TSMSM, while a minority expressed discomfort and displayed attitudes that likely reflected on their lived biases as it related to offering care and services to TSMSM.

Conclusion: The demonstrated high HIV prevalence among TSMSM in Nairobi reflects the urgent need for tailored structural, biomedical and behavioural prevention interventions for this young key population. Structural interventions are required to address the environmental, social and economic factors that influence individual risk and protective behaviours in relation to HIV infection. Biomedical interventions such as pre-exposure prophylaxis are necessary to reduce the chances of transmission of HIV. The observed high prevalence of curable STIs calls for interventions to improve prevention, as well as prompt detection and treatment of these STIs. This is important because untreated STIs biologically potentiate the transmission and acquisition of HIV, and cause considerable morbidity on their own. Furthermore, there is a need for interventions that foster inclusive attitudes among, and improve the knowledge/skills of HCPs in tertiary institution-based health facilities, so as to make services more culturally competent, equitable and accessible for TSMSM.

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List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
CARTA	Consortium for Advanced Research Training in Africa
CAS	Condomless Anal Sex
CBO	Community-based Organization
CI	Confidence Intervals
COREQ	Consolidated Criteria for Reporting Qualitative Studies
COVID-19	Corona Virus Disease 2019
DNA	Deoxyribonucleic Acid
HCPs	Healthcare Providers
HIV	Human Immunodeficiency Virus
IBBA	Integrated Biological and Behavioural Assessment
IQR	Inter-Quartile Range

LGBTQ	Lesbian, Gay, Bisexual, Transgender and Queer/Questioning
MSM	Men who have Sex with Men
NAAT	Nucleic Acid Amplification Test
NASCOP	National AIDS and STI Control Program
NGO	Non-governmental Organization
OR	Odds Ratio
PCR	Polymerase Chain Reaction
PEP	Post-exposure Prophylaxis
PrEP	Pre-exposure Prophylaxis
RDS	Respondent-Driven Sampling
REDCap®	Research Electronic Data Capture
RPR	Rapid Plasma Reagin
SSA	Sub-Saharan Africa
STI	Sexually Transmitted Infections
TPHA	Treponema Pallidum Haemagglutination Assay
TSMSM	Tertiary Student Men who have Sex with Men
TVET	Technical and Vocational Education Training
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organization
YMSM	Young Men who have Sex with Men

Organization of the Thesis

This thesis follows the 'Divided Block' format, which is one of the formats recommended by the Faculty of Health Sciences, University of the Witwatersrand. This format includes Literature Survey, Results and Conclusion chapters. The results are presented in separate chapters, with each chapter subdivided into introduction, methods, results, discussion and conclusion sections, much like the format used for research publications. References appear at the end of each chapter.

Accordingly, this thesis is organized into seven chapters. Chapter 1 is the literature survey that introduces the topics that will be covered in the thesis, discusses what is known about these topics, and concludes with a statement of the research gaps and how the present work aimed to address these gaps. Chapter 2 covers the formative qualitative research that was conducted to assess the appropriateness and acceptability of RDS in recruiting TSMSM for a bio-behavioural survey. Chapters 3 and 4 detail the HIV/STIs bio-behavioural survey where the prevalence of HIV and five curable STIs, and associated risk factors among TSMSM were estimated. Chapter 5 covers the healthcare engagement experiences of TSMSM, and chapter 6 the attitudes and perspectives of HCPs towards care for TSMSM. Chapter 7 consolidates all the findings from chapters 2 to 6, and offers concluding remarks in terms of recommendations for future research, policy and practice.

Candidate's Role

With the support of the supervisors, the candidate conceptualized the study, developed the study protocol and tools, performed all the interviews during the first phase, oversaw data collection during the second phase, and conducted half of the interviews and focus group discussions during the third phase. The remaining interviews and focus group discussions conducted during the third phase were led by Peter Kaberia who is acknowledged for his contributions. The candidate conducted data analyses for all phases of the work with the support of his supervisors and a statistician (Babatunde Adedokun) who is also acknowledged. The candidate wrote the first draft of the thesis, revised it through an iterative review process with his supervisors' incorporating guidance and comments, and prepared and submitted the final version for examination. The candidate is first author in four papers and two manuscripts under review emanating from the PhD work. The candidate acquired funding for the study through the CARTA programme.

Chapter 1: Literature Survey

1.0 Preamble

Part of this literature survey is from the study protocol published in October 2021(1). The literature survey has since been updated to reflect current and evolving knowledge in the field of study. In addition, each results chapter has an introduction section that leans heavily on this literature survey, and then builds on it in order to provide a detailed and focused background for the part of the study whose results are presented in each of those chapters.

1.1 Introduction

Globally in 2021, 38.4 million people were living with human immunodeficiency virus (HIV), with 1.5 million people becoming newly infected with HIV and 650,000 dying from acquired immunodeficiency syndrome (AIDS)-related illnesses(2). Despite significant progress in HIV prevention strategies and treatment regimens over the last four decades, HIV remains a leading cause of morbidity and mortality worldwide. In the 2019 global burden of disease report, HIV/AIDS was ranked among the top ten causes of disability adjusted life years among those aged 10-24 years (ranked ninth) and 25-49 years (ranked second)(3). Furthermore, cases of other sexually transmitted infections (STIs) have also been on the rise, with 373.1 million new cases of four curable STIs (chlamydia, gonorrhea, syphilis and trichomoniasis) reported in 2021(4).

The Joint United Nations Programme on HIV/AIDS (UNAIDS) strategy ‘Fast Track: Ending the AIDS Epidemic by 2030’, drives the global 95-95-95 goals: that by 2030, 95% of people living with HIV know their HIV status, 95% of people who know their status are on HIV treatment, and 95% of people on HIV treatment have a suppressed viral load(5). Addressing the needs of key populations is pertinent to achieving these ambitious HIV response goals. Key populations are groups who, due to specific behaviours are at increased risk of HIV infection irrespective of the epidemic type or local context. Their vulnerability to HIV is also increased by legal and social issues such as criminalization and stigmatization of their behaviours, respectively. They include gay, bisexual and other men who have sex with men (referred to here as MSM), transgender people, people who inject drugs, sex workers and people in prisons and other closed settings(6). Whereas HIV incidence in the general population has continued to fall worldwide, it has been on the rise among most key populations(6), necessitating targeted focus on these populations if the

UNAIDS goals are to be realized.

This literature survey and study focuses on MSM in general, and young MSM (YMSM) attending tertiary academic institutions in particular. The term tertiary student MSM (TSMSM) is used herein to reference this population. By definition, MSM is an epidemiological term that captures an array of male-to-male sexual behaviours and departs from characterization of these men by sexual orientation (homosexual, bisexual, heterosexual) or gender identity (male, transgender, queer). MSM include gay-identified men, heterosexually-identified men who have sex with men, bisexual men, men who sell sex to men who may have any sexual orientation and men who have sex with men in all-male settings such as prisons. The use of the term MSM takes cognizance of the high probability of HIV transmission per act of receptive anal intercourse, which has a central role in explaining the disproportionate HIV burden in this population(7). As well, criminalization of same-sex sexual behaviours, and societal stigma and discrimination against MSM increases their vulnerability to HIV(6).

1.2 HIV/STIs among MSM

Despite comprising only 1-3% of the world population, in 2021 MSM accounted for one fifth (21%) of all new adult HIV infections, with the risk of acquiring HIV being 28 times higher among MSM compared to heterosexual men(8). In sub-Saharan Africa (SSA), HIV prevalence is approximately five times higher among MSM than among men in the general population(9). In Southern Africa, high HIV prevalence has been reported in South Africa – 37.5%(10), Namibia – 12.4%, Botswana – 19.6% and Malawi – 12.5% to 21.4%(11–13). Similarly, this pattern is observed in West African countries where HIV prevalence is also high in countries such as Nigeria – 34.9%(14), Ivory Coast – 18%(15) and Ghana – 17%(16). In the East Africa region, high prevalence of HIV infection has also been reported in Tanzania – 30.2%(17), Uganda – 12.9%(18) and Kenya – 25.0%(19). Furthermore, high prevalence of various STIs among MSM has been reported in various countries in SSA. These include: chlamydia in Tanzania – 7.5%(17) and Kenya – 26%(20), *Mycoplasma genitalium* infection in Nigeria – 36.8%(21), gonorrhea in Tanzania – 14.4%(17) and Kenya – 26%(20), syphilis in Malawi – 12.3%(13) and Uganda – 9%(18), and trichomoniasis in South Africa – 9%(22).

1.3 HIV/STIs among young MSM

The HIV epidemic universally remains poorly defined among YMSM aged 15 – 24 years. There is minimal data on HIV prevalence and associated risk factors. This, in part, is attributed to lack of research and surveillance, and the difficulty of reaching YMSM who may fear disclosing their same-sex sexual behaviour due to societal stigma(23). In most countries, YMSM are made especially vulnerable to HIV by criminalization of homosexuality, widespread discrimination, stigma and violence, power imbalances in relationships, and alienation from family and friends(24). Due to these factors, YMSM are often at greater risk of acquiring HIV than young heterosexual males and older MSM(25).

Despite the relative paucity of research targeting YMSM worldwide, estimates of HIV prevalence among MSM have pointed to consistently high rates of infection among YMSM(26). A meta-analysis of studies published between 2006 and 2012 in China estimated the prevalence of HIV and syphilis among YMSM attending high school and college/university to be 4.4% and 5.7%, with separate study prevalence ranging from 1.1% to 26.9% and 2.2% to 15.4% respectively(27). In the USA, between 2008 and 2010, new HIV infections among YMSM aged 13-24 years increased by 22%, compared to 12% among MSM overall(28), with 92.8% of all diagnosed HIV infections among young males aged 13-19 years attributed to YMSM in 2011(29). In low and middle income countries, HIV prevalence as high as 9.6% in Nigeria, 12.7% in Senegal, 24% in Bahamas, and 28% in Jamaica, have also been reported among YMSM(30).

1.4 HIV/STIs among tertiary student MSM

Among tertiary students in the USA, TSMSM were found to be especially vulnerable to HIV infection(31). Further, a study of TSMSM attending university health services in the USA showed that 3% of participants had either a rectal chlamydia or pharyngeal gonorrhea infection(32). Similarly, a study among university students in China demonstrated that TSMSM were more sexually active and at greater risk of STIs than their non-TSMSM counterparts(33). Additional studies in China have reported considerable prevalence of HIV and syphilis among TSMSM, ranging from 2.5% to 5.5% and 4.4% to 7%, respectively(34–36), with many TSMSM only learning of their HIV-positive serostatus at university(37). In a South African higher education sector HIV survey, 6% of male students reported engaging in same-sex sexual practices and HIV

prevalence among TSMSM (4.1%) was greater than twice that of heterosexual male students (1.7%)(38).

1.5 Risk factors for HIV/STIs among tertiary student MSM

TSMSM like other YMSM may be involved in practices that amplify their risk of acquiring HIV. Upon joining tertiary institutions, they are suddenly exposed to peers with similar sexual orientation, more freedom, and more socializing opportunities. Subsequently, many have sex more frequently, and some might have condomless anal sex (CAS) more frequently(37). A meta-analysis of studies among Chinese high school and university student MSM found high rates of CAS, unsatisfactory condom use during the last homosexual anal intercourse, and having multiple sex partners(39). Additionally, TSMSM in the USA have been shown to have complex and expansive sexual networks within which HIV/STIs may circulate widely and amplify microepidemics(40). The results of a behavioural survey in 14 higher education institutions in South Africa indicated a high prevalence of various risk factors for HIV/STIs transmission among TSMSM, including: high partner turnover, concurrent sexual partners, early sexual debut, having female sex partners in addition to male partners, forced sex experiences, inconsistent condom use, and alcohol and drug use(41). With most tertiary students owning smart phones, TSMSM like other MSM may also use geosocial applications such as Grindr® to quickly explore access to and secure casual sex partners for immediate sexual gratification, without paying much attention to the accompanying risk of HIV/STIs infection(41,42).

1.6 Biological and behavioural relationships between HIV and STIs

Untreated STIs biologically potentiate transmission and acquisition of HIV through a variety of physiologic mechanisms. For instance, primary syphilis infection which is characterized by genital ulcers and lesions may enhance the risk of HIV transmission by increasing HIV viral shedding, and acquisition by providing an entry portal for HIV(43). Primary and secondary syphilis infection stages also increase HIV viral load thus exacerbating the clinical course of HIV infection(44). In addition, during the immune response to secondary syphilis infection, HIV susceptible inflammatory cells such as CD4, CD8 and activated macrophages are recruited to the site of infection and this may further facilitate HIV acquisition(43,45). Non-ulcerative STIs such as chlamydia and gonorrhea are thought to increase the risk of HIV acquisition by damaging the integrity of the genital or rectal epithelium, or by increasing the availability of HIV target cells in

the genital or anorectal tracts(43). Increased HIV transmission is thought to occur from increased viral shedding of HIV associated with prevalent chlamydia/gonorrhea infection(43). In MSM, rectal chlamydia and gonorrhea re-infection have been associated with increased risk of HIV seroconversion(46). A recent modelling study in the USA demonstrated that 10.4% of incident HIV infections were attributable to prevalent urethral and rectal chlamydia/gonorrhea infection(47).

Since behavioural risk factors associated with acquiring STIs, such engaging in CAS, having multiple sex partners and casual sex partners, often put individuals at heightened risk for HIV infection, this may contribute to the observed association between prevalent STIs and incident HIV(47). For example, MSM with multiple sex partners are more likely to be diagnosed with both HIV and STIs(48). Screening for STIs can therefore help assess a person's risk for acquiring HIV. Treatment of STIs is important for alleviation of discomfort, pain and/or suffering caused by the infections, preventing the complications of those infections, and preventing transmission to sexual partners. However, the treatment of STIs by itself does not prevent HIV infection(49). The syndemic relationships between HIV and STIs necessitate the importance of combining research and surveillance for both, so as to take advantage of scarce resources and mitigate the risk of HIV infection ultimately.

1.7 Barriers to access and use of health services by MSM

Worldwide, major inequities persist in access to HIV/STIs prevention, care, and treatment services for MSM(50), with MSM < 30 years reporting significantly lower levels of access to sexual health services, including access to low-cost STIs testing and treatment, MSM-focused behaviourally congruent sexual health education and HIV educational materials, and risk-reduction programs(51). These inequities are perpetuated by individual, health system, and structural level barriers that limit access and use of sexual health services by MSM.

At the individual level, a review of the needs, barriers and gaps in provision of services to young key populations showed that YMSM with lower levels of access to sex education may be less familiar with what constitutes safer sex practices(24). YMSM with internalized stigma experience more social isolation and reduced ability to ask trusted adults for support in health decision making(52). Fear of judgment, condescension and other expressions of condemnation from healthcare providers (HCPs) have also been shown to deter YMSM from accessing services(53).

Additionally, YMSM who do not feel comfortable disclosing their sexual practices to a HCP are less motivated to seek health services especially if they feel that they must hide or disclose some part of their identity during visits to HCPs(54).

At the health system level, sexual stigma is a major cause of disparities in health for MSM. In SSA countries such as the Kingdom of Eswatini, Uganda and Ghana, sexual stigma and discrimination by HCPs have been shown to hinder healthcare seeking among MSM, including for HIV prevention and treatment services(55–57). MSM's experiences of discrimination at health facilities characterized by HCPs' stigmatizing attitudes, patient neglect, differential treatment based on HIV status and sexual orientation, reluctance to talk about same-sex sexual matters, gossiping about, isolation, and verbal abuse of MSM clients, often lead to sub-standard healthcare service provision and can increase MSM's fear of seeking healthcare as shown by studies in Botswana, Malawi and Namibia(58), South Africa(59–61), Kenya(62) and the Kingdom of Eswatini(63). A global survey of YMSM found out that fear of discrimination by HCPs was a significant deterrent with regards to YMSM seeking HIV/STIs testing, counseling and treatment(64). A study at a rural South African university revealed that fear of sexual stigma and discrimination caused most TSMSM to hide their true sexual orientation and gender identity. As a result of many TSMSM being closeted, there was sharing of sex partners and having multiple concurrent sex partners within the small pool of TSMSM who were out. In addition, TSMSM seized opportunities to have sex with new partners in unconducive environments such as toilets in nightclubs. Due to the unplanned nature of these sex escapades, sex in most cases was condomless. Taken together, these sexual behaviours increased the risk of infection with HIV/STIs for TSMSM(65). Furthermore, access to healthcare services such as post-exposure prophylaxis was hampered by institutionalized stigma and discrimination against TSMSM within the university in general, and at the university's health facility in particular(66).

Structural factors such as criminalization of same-sex sexual behaviours(67), arrests and convictions of MSM(68), homophobia(69), as well as possible violence by members of the public against MSM due to sexual preferences (70), have also been shown to keep MSM away from health facilities hence hindering access and use of health services.

1.8 Health services for tertiary student MSM in Kenya

In Kenya, healthcare services are offered by health facilities owned by the government, private sector, non-governmental, faith-based and community-based organizations(71). The Nairobi metropolis has an abundance of public and private health facilities(72), community pharmacies(73), and a few non-governmental/community-based MSM-friendly healthcare facilities(74) where MSM can seek medical or psychosocial care when needed. Aside from these facilities, various tertiary institutions within the metropolis have health facilities that offer care to their student population(75–77). The operational model of available medical aid and support schemes for tertiary students differs among institutions. Usually, students pay an annual medical fee at the beginning of the academic year which caters for their outpatient needs within the tertiary institution's health facility, and in some cases for inpatient needs depending on the specific institution's medical scheme. While the tertiary institutions have autonomy in hiring of healthcare providers to work in their health facilities, these facilities, like all other facilities in the country are regulated by the Kenyan Ministry of Health. Although awareness and knowledge exists on the challenges experienced in accessing health services for the general MSM population in Kenya(78), the experiences of YMSM (including TSMSM) with healthcare engagement from the wide array of the health service providers is less documented in scientific literature.

1.9 Research gaps

The foregoing discussion illustrates how MSM are a key population at higher risk of HIV/STIs the world over, and how YMSM are disproportionately affected by HIV/STIs compared to young heterosexual men and older MSM. Despite the disproportionate burden of HIV/STIs among YMSM, there is a relative paucity of research and interventions targeting HIV/STIs prevention among YMSM. In SSA, though the body of evidence on the epidemiology of HIV/STIs has considerably grown over the last two decades, research among YMSM has continued to lag behind. In Kenya, there is a dearth of knowledge on the burden of HIV among YMSM, including TSMSM. Additionally, the prevalence of STIs among TSMSM is also not known, despite the fact that untreated STIs biologically potentiate transmission and acquisition of HIV, as well as cause considerable morbidity on their own. Data on risk factors associated with HIV/STIs infection is also lacking, thus limiting the scope of evidence-based interventions for HIV/STIs prevention and control. Besides, the barriers TSMSM experience in accessing and utilizing general and sexual

health services have also not been explored. Further, little is known about the attitudes and perspectives of tertiary institution-based HCPs towards care for TSMSM – factors which are critical to access and use of health services by TSMSM. These are the knowledge gaps this study aimed to fill.

The findings of this study contribute to the sparse body of knowledge of HIV/STIs epidemiology among Kenyan YMSM in general, and TSMSM in particular. Future research could build on these findings and continue to grow the body of knowledge in the field. Moreover, the findings have the potential to inform HIV/STIs prevention and control programming for TSMSM, by policy makers such the Kenyan ministries of health and education, tertiary education institutions, HCPs, advocacy groups and other interested stakeholders.

1.10 Rationale for methods used

Integrated biological and behavioural assessment (IBBA) is a term that refers to an overarching approach to tracking HIV/STIs prevalence (biological component), and linking these data with related behavioural factors (behavioural component), among key populations at higher risk for HIV/STIs infection, such as MSM(79). Other synonyms of the term IBBA are integrated biological behavioural surveillance or simply bio-behavioural survey. Respondent-driven sampling (RDS) is both a recruitment and statistical method(80). It utilizes "snowball sampling" where individuals recruit those they know, the recruited individuals in turn recruit those they know and so on. This recruitment is combined with a mathematical model that weights the sample to compensate for the non-random (snowball) sampling(80). Using RDS makes it possible to draw statistically valid samples from hidden populations – such as MSM(81), and provide unbiased population estimates (such as HIV/STIs prevalence) and measures of the precision of those estimates (such as confidence intervals)(82). Recruitment begins with ‘seeds’ purposely selected from the target population and given a limited number of ‘coupons’ to recruit their peers into the study. Participants who are recruited by the ‘seeds’ form the first ‘wave’ of recruitment. Participants in the first ‘wave’ are then issued with ‘coupons’ to recruit the second ‘wave’ of participants. This process goes on until the desired sample size is reached. To encourage recruitment, participants are given an incentive to complete the survey (primary incentive) and to recruit their peers (secondary incentive)(83). **Figure 1.1** shows theoretical RDS recruitment chains(83).

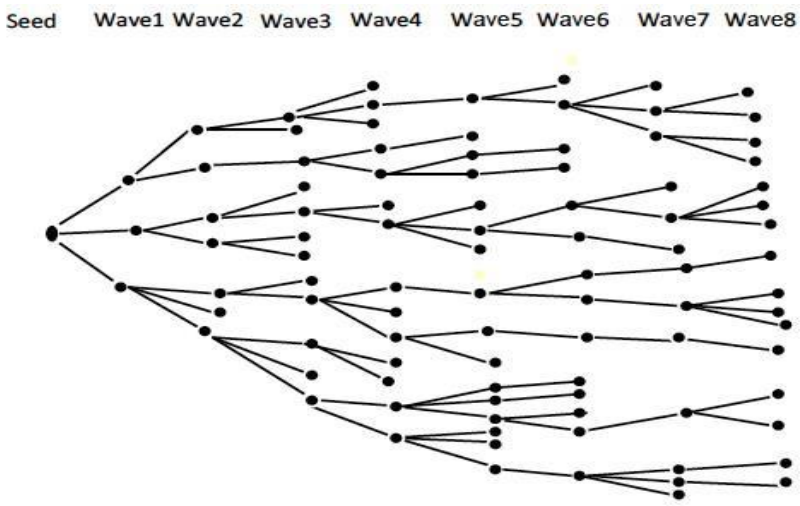


Figure 1.1: Theoretical RDS recruitment chains

The UNAIDS/World Health Organization (WHO) guidelines for bio-behavioural surveys recommend conducting formative research prior to, and incorporating supplemental studies in bio-behavioural surveys(79). In this study, formative research was conducted prior to the bio-behavioural survey. In addition, qualitative in-depth interviews were held with selected TSMSM to explore their experiences with access and use of health services. Finally, focus group discussions (FGD) were conducted with HCPs from tertiary institutions to assess their attitudes and perspectives towards caring for TSMSM.

1.11 Aims of the study

The aims of this study were:

1. To assess the appropriateness and acceptability of using RDS as a strategy for recruiting TSMSM in a HIV/STIs bio-behavioural survey.
2. To estimate HIV prevalence and associated risk factors among TSMSM.
3. To estimate prevalence of five curable STIs (chlamydia, gonorrhoea, syphilis, trichomoniasis and *Mycoplasm genitalium* infection) and associated risk factors among TSMSM.
4. To explore experiences of TSMSM with access and use of health services.
5. To assess HCPs' attitudes and perspectives towards care for TSMSM.

References

1. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal [Internet]. 2021;9:619694. Available from: https://www.frontiersin.org/article/10.3389/fpubh.2021.619694
2. Joint United Nations Programme on HIV/AIDS (UNAIDS). Global HIV & AIDS statistics — Fact sheet [Internet]. 2022 [cited 2022 Oct 11]. Available from: https://www.unaids.org/en/resources/fact-sheet
3. Vos T, Lim SS, Abbafati C, Abbas KM, Abbasi M, Abbasifard M, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204–22.
4. World Health Organization (WHO). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021 [Internet]. Geneva, Switzerland: WHO; 2021. Available from: https://www.who.int/publications/i/item/9789240027077
5. UNAIDS (Joint United Nations Programme on HIV/AIDS). Fast-Track: Accelerating Action to End the AIDS Epidemic by 2030 [Internet]. Geneva, Switzerland: UNAIDS; 2014. Available from: https://www.unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf
6. World Health Organization. Consolidated guidelines on HIV prevention, diagnosis, treatment and care for key populations – 2016 update [Internet]. World Health Organization. Geneva, Switzerland: UNAIDS; 2016. Available from: https://www.who.int/publications/i/item/9789241511124
7. 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.
8. Joint United Nations Programme on HIV/AIDS (UNAIDS). In Danger: UNAIDS Global AIDS Update 2022 [Internet]. Geneva, Switzerland: UNAIDS; 2022. Available from: https://www.unaids.org/sites/default/files/media_asset/2022-global-aids-update_en.pdf
9. Hessou PHS, Glele-Ahanhanzo Y, Adekpedjou R, Ahouada C, Johnson RC, Boko M, et

al. Comparison of the prevalence rates of HIV infection between men who have sex with men (MSM) and men in the general population in sub-Saharan Africa: a systematic review and meta-analysis. BMC Public Health. 2019;19(1):1634.

10. Fearon E, Tenza S, Mokoena C, Moodley K, Smith AD, Bourne A, et al. HIV testing, care and viral suppression among men who have sex with men and transgender individuals in Johannesburg, South Africa. PLoS One. 2020;15(6):e0234384.
11. Baral S, Trapence G, Motimedi F, Umar E, Iipinge S, Dausab F, et al. HIV Prevalence, Risks for HIV Infection, and Human Rights among Men Who Have Sex with Men (MSM) in Malawi, Namibia, and Botswana. PLoS One. 2009;4(3):e4997.
12. Wirtz AL, Jumbe V, Trapence G, Kamba D, Umar E, Ketende S, et al. HIV among men who have sex with men in Malawi: elucidating HIV prevalence and correlates of infection to inform HIV prevention. J Int AIDS Soc. 2013;16(Suppl 3):18742.
13. Wirtz AL, Trapence G, Kamba D, Gama V, Chalera R, Jumbe V, et al. Geographical disparities in HIV prevalence and care among men who have sex with men in Malawi: results from a multisite cross-sectional survey. Lancet HIV. 2017;3018(17):30042–5.
14. Vu. L, Adebajo. S, Tun. W, Sheehy. M, Karlyn. A, Njab. J, Azeez. A et al. High HIV prevalence among men who have sex with men in Nigeria: implications for combination prevention. J Acquir Immune Defic Syndr. 2013;63(2):221–7.
15. Hakim AJ, Aho J, Semde G, Diarrassouba M, Ehoussou K, Vuylsteke B, et al. The epidemiology of HIV and prevention needs of men who have sex with men in Abidjan, Cote d'Ivoire. PLoS One. 2015;10(4):e0125218.
16. Nelson LE, Wilton L, Agyarko-Poku T, Zhang N, Aluoch M, Thach CT, et al. The Association of HIV Stigma and HIV/STD Knowledge With Sexual Risk Behaviors Among Adolescent and Adult Men Who Have Sex With Men in Ghana, West Africa. Res Nurs Health. 2015;38(3):194–206.
17. Ross MW, Nyoni J, Ahaneku HO, Mbwambo J, McClelland RS, McCurdy SA. High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania. BMJ Open. 2014;4(8):e006175.
18. Kim EJ, Hladik W, Barker J, Lubwama G, Sendagala S, Ssenkusu JM, et al. Sexually transmitted infections associated with alcohol use and HIV infection among men who have sex with men in Kampala, Uganda. Sex Transm Infect. 2016;92(3):240–5.

19. Smith AD, Kimani J, Kabuti R, Weatherburn P, Fearon E, Bourne A. HIV burden and correlates of infection among transfeminine people and cisgender men who have sex with men in Nairobi, Kenya: an observational study. Lancet HIV. 2021 May 1;8(5):e274–83.
20. Sanders EJ, Thiong AN, Okuku HS, Mwambi J, Priddy F, Shafi J, et al. High prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae infections among HIV-1 negative men who have sex with men in coastal Kenya. Sex Transm Infect. 2010;86:440–1.
21. Crowell TA, Lawlor J, Lombardi K, Nowak RG, Hardick J, Odeyemi S, et al. Anorectal and Urogenital Mycoplasma genitalium in Nigerian Men Who Have Sex with Men and Transgender Women: Prevalence, Incidence, and Association with HIV. Sex Transm Dis. 2020;47(3):202–6.
22. Hoffman CM, Fritz L, Radebe O, Dubbink JH, Mcintyre JA, Kock MM, et al. Rectal Trichomonas vaginalis infection in South African men who have sex with men. Int J STD AIDS. 2018;29(14):1445–7.
23. World Health Organization (WHO). HIV and young men who have sex with men: Technical brief. Geneva, Switzerland: WHO; 2015.
24. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. J Int AIDS Soc. 2015;18(Suppl 1):29–40.
25. Mustanski BS, Newcomb ME, Bois SN Du, Garcia SC, Grov C. HIV in Young Men Who Have Sex with Men: A Review of Epidemiology, Risk and Protective Factors, and Interventions. J Sex Res. 2011;48(2–3):218–53.
26. 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(June):2665–78.
27. Li Y, Xu J, Reilly KH, Zhang J, Wei H, Jiang Y, et al. Prevalence of HIV and Syphilis Infection among High School and College Student MSM in China: A Systematic Review and Meta-Analysis. PLoS One. 2013;8(7):e69137.
28. Rhodes SD, Wong FY. HIV Prevention Among Diverse Young MSM: Research Needs, Priorities and Opportunities. AIDS Educ Prev. 2016;28(3):191–201.
29. Centre for Disease Control and Prevention. HIV Among Youth in the US: Protecting a Generation [Internet]. CDC Vital Signs. [cited 2020 Sep 14]. Available from: https://www.cdc.gov/vitalsigns/pdf/2012-11-27-vitalsigns.pdf

30. Joint United Nations Programme on HIV/AIDS (UNAIDS). Securing the Future: Synthesis of Strategic Information on HIV and Young People. Geneva, Switzerland: UNAIDS; 2011.
31. Centre for Disease Control (CDC). HIV Transmission Among Black College Student and Non-Student Men Who Have Sex With Men - North Carolina, 2003 [Internet]. Morbidity and Mortality Weekly Report. 2004 [cited 2020 Sep 16]. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5332a1.htm
32. Pinsky L, Chiarilli DB, Klausner JD, Kull RM, Okeefe R, Heffer C, et al. Rates of asymptomatic nonurethral gonorrhea and chlamydia in a population of university men who have sex with men. J Am Coll Heal. 2012;60(6):481–4.
33. Cong L, Ono-kihara M, Xu G, Ma Q, Pan X, Zhang D, et al. The characterisation of sexual behaviour in Chinese male university students who have sex with other men: A cross-sectional study. BMC Public Health. 2008;8(250).
34. Xu J-J, Reilly KH, Lu C-M, Ma N, Zhang M, Chu Z-X, et al. A cross-sectional study of HIV and syphilis infections among male students who have sex with men (MSM) in northeast China: implications for implementing HIV screening and intervention programs. BMC Public Health. 2011;11(287).
35. Zheng J, Wu Z, Poundstone KE, Pang L, Rou K. HIV, syphilis infection, and risky sexual behaviors among male university students who have sex with men in Beijing, China: a cross-sectional study. AIDS Educ Prev. 2012;24(1):78–88.
36. Zhang L, Ding X, Lu R, Feng L, Li X, Xiao Y, et al. Predictors of HIV and syphilis among men who have sex with men in a chinese metropolitan city: Comparison of risks among students and non-students. PLoS One. 2012;7(5):e37211.
37. Zou H, Tucker JD, Fan S, Xu J, Yu M, Luo Z, et al. Learning about HIV the hard way: HIV among Chinese MSM attending university. Lancet Infect Dis. 2018;18(1):16–8.
38. Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV Prevalence and Related Factors: Higher Education Sector Study South Africa [Internet]. Johannesburg, South Africa; 2009. Available from: HEAIDS
39. Yang Z, Huang Z, Dong Z, Zhang S, Han J, Jin M. Prevalence of high-risky behaviors in transmission of HIV among high school and college student MSM in China: A meta-analysis. BMC Public Health. 2015;15(1272).

40. Hightow LB, MacDonald PDM, Pilcher CD, Kaplan AH, Foust E, Nguyen TQ, et al. The Unexpected Movement of the HIV Epidemic in the Southeastern United States. JAIDS J Acquir Immune Defic Syndr. 2005;38(5):531–7.
41. Brink JG, Unit E, Africa S. Considerations for South African Higher Education: A National Student Men who Have Sex with Men Sexual Behavior Survey. South African J High Educ. 2017;31(4):184–207.
42. Hall WJ, Sun CJ, Tanner AE, Mann L, Stowers J, Rhodes SD. HIV Prevention Opportunities with GPS-based Social and Sexual Networking Applications for Men who have Sex with Men. AIDS Educ Prev. 2017;29(1):38–48.
43. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Health. 1999;75:3–17.
44. Buchacz K, Patel P, Taylor M, Kerndt PR, Byers RH, Holmberg SD, et al. Syphilis increases HIV viral load and decreases CD4 cell counts in HIV-infected patients with new syphilis infections. AIDS. 2004;18(15):2075–9.
45. Salazar JC, Cruz AR, Pope CD, Valderrama L, Trujillo R, Saravia NG, et al. Treponema pallidum elicits innate and adaptive cellular immune responses in skin and blood during secondary syphilis: a flow-cytometric analysis. J Infect Dis. 2007;195(6):879–87.
46. Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. JAIDS J Acquir Immune Defic Syndr. 2010;53(4):537–43.
47. Jones J, Weiss K, Mermin J, Dietz P, Rosenberg ES, Gift TL, et al. Proportion of Incident HIV Cases among Men Who Have Sex with Men Attributable to Gonorrhea and Chlamydia: A Modeling Analysis. Sex Transm Dis. 2019;46(6):357–63.
48. Koblin BA, Husnik MJ, Colfax G, Huang Y, Madison M, Mayer K, et al. Risk factors for HIV infection among men who have sex with men. AIDS. 2006;20(5):731–9.
49. Steen R, Wi TE, Kamali A, Ndowa F. Control of sexually transmitted infections and prevention of HIV transmission: Mending a fractured paradigm. Bull World Health Organ. 2009;87(11):858–65.
50. World Health Organization. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people.

Geneva, Switzerland: World Health Organization; 2011.

51. Beck J, Santos G-M, Ayala G. Young Men Who Have Sex with Men : Health, Access , and HIV. The Global Forum on MSM and HIV (MSMGF); 2013.
52. Fields EL, Bogart LM, Smith KC, Malebranche DJ, Ellen J, Schuster MA. "I Always Felt I Had to Prove My Manhood ": Homosexuality, Masculinity, Gender Role Strain, and HIV Risk Among Young Black Men Who Have Sex With Men. Am J Public Health. 2015;105(1):122–31.
53. Rounds K, Mcgrath BB, Walsh E. Perspectives on provider behaviors: A qualitative study of sexual and gender minorities regarding quality of care. Contemp Nurse. 2014;44(1):99–110.
54. Wall KM, Khosropour CM, Sullivan PS. Offering of HIV Screening to Men Who Have Sex With Men by Their Health Care Providers and Associated Factors. J Int Assoc Physicians AIDS Care. 2010;9(5):284–8.
55. Risher K, Adams D, Sithole B, Ketende S, Kennedy C, Mnisi Z, et al. Sexual stigma and discrimination as barriers to seeking appropriate healthcare among men who have sex with men in Swaziland. J Int AIDS Soc. 2013;16(Suppl 2):1–9.
56. Wanyenze RK, Musinguzi G, Matovu JKB, Kiguli J, Nuwaha F, Mujisha G, et al. "If You Tell People That You Had Sex with a Fellow Man, It Is Hard to Be Helped and Treated " : Barriers and Opportunities for Increasing Access to HIV Services among Men Who Have Sex with Men in Uganda. PLoS One. 2016;11(1):1–19.
57. Kushwaha S, Lalani Y, Maina G, Ogunbajo A, Wilton L, Agyarko-Poku T, et al. "but the moment they find out that you are MSM …": a qualitative investigation of HIV prevention experiences among men who have sex with men (MSM) in Ghana's health care system. BMC Public Health. 2017;17(770).
58. Fay H, Baral SD, Trapence G, Motimedi F, Umar E, Iipinge S, et al. Stigma, health care access, and HIV knowledge among men who have sex with men in Malawi, Namibia, and Botswana. AIDS Behav. 2011;15(6):1088–97.
59. Rispel LC, Metcalf CA, Cloete A, Moorman J, Reddy V, Moormand J. You become afraid to tell them that you are gay: Health service utilization by men who have sex with men in South African cities. J Public Health Policy. 2011;32(Supplement 1):137–51.
60. Duby Z, Nkosi B, Scheibe A, Brown B, Bekker L-G. 'Scared of going to the clinic':

Contextualising healthcare access for men who have sex with men, female sex workers and people who use drugs in two South African cities. South Afr J HIV Med. 2018;19(1):1–8.

61. Lane T, Mogale T, Struthers H, Mcintyre J, Kegeles SM. "They see you as a different thing": The Experiences of Men Who Have Sex with Men with Health Care Workers in South African Township Communities. Sex Transm Infect. 2009;84(6):430–3.
62. Shangani S, Naanyu V, Operario D, Genberg B. Stigma and Healthcare-Seeking Practices of Men Who Have Sex with Men in Western Kenya: A Mixed-Methods Approach for Scale Validation. AIDS Patient Care STDS. 2018;32(11):477–86.
63. Kennedy CE, Baral SD, Fielding-miller R, Adams D, Dludlu P, Sithole B, et al. '"They are human beings , they are Swazi "': intersecting stigmas and the positive health, dignity and prevention needs of HIV-positive men who have sex with men in Swaziland. J Int AIDS Soc. 2013;16(Suppl 3):1–7.
64. Wilson, Patrick; Santos, Glenn-Milo; Pato, Herbert ; Ayala G. Access to HIV Prevention Services and Attitudes about Emerging Strategies : A Global Survey of Men Who Have have sex with Men and their Healthcare Providers. The Global Forum on MSM and HIV (MSMGF); 2011.
65. Mavhandu-Mudzusi AH. Impact of Stigma and Discrimination on Sexual Wellbeing of LGBTI Students in a South African Rural University. South African J High Educ. 2017;31(4):208–18.
66. Mavhandu-Mudzusi AH, Sandy PT. Religion-related stigma and discrimination experienced by lesbian, gay, bisexual and transgender students at a South African rural-based university. Cult Heal Sex. 2015;17(8):1049–56.
67. State Sponsored Homophobia. A World Survey of Sexual Orientations Laws: Criminalization, Protection and Recognition. ILGA, Geneva. 2016.
68. Santos G, Makofane K, Arreola S, Do T, Ayala G. Reductions in access to HIV prevention and care services are associated with arrest and convictions in a global survey of men who have sex with men. Sex Transm Infect. 2017;93:62–4.
69. Semugoma P, Nemande S, Baral SD. The irony of homophobia in Africa. Lancet. 2012;380(9839):312–4.
70. Bhattacharjee P, Morales GJ, Kilonzo TM, Dayton RL, Musundi RT, Mbole JM, et al.

Can a national government implement a violence prevention and response strategy for key populations in a criminalized setting ? A case study from Kenya. J Int AIDS Soc. 2018;21(S5):109–14.

71. Africa Health Business. Kenya's Health Sector [Internet]. Country Overview. 2021 [cited 2023 May 4]. Available from: https://ahb.co.ke/wp-content/uploads/2021/07/Country-Overview_Kenya.pdf
72. Omulo C. 7,900 clinics operating illegally in Nairobi, committee reports. Daily Nation [Internet]. 2020 Jun 29; Available from: https://nation.africa/kenya/counties/nairobi/7900-clinics-operating-illegally-/1954174-5065806-vkdmjmz/index.html
73. Toroitich AM, Dunford L, Armitage R, Tanna S. Patients Access to Medicines – A Critical Review of the Healthcare System in Kenya. Risk Manag Healthc Policy. 2022;15(January):361–74.
74. Daily Active. Nairobi's very own gay clinic with a surprising number of patients. Daily Active [Internet]. 2019 May 24; Available from: https://dailyactive.info/2019/05/24/a-look-at-nairobis-very-own-gay-clinic-with-a-surprising-number-of-same-sex-patients/
75. University of Nairobi. University of Nairobi Health Services [Internet]. [cited 2022 Apr 29]. Available from: http://healthservices.uonbi.ac.ke/
76. Kenyatta University. Kenyatta University Health Unit [Internet]. [cited 2022 Apr 29]. Available from: http://www.ku.ac.ke/healthunit/
77. Jomo Kenyatta University of Agriculture and Technology. Jomo Kenyatta University of Agriculture and Technology Health Services Department [Internet]. [cited 2022 Apr 29]. Available from: http://www.jkuat.ac.ke/departments/hospital/
78. Bourne A, Carman M, Kabuti R, Nutland W, Fearon E, Liku J, et al. Experiences and challenges in sexual health service access among men who have sex with men in Kenya. Glob Public Health. 2021 Oct 10;1–12.
79. WHO, CDC, UNAIDS F 360. Biobehavioural Survey Guidelines for Populations at Risk for HIV. Geneva: World Health Organization. 2017.
80. Respondent Driven Sampling [Internet]. [cited 2021 Sep 24]. Available from: http://www.respondentdrivensampling.org/
81. Stahlman S, Johnston LG, Yah C, Ketende S, Maziya S, Trapence G, et al. Respondent-driven sampling as a recruitment method for men who have sex with men in southern sub-

Saharan Africa: a cross-sectional analysis by wave. Sex Transm Infect. 2016;92(4):292–8.

82. Okal J, Raymond HF, Tun W, Musyoki H, Dadabhai S, Broz D, et al. Lessons learned from respondent-driven sampling recruitment in Nairobi: Experiences from the field. BMC Res Notes. 2016;9(158).

83. Johnston LG, Sabin K. Sampling Hard-to-Reach Populations with Respondent Driven Sampling. Methodol Innov Online. 2010;5(2):38–48.

Chapter 2: Formative Research

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Abstract

Background: Tertiary student men who have sex with men (TSMSM) may engage in behaviours that increase their risk of infection with human immunodeficiency virus (HIV) and sexually transmitted infections (STIs). Respondent-driven sampling (RDS) has become a popular method for discreetly recruiting marginalized key populations into HIV/STIs research. We conducted formative research to assess perceptions related to appropriateness and acceptability of RDS in recruiting TSMSM into a prospective HIV/STIs bio-behavioural survey in Nairobi, Kenya.

Methods: Between September and October 2020, semi-structured qualitative interviews were held with service providers from community-based and non-governmental organizations that serve MSM (N=3), and TSMSM (N=13). Interviews explored social networks of TSMSM, acceptability of using RDS as a sampling method, potential RDS implementation challenges, and proposed solutions to these challenges. Interviews were done in English, audio-recorded and transcribed verbatim, then analyzed thematically using NVivo version 11.

Results: Service providers reflected that TSMSM in Nairobi had large though concealed networks due to the fears associated with criminalization of same-sex relationships, and lived experiences related to stigma and marginalization, thus making RDS an appropriate sampling method for recruiting TSMSM into a prospective HIV/STIs bio-bheavioural survey. Risk of ineligible persons attempting to participate due to the associated double incentive (reimbursement for both participation and recruitment of peers) was noted, and using student identification documents as part of eligibility screening was recommended to mitigate this risk. TSMSM also perceived RDS to be an acceptable strategy based on the reported large social network sizes ranging from 10-40, and the trust among them. TSMSM were concerned about participating due to the risk of being

outed as MSM and hence emphasized that researchers needed to assure them of their confidentiality, and include MSM as part of the study team to encourage participation. TSMSM suggested coupons should: indicate value of reimbursement, be discreet, pocket-sized and placed in an envelope to avoid loss that may lead to inadvertent disclosure of same-sex behaviour, and provide directions to and contacts of the study site for easier location and access.

Conclusion: RDS was perceived as both an appropriate and acceptable sampling method. Anticipated challenges of RDS implementation were highlighted, and possible solutions to these challenges suggested should the challenges be encountered.

2.0 Introduction

World over, the HIV epidemic remains poorly defined among young MSM (YMSM) aged 15 – 24 years. There is minimal data on population size estimates of YMSM, HIV prevalence among them, as well as risk and protective factors. This is partially attributed to limited research and surveillance, and the difficulty of reaching YMSM with services(1), especially in countries like Kenya, where same-sex sexual behaviour continues to be criminalized(2). Additionally, YMSM are vulnerable to HIV due to widespread discrimination and stigmatization, homophobia and violence, power imbalances in relationships and alienation from family and friends(3). Largely due to these factors, YMSM are invariably at disproportionate risk of acquiring HIV/STIs than young heterosexual males or older MSM(4).

During the transition period from adolescence to adulthood and a parallel shift from secondary to tertiary educational institutions, many students find themselves for the first time in their lives in a predominantly unsupervised environment related to their behaviour, increased freedom and opportunities to engage in behavioural risks such as alcohol use and casual sex(5). For tertiary student MSM (TSMSM), this involves a growing exposure to peers with similar sexual preferences and orientation, increased freedom and autonomy in young adulthood, and more socializing opportunities(6). Consequently given the opportunities, they engage in sex more frequently(7), and some might have condomless anal sex (CAS) more regularly(8), hence increasing their risks for HIV/STIs infection. With most tertiary students in Kenya owning smart phones(9), TSMSM like other MSM may also utilize geosocial applications such as Grindr® to rapidly explore access to and secure casual sex partners for immediate sexual gratification, without paying much attention to the accompanying risk of HIV/STIs infection(10).

Even in countries where same-sex behaviour is legal and data is available, TSMSM have been found to engage in higher risk behaviour that increases their susceptibility to HIV/STIs. A systematic review and meta-analysis of studies published between 2003 and 2016 in China found that TSMSM engaged in sex work, group sex, sex with female partners, drug use and seeking casual sex partners online(11). In the USA, TSMSM have been shown to have complex and expansive sexual networks within which HIV/STIs may circulate widely and magnify microepidemics(12). In South Africa, a behavioural survey among TSMSM showed a high prevalence of various risk factors for HIV transmission among TSMSM, including high partner turnover, concurrent sexual partners, presence of STIs, early sexual debut, having female sex partners in addition to male sex partners, forced sex experiences, inconsistent condom use, and alcohol and drug use(13).

In Kenya, same-sex sexual behaviour is criminalized(2). This may further amplify the impact of behavioural risk taking on HIV/STIs transmission, over and above what has been observed among TSMSM in countries where same-sex sexual behaviour is legal(11–13). A literature review of TSMSM in Kenya yielded no information on the prevalence of HIV/STIs nor risk behaviours in this potentially at-risk sub-group of MSM. There is a need to conduct research to better understand this dual epidemic in this neglected sub-population, so as to inform the structure and design of requisite prevention interventions.

Respondent-driven sampling (RDS) has become a popular method to assess HIV/STIs and risk behaviours in marginalized, hidden or hard-to-reach populations such as MSM. RDS is both a recruitment and statistical method that utilizes "snowball sampling", where individuals recruit those they know, the recruited individuals in turn recruit those they know and so on until an adequate sample is reached. This recruitment is combined with a mathematical model that weights the sample to compensate for the non-random sampling(14). Using RDS makes it possible to draw statistically valid samples from populations for whom there is no sampling frame, and provide unbiased population estimates and confidence intervals of disease prevalence and risk behaviours such as CAS among MSM(15). Recruitment begins with ‘seeds’ purposely selected from the target population and given ‘coupons’ to recruit their peers into the study. Participants who are recruited by the ‘seeds’ form the first ‘wave’ of recruitment. Participants in the first ‘wave’ are then issued with ‘coupons’ to recruit the second ‘wave’ of participants. This process goes on until the

calculated sample size is reached. To encourage recruitment, participants are given an incentive to complete the survey (primary incentive) and to recruit their peers (secondary incentive)(16).

Previous studies that investigated HIV/STIs in TSMSM recruited participants through either convenience sampling(17–19), or conducted studies among the general MSM population then drew a subset of TSMSM from this sample(20), or conducted studies among the general tertiary student population then drew a subset of TSMSM from this sample(7,13,21). Formative research helps researchers and public health practitioners reach their target population and define that population's characteristics that are pertinent to a particular public health issue of interest(22). Assessing appropriateness and acceptability is important so as to gauge the suitability of a particular method for a given population, and the agreeability of that method to a range of stakeholders, respectively(23). We conducted formative research to investigate these two outcomes for RDS as a recruitment strategy for TSMSM in a proposed HIV/STIs bio-behavioural survey; and to identify potential challenges that would be faced with the use of this method, as well as possible solutions to these drawbacks.

2.1 Methods and materials

Study methods are provided in the published study protocol(24), and summarized below:

2.1.1 Study design and setting

This was a qualitative study in which data was collected through semi-structured interviews with service providers from organizations that serve MSM, and TSMSM. The study was conducted in Nairobi, the capital city of Kenya and home to approximately 150 campuses of various colleges and universities(25).

2.1.2 Participants, sampling and recruitment

Service providers were purposely selected from community-based organizations (CBOs) that provide MSM-exclusive health services (n=2) and from a non-governmental organization (NGO) that provides MSM-friendly health services (n=1). The three organizations were selected purposely, first, because they are the main providers that offer MSM-exclusive/friendly health services in Nairobi, and are popular with both YMSM and TSMSM. Secondly, we sought to obtain information on how to best reach different typologies of TSMSM, with the 'more out' TSMSM assumed to be more likely to use the MSM-exclusive services and those 'less out' the non-

exclusive but MSM-friendly services. Thirdly, the three organizations are conveniently located, with the NGO being within and the CBOs located about five kilometres (three miles) from the central business district, hence easily accessible by TSMSM.

TSMSM were purposely recruited with the help of the service providers at the three facilities in order to build trust between the interviewer and TSMSM and help obtain honest reflections during the interviews. After completing the interviews, the service providers were given the telephone contact of one member of the study team, and asked to request TSMSM known to them to contact the member of the study team regarding possible participation in the formative research. The service providers were given the ideal qualities of the TSMSM the study team was interested in speaking to, including: peer leaders with a social network size of at least nine TSMSM, interested in research and working with the TSMSM community.

2.1.3 Data collection procedures

Semi-structured interview guides were obtained from the integrated HIV bio-behavioural surveillance toolbox of the University of California, San Francisco(26), and modified to fit the purpose of the current study. Prior to the interviews, the interviewer explained the key components of the RDS method to participants. Interviews with service providers consisted of five major domains, namely: service providers' roles in their respective organization, type of services offered by the organizations, description of the TSMSM community and their networks, acceptability of using RDS to recruit participants for the HIV/STIs bio-behavioural survey, and linkage with TSMSM who would be willing to take part in the formative research. Interviews with TSMSM consisted of three major domains, namely: their social networks, appropriateness and acceptability of using RDS to recruit participants for the planned HIV/STIs bio-behavioural survey, and challenges expected with the use of RDS and proposed solutions to these challenges. The network size was estimated by asking the question: *'How many TSMSM do you know by name, and they know you by name, and they live in and around the city of Nairobi?'*. Demographic information was also collected using a brief self-administered questionnaire on REDCap® (Vanderbilt University).

Interviews with the service providers were held at their respective work places. Interviews with the TSMSM were held in a private room at the integrated counselling and education center of University of Nairobi health services department. Only the interviewer and one participant were

present at the time of every interview. Interviews with the service providers lasted an average of 40 minutes and those with TSMSM took an average of 35 minutes. For the interviews with TSMSM, saturation was reached by the 10th participant. All interviews were held between September and October 2020. As this was during the COVID-19 pandemic, prevention and control measures as set by the Kenyan government were adhered to. The interviewer took notes during all the interviews. All interviews were audio-recorded, transcribed and translated to English in the few instances where Swahili was used. The interviewer then read the transcripts as he listened to the audio-recordings to ensure that the transcripts and translations if any, were accurate.

2.1.4 Data analysis and reporting

Data in form of the transcripts was managed using NVivo software version 11 (QSR International). Analysis followed the content analysis theoretical framework, that systematically organizes qualitative data in a structured manner(27). Analysis was done both deductively and inductively, using themes set *a priori* and coding emerging ones, respectively. Themes were supported with verbatim excerpts from the transcripts. Coding was done independently by two members of the study team, who then compared codes for agreement and decided whether to merge some codes, get rid of others or come up with new ones. Themes were described and supported with illustrative excerpts from the interviews. Excerpts were attributed to participants using pseudonyms, age in years and role (service provider or TSMSM). Reporting of the study followed the consolidated criteria for reporting qualitative studies (COREQ)(28).

2.1.5 Data trustworthiness

The trustworthiness of the data was premised on the following criteria: credibility, transferability, dependability and confirmability(29,30). To ensure credibility, the study used well-established methods for qualitative investigation. Prior to data collection, the first author familiarized himself with the setup and roles of the participating CBOs/NGO by reading content posted on the organizations' respective websites. During data collection, iterative questioning was deployed by rephrasing previously asked questions to gain deeper understanding of and confirm the information provided by participants at the first instance of questioning. Member checking was done "on the spot" by paraphrasing and summarizing what the participants said at intervals and at the end of the interviews, respectively. For transferability, details about the study participants, study design, data collection procedures and analysis have been made available to help the comprehension of the

findings, and comparison/contrast of these findings with those of similar studies. To address dependability, the study processes have been reported in sufficient detail to enable future researchers reproduce the study, even if not necessarily to obtain similar results. For confirmability, individual interviews were used due to the sensitivity of the study topic occasioned by criminalization and marginalization of same-sex behaviour in Kenya. Confirmability was also established by supporting the findings with verbatim quotes from the participants.

2.1.6 Ethical considerations

Participants provided written informed consent before taking part in the study. The study protocol was reviewed and approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number: M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number: P990/12/2019). The study also received a letter of support from the Key Populations Program of the National AIDS and STI Control Program (NASCOP), Ministry of Health, Government of Kenya.

2.2 Results

2.2.1 Participants' characteristics

The service providers who participated from the CBOs were both male, 32 years of age and self-identified as gay. The service provider from the NGO was female, aged 47 years and identified as heterosexual. All the providers had college degrees. All the service providers had dual roles at their respective organizations. The service provider at the first CBO worked as a pre-exposure prophylaxis (PrEP) program officer/research coordinator, the one at the second CBO as a community mapping officer/peer educators' supervisor and the one at the NGO as a clinician/head of the clinic. These service providers were selected on the basis of their day-to-day interaction with members of the MSM population, and the assumption that they would have rich information on the TSMSM sub-population who were part of their clientele. All the three organizations offered HIV/STI prevention, treatment and care services. Additionally, the two CBOs offered other services including: community outreaches, economic empowerment of, and provision of legal aid to the MSM communities they served. On the other hand, the NGO offered care to victims of gender-based violence, and sexual and reproductive health services to other key populations such as female sex workers. The service providers referred 16 TSMSM to the research team, out of which 13 participated in the formative research. Of the three excluded from the interviews, one

had already completed university education, one was not studying in Nairobi and the third one was unable to create time for the interview.

Sociodemographic characteristics of the TSMSM participants are presented in **Table 2.1**. More than three-quarters (76.9%) were between 21-24 years of age. All participants were undergraduate students in their first (23.1%), second (38.5%) or third (38.5%) years of study. A majority (69.2 %) identified as homosexual or gay and the rest as bisexual.

Table 2.1: Sociodemographic characteristics of TSMSM in Nairobi, Kenya (N=13)

Variable	**Category**	**n (%)**
Age in years	18-20	3 (23.1)
	21-24	10 (76.9)
Sexual orientation	Homosexual or gay	9 (69.2)
	Bisexual	4 (30.8)
Network size	10 – 24	6 (46.2)
	25 – 40	7 (53.8)
Year of study	Year 1	3 (23.1)
	Year 2	5 (38.5)
	Year 3	5 (38.5)
Type of institution	University	11 (84.6)
	*TVET/College	2 (15.4)
Ownership of institution	Public	9 (69.2)
	Private	4 (30.8)
Field of study	Science, technology, engineering and mathematics	7 (53.8)
	Arts, business and humanities	6 (46.2)
Residence	Rented (apartment/flat/hostel outside college/university)	8 (61.5)
	At home with family	5 (38.5)
Ethnicity	Bantu	9 (69.2)
	Nilote	4 (30.8)
Religion	Christian	12 (92.3)
	Muslim	1 (7.7)
Main source of finances	Part time employment	8 (61.5)
	Parents/guardians	5 (38.5)

*TVET: Technical and vocational education training institution

The following section explores main themes from the analysis of the interviews with both the service providers and TSMSM. Themes are described and supported with illustrative quotes from the interviews. Quotes are attributed to participants using pseudonyms, age in years and role.

2.2.2 Social networks of TSMSM

A key theme that emerged from the interviews is that TSMSM constituted a large and well networked sub-group of the MSM community. TSMSM formed networks among themselves, as

well as with other sub-groups of MSM. TSMSM had regular face-to-face interactions with their peers from the same institution and those from different institutions. However, since the outbreak of COVID-19, these interactions had been hampered by government-imposed restrictions to reduce risk of disease transmission through in-person contact. Consequently, TSMSM mainly interacted through social media applications such as Facebook®, WhatsApp®, Twitter® and Instagram®.

> "In the student MSM community, what happens is that there is some sort of invisible network that is hidden but it is very large and well connected." – Justin, 32 years, service provider

> "I know about 30 to 40 people (other TSMSM in Nairobi). I have seen about 10 (in the last 30 days) … due to the COVID situation, most people travelled (out of Nairobi) … most of them are the people we study with, like in the same institution… but I also know others from other universities." – Kyle, 23 years, student

> "Twenty-five to thirty (number of TSMSM known). Due to the corona (COVID-19), I have seen about 12… we are used to each other… we always chat through WhatsApp®, Facebook® and Twitter® sometimes… even through Instagram®." – Caleb, 24 years, student

TSMSM exhibited strong ties with their peers (intra-group ties), through which they found safe spaces to socialize such as night clubs and house parties. The house parties offered opportunities to engage in risky behaviours such as use of alcohol and casual sex. In spaces where there were other MSM such as night clubs, TSMSM tended to interact and socialize with each other, staying away from other MSM perceived to have lower educational attainments.

> "They (TSMSM) love parties… like on Fridays, they have house parties among themselves… so they really interact among themselves so much, then they get drunk and have sex." – Nicole, 47 years, service provider

> "Most of them (MSM) group themselves into clusters, whereby even if you get into a club, you will find them like the tertiary ones (students) are seated at one corner, and the lower end ones (with lower education levels) at the other corner." – Mike, 32 years, service provider

TSMSM also interacted with other sub-groups of MSM. TSMSM were a bridging sub-population between well-off or financially secure, older MSM and less well-off MSM within their age-group, and engaged in transactional sex, receiving money from the former and in turn giving money to the later.

> "MSM students have sponsors (older and well-off MSM) … because they want to have a flashy lifestyle, they want to have money, so they will have sponsors to sponsor their lifestyles." – Nicole, 47 years, service providers

> "Tertiary MSMs, they have sex with those guys with money so that they can cater for their needs. Once (after) they are from that upper end, they will come into the clubs... they try to mingle and buy sex from the lower end partners." – Mike, 32 years, service providers

2.2.3 Appropriateness and acceptability of using RDS to recruit TSMSM

Participants felt that RDS would be an appropriate and acceptable method of recruiting TSMSM to the prospective HIV/STIs bio-behavioural survey. TSMSM regarded RDS as an appropriate recruitment strategy due to the hidden but networked nature, and the trust that existed among members of the TSMSM community. The perceived trust among peers would enable them reach each other better, as compared to the research team trying to reach the TSMSM directly.

> "It (RDS) would work best and I think it is one of the recommended methods especially MSM being hidden… of course they will tend to trust information coming from their peers and this group of MSM is actually very highly networked" – Jay, 24 years, student

> "I think it (RDS) would work very well because it's easier for me to refer someone than you going out there to look for a guy to participate... they (my friends) would believe my word of mouth so it's convincing enough." – Trevor, 22 years, student

Service providers noted that they were already known and trusted by TSMSM, and this existing relationship would make TSMSM referred by the service providers more likely to agree to participate in the prospective survey.

> "If you are given something by a friend of yours, it is easy to accept it… but if you are given by a stranger, that is when challenges come in… because you (researchers) are already embedding yourselves in the existing networks, then it is okay because of the

already existing trust between us (service providers) and the students." – Justin, 32 years, service provider

The proposed double reimbursement for first participating and then getting a friend to participate in the prospective survey, also made RDS popular. The first reimbursement would be used to cater for expenses such as travel fare to get to the survey site, and the second one would motivate peers to bring in their friends or peers to take part in the prospective survey.

> "It (RDS) will be good because of the reimbursement… you are using your transport from where you live to the place where you are going to get the service or the research so it will be a good thing. Once you've told someone that the moment you bring someone there is something for you it's not that hard (for a friend to agree to participate)." – Danny, 20 years, student

> "I think since there is a small reimbursement, I think that would motivate people to really recruit their friends to come for the study." – Kyle, 23 years, student

2.2.4 RDS anticipated challenges and proposed solutions

Participants anticipated that while a helpful strategy, RDS implementation would face some challenges. They also offered probable ways of mitigating these challenges. Key among the anticipated challenges was that if the survey was associated with CBOs that serve sex workers, then TSMSM would not be willing to take part in the survey, since they would not want to be associated with sex work. It was proposed that the researchers present themselves to possible participants as independent from these CBOs so as to encourage participation.

> "The only challenge will be if this (the survey) is associated with some organizations it might discourage some people from participating. You find this group (TSMSM) sometimes doesn't want to be associated with some community clinics because they have a reputation of serving sex workers… I guess I like that you presented yourself as an independent researcher from an academic institution, that is straightforward… people will feel free to participate." – Jay, 24 years, student

Another foreseen challenge was the possible loss of recruitment coupons. Participants suggested various ways of handling this, including: indicating the incentives on the coupons so that TSMSM would be motivated to keep the coupons safely, having coupons in a small size that would easily

fit in the pocket, and placing coupons in an envelope.

> "They (coupons) get lost a lot, someone just presents himself without it. If they are communicating the incentive directly, then it works… someone will be able to store it properly." **–** Jay, 24 years, student

> "The challenge I was thinking of is when it (the coupon) gets lost… but if it will be in a smaller size, a pocketable size it is not easy to lose it." – Frank, 21 years, student

> "The person can lose the coupon. If it can be sealed in an envelope well, then it will be easy for them to handle." **–** Caleb, 24 years, student

It was also noted that some TSMSM would be unwilling to participate if they were not assured about confidentiality with regard to their same-sex sexual behaviour. To encourage TSMSM recruitment, it was suggested that during consenting, TSMSM be provided with adequate information on how their privacy and confidentiality would be guaranteed, and assurance that it was safe to participate in the survey.

> "I believe with detailed information, if one got the information correctly, maybe the willingness (to participate) would be much better." – Kyle, 23 years, student

> "Most of them (MSM), I think you need to assure them of the confidentiality in the interview. That is the thing that most MSM fear. Maybe they will be mentioned out there, or if they are students like at the university, they will be discriminated." – Pitts, 24 years, student

To further encourage recruitment, it was suggested that part of the survey team be MSM since TSMSM would be more comfortable opening up to other MSM.

> "Due to the sensitivity of what you're dealing with, only some of my friends would agree to come for the study… most of them are ok opening up to fellow members (MSM) but when it comes to somebody else they don't open up. So it is good to have other MSM working with you." – Perry, 20 years, student

Participants also predicted that TSMSM would encounter a twofold challenge in getting to the survey site – knowing the location of the survey site and having the means to get to the survey site. To allay this challenge, participants proposed that the survey team should consider: giving directions to the survey site by sharing a location pin on smart phones, providing a telephone

number TSMSM could call if they needed clarifications about the location of the survey site, and reimbursing participants with money to cover transport costs.

> "In terms of direction, if someone has a smartphone you can send them the location pin [GPS coordinates] of the study office. It could work… instead of walking around asking from people… and include phone details just for inquiries." – Andy, 23 years, student

> "You might find someone does not have the transport to get to town. If there could be a way they could be sorted out when they come, they get reimbursed the amount… I think it would work. It would give someone motivation to come and participate." – Andy, 23 years, student

From the service providers' point of view, it was noted that due to the proposed incentives in the prospective survey, there was a likelihood of recruiting MSM who were not TSMSM and/or men who were not MSM. To mitigate this to some extent, it was recommended that the research team could ask to see student identification cards and compare the student's facial appearance with the image on the identification cards.

> "When someone wants to get the incentive and does not have friends who are students, you are likely to be brought people who are coached… you are also likely to be brought people who are not MSM who are also coached." – Nicole, 47 years, service provider

> "To participate, one comes with his school ID… but now, one can borrow an ID… it is still not 100% viable (foolproof) but it tries to limit number of non-students participating." – Nicole, 47 years, service provider

Finally, carrying out the prospective survey when tertiary learning institutions were closed due to COVID-19 restrictions, or when students were having examinations, would interfere with recruitment of participants. It was proposed that the prospective survey be conducted at a time when COVID-19 restrictions would have eased, and students were not sitting examinations.

> "For a student it depends on whether he is currently in college or at home because of corona (COVID-19) … and also, are you giving these coupons during exams time? Of course no one would come if they have exams. And you know students at university, they only read during exams time and therefore they would not bring back the coupons during that time." – Justin, 32 years, service provider

"It is better if you do the study when universities re-open (after COVID-19 restrictions have eased) and also when the students are not having exams." – Mike, 32 years, service provider

2.3 Discussion

We assessed whether RDS was an appropriate and acceptable strategy for recruiting young TSMSM for a HIV/STIs bio-behavioural survey. We also assessed challenges anticipated with the use of this method, and explored possible solutions to these challenges. RDS relies on certain assumptions that need to be met for RDS to be considered an appropriate sampling method for a particular population. These assumptions are: (1) the target population is sufficiently networked to sustain recruitment through the waves and eventually reach the desired sample size, (2) peer relationships are reciprocal (*a* knows and can recruit *b*, *b* knows and can recruit *a*), (3) recruitment within an individual's network is random and (4) sampling occurs with replacement so that the set of available recruits is not depleted(31). Our findings demonstrate that the first two assumptions were met for the TSMSM population. To begin with, the TSMSM population was well networked with members exhibiting close social ties and having large network sizes. Secondly, members of the TSMSM population formed reciprocal relationships characterized by trust between each other. Based on the fulfillment of these two assumptions, RDS would thus be an appropriate recruitment strategy for TSMSM. Besides the trust that existed between peers, RDS was also acceptable to TSMSM due to the proposed double incentives, and the discreet approach the method uses.

Our target population of TSMSM was young and socially marginalized. Other studies have shown that, to varying degrees, RDS is an appropriate and acceptable strategy for recruiting university students(32), sexual and gender minority youth, including young MSM(33), and young adult non-medical users of pharmaceutical opioids(34) into research. However, other studies have found that RDS may be an inappropriate strategy for recruiting socially marginalized populations such as urban young MSM(35) and young illicit drug users(36), mainly due to members of the target populations having small network sizes and insufficient ties within their networks, thus the inability to sustain recruitment. Notably, the studies highlighted here used data that was collected after the RDS surveys had been completed. To the best of our knowledge, this is the first study to use formative research to assess the appropriateness and acceptability of using RDS to recruit

young TSMSM for HIV/STI research in Kenya. As in other studies(37–39), this formative research provided us with useful information on the challenges that would be expected with the use of RDS, and probable solutions to these challenges. Being aware of these challenges is important to research teams, since the teams are then able to put in place measures to address these challenges prior to implementing RDS surveys and to pivot possible solutions when needed.

Our study had some limitations. By nature, formative research is not definitive, neither is it designed to test hypotheses. Rather, formative research can help inform whether RDS is an appropriate and acceptable strategy for the target population, as well as contribute to the RDS survey planning process. We cannot therefore say for sure that based on these findings that an RDS survey among TSMSM would be successful. We would have to conduct the RDS survey itself, then evaluate its outcomes and consider the value of the formative research to the RDS survey. Another limitation of this study is that we interviewed a small convenience sample of service providers. However, we felt that with this sample, given the dual roles each of the providers had at their respective organizations, and the day-to-day interactions the providers had with MSM, we would be able to obtain sufficient information to achieve the objectives of our study. Additionally, the three organizations from which the participants were sampled from are the primary providers of MSM exclusive/friendly services and are highly rated by MSM. As well, the study was conducted at a time when there were government-imposed COVID-19 restrictions, with most staff in these organizations working from home thus limiting their availability and accessibility to participate in the study. Finally, the study was conducted in the capital city which is expected to be more liberal than other smaller cities or rural settings in the country, thus limiting the generalizability of our findings. Nonetheless, these findings demonstrate the appropriateness and acceptability of RDS among TSMSM, in addition to bringing to light the anticipated challenges of using RDS and offering recommendations on how these challenges could be addressed prior to implementing the RDS survey.

2.4 Conclusion

TSMSM interviewed reported having large network sizes and strong ties within the networks, properties considered to be appropriate to sustain recruitment through the RDS waves. The RDS method was acceptable to TSMSM due to the trust that existed amongst them, hence making it easier for them to reach each other as compared to the researchers themselves attempting to reach

TSMSM directly. The study also offered valuable lessons on the challenges that would be expected with the use of RDS in the TSMSM population, and possible solutions to these challenges. Pre-assessing the suitability and agreeability of recruitment methods to reach young marginalized populations appears to be a practical way to begin to gain entry into these populations in an informed discreet manner, ensuring that the views and voices of possible future participants are incorporated into the design of prospective studies.

References

1. World Health Organization (WHO). HIV and young men who have sex with men: Technical brief. Geneva, Switzerland: WHO; 2015.
2. The Government of Kenya. Laws of Kenya Cap 63: The Penal Code. Kenya: Kenya Law; 1930.
3. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. J Int AIDS Soc. 2015;18(Suppl 1):219833.
4. Mustanski BS, Newcomb ME, Bois SN Du, Garcia SC, Grov C. HIV in Young Men Who Have Sex with Men: A Review of Epidemiology, Risk and Protective Factors, and Interventions. J Sex Res. 2011;48(2–3):218–53.
5. Fromme K, Corbin WR, Kruse MI. Behavioral Risks During the Transition From High School to College. Dev Psychol. 2008;44(5):1497–504.
6. Renn K. LGBTQ Students on Campus: Issues and Opportunities for Higher Education Leaders [Internet]. Higher Education Today. 2017 [cited 2021 Jun 10]. Available from: https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/.
7. Cong L, Ono-kihara M, Xu G, Ma Q, Pan X, Zhang D, et al. The characterisation of sexual behaviour in Chinese male university students who have sex with other men: A cross-sectional study. BMC Public Health. 2008;8(250).
8. Zou H, Tucker JD, Fan S, Xu J, Yu M, Luo Z, et al. Learning about HIV the hard way: HIV among Chinese MSM attending university. Lancet Infect Dis. 2018;18(1):16–8.
9. Ojino R, Mich L. Mobile Applications in University Education: the case of Kenya. J E-Learning Knowl Soc. 2018 Feb 1;14(1):111–25.
10. Hall WJ, Sun CJ, Tanner AE, Mann L, Stowers J, Rhodes SD. HIV Prevention

Opportunities with GPS-based Social and Sexual Networking Applications for Men who have Sex with Men. AIDS Educ Prev. 2017;29(1):38–48.

11. Fan S, Yang Z, Hou F, Yu M, Luo Z, Liao M, et al. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: A systematic review and meta-analysis. Sex Health. 2019;16(6):554–65.
12. Hightow LB, MacDonald PDM, Pilcher CD, Kaplan AH, Foust E, Nguyen TQ, et al. The Unexpected Movement of the HIV Epidemic in the Southeastern United States. JAIDS J Acquir Immune Defic Syndr. 2005;38(5):531–7.
13. Brink JG, Unit E, Africa S. Considerations for South African Higher Education: A National Student Men who Have Sex with Men Sexual Behavior Survey. South African J High Educ. 2017;31(4):184–207.
14. Respondent Driven Sampling [Internet]. [cited 2021 Sep 24]. Available from: http://www.respondentdrivensampling.org/.
15. Okal J, Raymond HF, Tun W, Musyoki H, Dadabhai S, Broz D, et al. Lessons learned from respondent-driven sampling recruitment in Nairobi: Experiences from the field. BMC Res Notes. 2016;9(158).
16. Johnston LG, Sabin K. Sampling Hard-to-Reach Populations with Respondent Driven Sampling. Methodol Innov Online. 2010;5(2):38–48.
17. Xu J-J, Reilly KH, Lu C-M, Ma N, Zhang M, Chu Z-X, et al. A cross-sectional study of HIV and syphilis infections among male students who have sex with men (MSM) in northeast China: implications for implementing HIV screening and intervention programs. BMC Public Health. 2011;11(287).
18. Zheng J, Wu Z, Poundstone KE, Pang L, Rou K. HIV, syphilis infection, and risky sexual behaviors among male university students who have sex with men in Beijing, China: a cross-sectional study. AIDS Educ Prev. 2012;24(1):78–88.
19. Pinsky L, Chiarilli DB, Klausner JD, Kull RM, Okeefe R, Heffer C, et al. Rates of asymptomatic nonurethral gonorrhea and chlamydia in a population of university men who have sex with men. J Am Coll Heal. 2012;60(6):481–4.
20. Zhang L, Ding X, Lu R, Feng L, Li X, Xiao Y, et al. Predictors of HIV and syphilis among men who have sex with men in a chinese metropolitan city: Comparison of risks among students and non-students. PLoS One. 2012;7(5):e37211.

21. Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV Prevalence and Related Factors: Higher Education Sector Study South Africa. Johannesburg, South Africa; 2009.
22. Forrest JI, Stevenson B, Rich A, Michelow W, Pai J, Jollimore J, et al. Community mapping and respondent-driven sampling of gay and bisexual men's communities in Vancouver, Canada. Cult Heal Sex. 2014;16(3):288–301.
23. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for Implementation Research: Conceptual Distinctions, Measurement Challenges, and Research Agenda. Adm Policy Ment Heal Ment Heal Serv Res. 2011;38(2):65–76.
24. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal. 2021;9:619694.
25. Study in Kenya. Universities and Colleges in Nairobi County [Internet]. 2021 [cited 2022 Jun 24]. Available from: https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1.
26. University of California San Francisco (UCSF). Integrated HIV Bio-behavioural Surveillance Toolbox [Internet]. [cited 2021 Sep 24]. Available from: https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox.
27. Liamputtong P. Qualitative Research Methods. 5th ed. Docklands, Victoria, Australia: Oxford University Press; 2020.
28. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Heal Care. 2007;19(6):349–57.
29. Guba EG. Criteria for assessing the trustworthiness of naturalistic inquiries. ECTJ. 1981;29(2):75.
30. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. Educ Inf. 2004;22(2):63–75.
31. Volz E, Heckathorn D. Probability Based Estimation Theory for Respondent Driven Sampling. J Off Stat. 2008 Mar 1;24:79–97.

32. Wejnert C, Heckathorn DD. Web-Based Network Sampling: Efficiency and Efficacy of Respondent-Driven Sampling for Online Research. Sociol Methods Res. 2008;37(1):105–34.
33. Wirtz AL, Iyer JR, Brooks D, Hailey-Fair K, Galai N, Beyrer C, et al. An evaluation of assumptions underlying respondent-driven sampling and the social contexts of sexual and gender minority youth participating in HIV clinical trials in the United States. J Int AIDS Soc. 2021 May 1;24(5):e25694.
34. Daniulaityte R, Falck R, Li L, Nahhas RW, Carlson RG. Respondent-driven sampling to recruit young adult non-medical users of pharmaceutical opioids: Problems and solutions. Drug Alcohol Depend. 2012;121(1):23–9.
35. Kuhns LM, Kwon S, Ryan DT, Garofalo R, Phillips G, Mustanski BS. Evaluation of Respondent-Driven Sampling in a Study of Urban Young Men Who Have Sex with Men. J Urban Heal. 2015;92(1):151–67.
36. Bryant J. Using respondent-driven sampling with 'hard to reach' marginalised young people: problems with slow recruitment and small network size. Int J Soc Res Methodol. 2014;17(6):599–611.
37. Higgins DL, O'Reilly K, Tashima N, Crain C, Beeker C, Goldbaum G, et al. Using formative research to lay the foundation for community level HIV prevention efforts: An example from the AIDS community demonstration projects. Public Health Rep. 1996;111(SUPPL. 1):28–35.
38. Allen DR, Finlayson T, Abdul-Quader A, Lansky A. The role of formative research in the National HIV Behavioral Surveillance System. Public Health Rep. 2009;124(1):26–33.
39. Johnston LG, Whitehead S, Simic-Lawson M, Kendall C. Formative research to optimize respondent-driven sampling surveys among hard-to-reach populations in HIV behavioral and biological surveillance: Lessons learned from four case studies. AIDS Care - Psychol Socio-Medical Asp AIDS/HIV. 2010;22(6):784–92.

Chapter 3: HIV Prevalence and Associated Risk Factors

Publication:

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Abstract

Background: Young gay, bisexual and other men who have sex with men (MSM), are a key population at higher risk of HIV infection yet they are underrepresented in research. We conducted a bio-behavioural survey to estimate HIV prevalence and associated risk factors among tertiary student MSM (TSMSM) in Nairobi, Kenya.

Methods: Between February and March 2021, 248 TSMSM aged ≥18 years who reported sex with another man in the past year participated in a respondent-driven sampling (RDS)-based cross-sectional survey. Participants completed an electronically self-administered behavioural survey and provided a blood sample for HIV antibody testing, alongside urine, healthcare provider collected anorectal and oropharyngeal swabs for pooled testing of sexually transmitted infections (STIs) using a multiplex nucleic acid amplification test. RDS-Analyst v.0.72 and Stata v.15 software were used for data analyses. Differences in proportions were examined using chi-square (χ^2) test, and unweighted multivariate logistic regression was used to assess factors associated with HIV infection.

Results: HIV prevalence among study participants was 8.3%, whereas the RDS-weighted prevalence was 3.6% (95 % CI: 1.3% - 6.0%). Median ages of participants and at self-reported first anal sex with a man were 21 (interquartile range [IQR] 20-22) and 18 (IQR 17-19) years, respectively. Majority (89.3%) of TSMSM owned a smart phone, 46.5% had ever used a geosocial networking app for MSM such as Grindr ®, and 33.6% met their last sex partners online. Almost three-quarters (71.3%) had >1 male sex partner in the year before the survey. A third (34.3%) did not use condoms with their last sex partner, 21.2% received money from their last sex partner and 40.9% had taken alcohol/another drug during their last sexual encounter. HIV infection was associated with studying in private institutions (adjusted odds ratio [AOR]=6.0; 95% CI: 1.2-30.0,

p=0.027), preferring a sex partner of any age – younger, same or older (AOR=5.2; 95 CI: 1.1-25.2, p=0.041), last sex partner being >25 years (AOR=6.4; 95% CI: 1.2-34.6, p=0.030) and meeting the last sex partner online (AOR=4.2; 95% CI; 1.1-17.0, p=0.043). In addition, prevalent gonorrhea infection (AOR=7.8; 95% CI: 2.0-29.9, p=0.003) was associated with testing positive for HIV.

Conclusions: HIV prevalence among TSMSM in Nairobi is alarmingly high, and is associated with factors such as studying in private institutions, age-disparate sexual relationships, meeting sex partners online, and prevalent gonorrheal infection. There is thus an urgent need for tailored HIV/STIs prevention and control interventions for this young key population, with digital health platforms seemingly a viable option for the delivery of such interventions.

3.0 Introduction

The incidence of human immunodeficiency virus (HIV) has continued to fall universally(1). Kenya has made laudable progress in the HIV response as shown by the sustained decline in HIV prevalence among adults (15-49 years) in the general population, from a high of ~ 10% in the mid-1990s to 4.5% in 2020(2). Whilst overall incidence has been declining, key populations such as men who have sex with men (MSM) still bear a disproportionate burden of the disease. Despite MSM consisting only 1-3% of the adult male population, one fifth (21%) of all new HIV infections reported in 2021 were among MSM, with MSM having 28-fold greater odds of acquiring HIV than men in the general population(3). In sub-Saharan Africa, the overall HIV prevalence is approximately five times higher among MSM than among men in the general population(4). In Nairobi – Kenya's capital, the prevalence of HIV among MSM is 25%(5) compared to 3.1% in the general male population (15 – 49 years old)(6), with 15.2% of all new HIV infections in the country occurring among MSM(7).

Kenya has a dedicated national program that leads the HIV response among key populations in the country(8). Despite tremendous progress made in scaling up HIV prevention among key populations, the program still grapples with challenges such as lack of updated bio-behavioural survey data, and gaps in reaching adolescent and young key populations(9), including tertiary student MSM (TSMSM). In countries such as China where data is available, HIV prevalence among TSMSM is 4.1%, and despite TSMSM constituting only an estimated 8.5% of the total tertiary student population, they account for over 80% of all HIV infections in the tertiary institutions(10). In South Africa, TSMSM comprise 6% of male tertiary students and have a HIV

prevalence of 4.1%, which is greater than twice that of the general male tertiary student population – 1.7%(11).

TSMSM like other young MSM (YMSM) may be involved in practices that heighten their risk of acquiring HIV. Upon joining tertiary institutions, they interact with peers who have similar same-sex sexual behaviour, experience more freedom from parental supervision, and have increased opportunities for socialization(12). As a result, studies have shown that TSMSM seek casual sex partners online, have sex more often, and engage in condomless anal sex, group sex and sex work(10). Additionally, TSMSM have been shown to have early sexual debut, forced sex experiences, high sex partner turnover, concurrent sex partners, inconsistent condom use, and alcohol and drug use(13). Taken together, these behaviours increase the risk of HIV acquisition among TSMSM. In many African countries, including Kenya, these behavioural risks are further amplified by structural factors such as criminalization of same-sex sexual behaviour(14), as well as societal stigma and discrimination towards individuals with same-sex behaviour(15).

Given the potential risk of HIV infection faced by TSMSM, it is important to understand what the HIV prevalence and associated risk factors are for this population. This information would be useful to stakeholders, including policy makers, service providers, advocacy groups and TSMSM themselves, in informing tailored prevention, risk reduction or eradication, and control responses for this population, and contribute towards the Joint United Nations Programme on HIV/AIDS (UNAIDS) ambitious goal of ending AIDS as a public health threat by 2030(16). This study aimed to estimate HIV prevalence and associated factors among TSMSM in Nairobi, Kenya.

3.1 Methods and materials

Study methods are detailed in the published study protocol(17), and summarized below:

3.1.1 Study design and setting

We conducted a cross-sectional survey between February and March 2021, after COVID-19 restrictions were eased in Kenya and tertiary institutions allowed to re-open for in-person learning. Nairobi, the capital city of Kenya, was selected as the study area because of its large population of tertiary students spread across approximately 150 campuses of various universities, and technical and vocational education training institutions (TVETs) within its metropolis(18). These tertiary institutions are within a radius of approximately 25 kilometres (16 miles) from the Nairobi central business district. This area extends to the neighbouring counties of Kiambu, Kajiado and

Machakos as shown in **Figure 3.1**. The actual study was conducted in an office within the Nairobi central business district, where a similar study among the general MSM population had taken place in 2017.

3.1.2 Participants, sampling and recruitment

TSMSM were eligible to participate in the survey if they were ≥18 years, provided proof of being a registered student in a university or TVET in Nairobi; were assigned male gender at birth, reported having had consensual receptive or insertive oral or anal sexual intercourse with another man in the last 12 months and provided written informed consent (in English) to participate in the study. The sample size for the survey was calculated to estimate the prevalence of HIV among TSMSM, based on World Health Organization's (WHO) 2017 bio-behavioural survey guidelines for populations at higher risk of HIV infection(19). A minimum sample size of 200 TSMSM was planned using the Cochran formula(20), with a design effect of 3 to account for clustering, estimated HIV prevalence of 4.1% based on a previous study among TSMSM in South Africa(11), a level of precision of 0.05 and 10% non-response. Respondent-driven sampling (RDS) was used as the recruitment strategy following favourable findings from formative research that demonstrated the appropriateness and acceptability of the method for recruiting TSMSM into the survey(21). In summary, RDS is a chain referral sampling method that integrates a mathematical model that weights the sample to compensate for the non-random sampling, thereby minimizing old-style snowballing bias(22). From the TSMSM who took part in the formative research(21), six seeds were purposely selected based mainly on their self-reported personal network sizes and ability to recruit their peers. The seeds completed half a day training during which they were briefed on the purpose of the study, study procedures, eligibility criteria for prospective participants and types of incentives that would be offered. In addition, the seeds were offered a recruitment script which if needed would be used to inform their peers about the study. Upon completing the study procedures, each seed was issued three coupons to recruit their peers. A member of the study team used a prescribed form to screen prospective participants recruited by the seeds and subsequent participants. The screening involved checking the validity of the coupons (based on a unique code for each coupon linked to the seed starting off each recruitment chain), and fulfillment of the other set eligibility criteria. Upon completing the study procedures, each participant was briefed on how to recruit their peers into the study, issued three coupons and a recruitment script similar to the one issued to the seeds. Coupons were valid for a period of two

weeks from the date of issue. Each seed and subsequent participant could recruit only a maximum of three peers into the study. Issuing of three coupons went on until the survey had recruited 120 participants (inclusive of seeds). Subsequently, two coupons were issued until the 150th participant, after which no more coupons were issued. The study remained open for recruitment for two weeks after the last coupons were issued, and closed with 248 TSMSM having participated. Each participant was reimbursed 1000 Kenyan shillings (equivalent to US$ 10 at that time) for their time and expenses related to transport to and from the study site, and 300 Kenyan shillings (equivalent to US$ 3) for every peer they recruited into the study. In addition, participants were offered condoms and water-based lubricants.

3.1.3 Data collection tools and procedures

The behavioural survey was conducted through self- administered interviews on tablets using a questionnaire set up on the REDCap® software (Vanderbilt University). The questionnaire was adapted for this study from a validated questionnaire available from the integrated HIV bio-behavioural surveillance toolbox of the University of California, San Francisco(23). The questionnaire contained questions on sociodemographic characteristics and sexual behaviour, and was administered in English, the language of instruction in Kenyan tertiary institutions. The self-administered questionnaire was piloted among the six seeds. This opportunity was used to address any discrepancies noted such as inconsistent skip patterns. Additionally, any text that was unclear was further simplified. During the survey, a member of the study team was present to assist participants who encountered any difficulties navigating the digital platform. This assistance was limited to technical issues only, and did not extend to helping participants interpret or select responses on the questionnaire.

3.1.4 Biological specimen collection and testing

After completing the behavioural survey, participants were offered HIV testing based on the Kenyan national testing algorithm(24). The testing algorithm is serial and recommends use of an antibody screening test, followed by an antibody confirmatory test if the screening test is positive. In cases where results of the confirmatory test are discordant with those of the screening test, clients are referred to a reference laboratory where their samples are tested using an assay (either Western Blot or Enzyme-linked Immunosorbent Assay) which is distinct from both the screening and confirmatory tests. Capillary blood from a finger prick was drawn by a trained and experienced

HIV testing counselor, who had worked for previous studies at the study office, and was trained on the study procedures for the current study. Testing was done in a private room at the study office with only the counselor and one participant present at the time of sample collection and testing.

All samples were tested using the Determine® rapid test kit. Non-reactive tests were considered negative for HIV. Samples from those with reactive tests were subsequently tested with HIV-1/2 First Response® kit for confirmation of HIV seropositive status, except for participants who self-reported HIV seropositive status. There were no discordant results. Participants were offered pre- and post-HIV testing counselling. Participants who tested positive for HIV and were not on treatment were referred to facilities of their choice for HIV care and treatment. Participants who tested negative for HIV and were at high risk for HIV infection were referred for oral pre-exposure prophylaxis (PrEP) if not already initiated, or initiated and stopped. Participants also provided urine, anorectal and oropharyngeal swabs for pooled *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhea* and *Trichomonas vaginalis* testing using a multiplex nucleic acid amplification test (Sacace Biotechnologies®, Italy).

3.1.5 Data analysis

Data analysis excluded 6 seeds who were purposely selected to begin the RDS recruitment, and among whom the self-administered questionnaire was piloted. The weighted HIV prevalence with 95% confidence intervals (CI) was calculated using RDS Analyst (RDS-A) software version 0.72(25), where Gile's successive sampler estimator was used for weighting. This estimator takes into consideration the self-reported network sizes of participants, recruitment patterns and estimated size of the study population(26). As per recommendation(27), an estimated population size of 8406 for TSMSM (1.45% of male tertiary students in the Nairobi metropolis) was used, with 0.95 CI and 1000 bootstraps for variance estimation(26). Stata version 15 (College Station, TX: StataCorp LLC) was used for further analysis of the unweighted data. Some continuous variables such as age and self-reported number of sex partners were converted into binary categories. Categorical variables were summarized using proportions, and differences in proportions examined using chi-square (χ^2) test. Multivariate logistic regression models were used to measure associations between various factors and HIV infection. All exposure variables with a $p \leq 0.2$ in univariate analysis were included in the multivariate model. Other variables with $p > 0.2$

but considered to be potential confounders were also included in the multivariate model. Unweighted regression models were used since they have been shown to perform better than weighted regression models for RDS data(28).

3.1.6 Ethical considerations

Participants provided written informed consent before taking part in the study. The study protocol was reviewed and approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number: M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number: P990/12/2019). The study also received a letter of support from the Key Populations Program of the National AIDS and STI Control Program (NASCOP), Ministry of Health, Government of Kenya.

3.2 Results

3.2.1 Sociodemographic, sexual behaviour and contextual characteristics of TSMSM

A total of 248 TSMSM were recruited including 6 seeds. The final sample had a minimum of one and maximum of eight recruitment waves, as depicted by the recruitment networks in **Figure 3.2**. The median age of participants was 21 years (IQR 20-22), with 96.3% ≤24 years. As shown in **Table 3.1**, the youngest participant was 18 years and oldest 30 years old. Further, a majority (58.3%) were university students, almost three-quarters (71.9%) were in public institutions and four-fifths (79.3%) resided in college or rented hostels outside their campuses. A majority (89.3%) owned a smart phone at the time of study participation. The median age at reported anal sexual debut with a man was 18 years (IQR 17-19) and most reported consensual sexual debut (83.4%). Almost three-quarters (71.3%) had more than one sex partner, with 16.2% having participated in group sex within the last year. Approximately half (46.5%) had ever used a geosocial networking app for MSM such as Grindr ® for finding a sex partner, with one-third (33.6%) having met their last sex partner online. Approximately two-thirds (65.7%) and more than three-quarters (78.1%) had used condoms and lubricants, respectively, with their last sex partner. One-fifth (21.2%) received money from their last sex partner and less than half (40.9%) had taken alcohol or another drug during their last sexual encounter.

3.2.1 HIV prevalence, differences in proportions, and associated factors

The HIV prevalence among the study participants was 8.3%. The RDS-weighted HIV prevalence for the study population (TSMSM in Nairobi) was 3.6% (95 % CI: 1.3% - 6.0%). Three-quarters (77.3%) of those who tested positive for HIV knew of their HIV serostatus prior to testing in the study, and all of these participants reported being on antiretroviral therapy. As illustrated in **Table 3.1**, HIV prevalence was significantly higher among TSMSM studying in private institutions (16.2% vs 5.2%, p=0.005), residing at home with their families (16.0% vs 6.2%, p=0.026), who preferred older sex partners (22.2% vs 4.8%, p=0.001), whose last sex partner was >25 years old (24.3% vs 5.4%, p<0.001), who had more than one sex partner in the last year (11.0% vs 1.4%, p=0.015), who had ever used a geosocial networking app for MSM (15.2% vs 2.3%, p<0.001), who met their last sex partner online (16.0% vs 4.4%, p=0.002) and those who tested positive for MG (20.0% vs 6.9%, p=0.024) and NG (22.2% vs 5.8%, p=0.001).

The results of multivariate logistic regression are presented in **Table 3.2**. In multivariate analysis, independent risk factors for HIV infection were: studying in private institutions (Adjusted Odds Ratio [AOR]=6.0; 95% CI: 1.2-29.9, p=0.027), preferring a sex partner of any age (AOR=5.1, 95% CI: 1.1-25.2, p=0.041), having a last sex partner >25 years old (AOR=6.4; 95% CI: 1.2-34.6, p=0.030), meeting the last sex partner online (AOR=4.2; 95% CI; 1.1-17.0, p=0.043) and testing positive for NG (AOR=7.8, 95% CI: 2.0-29.9, p=0.003).

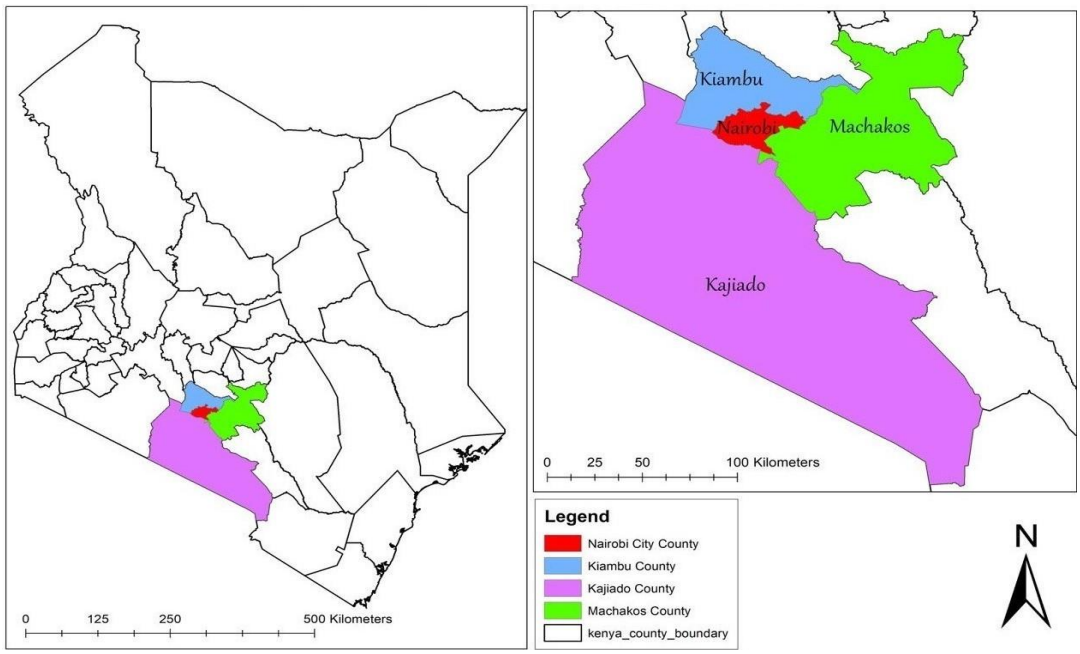


Figure 3.1: Map showing the study catchment area

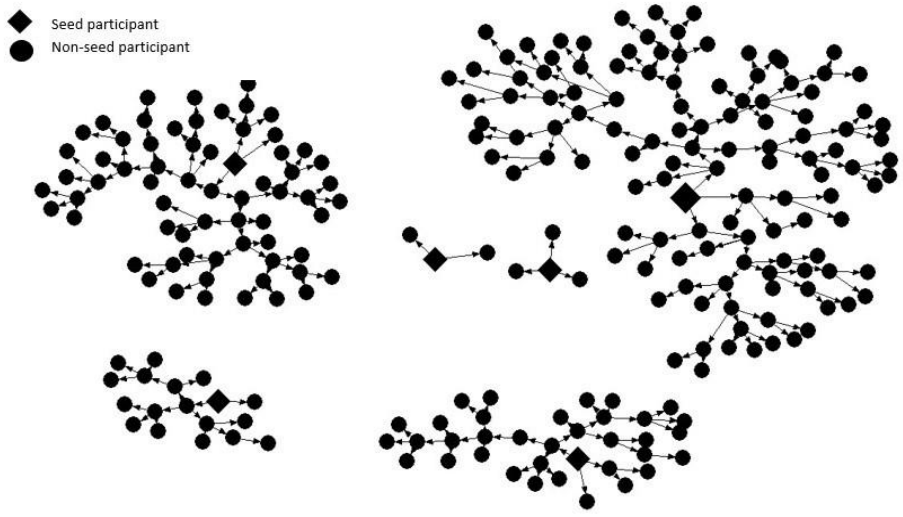


Figure 3.2: Recruitment networks of TSMSM in Nairobi, Kenya (N = 248)

Recruitment was initiated by six seeds who were issued with 418 coupons, 244 coupons were returned and out of these, 242 met the eligibility criteria for study participation and were subsequently enrolled into the study. The waves of recruitment per seed ranged from 1 to 8. Diamonds and circles indicate seed and non-seed participants, respectively.

Table 3.1: Sociodemographic, sexual behaviour and contextual characteristics of TSMSM in Nairobi, Kenya (N=242)

Variable	Category	n (%)	HIV negative n (%)	HIV positive n (%)	P value
Sociodemographic characteristics					
Age (years)	18-20	89 (36.8)	83 (93.3)	6 (6.7)	0.512
	21-30	153 (63.2)	139 (90.8)	14 (9.2)	
Level of institution	University	141 (58.3)	131 (93.0)	10 (7.0)	0.434
	College	101 (41.7)	91 (90.1)	10 (9.9)	
Type of institution	Public	174 (71.9)	165 (94.8)	9 (5.2)	0.005*
	Private	68 (28.1)	57 (83.8)	11 (16.2)	
Type of course	Engineering and technology	103 (42.6)	97 (94.2)	6 (5.8)	0.551
	Health, natural and social sciences	53 (21.9)	48 (90.6)	5 (9.4)	
	Business management	48 (19.8)	44 (91.7)	4 (8.3)	
	Arts and humanities	38 (15.7)	33 (86.8)	5 (13.2)	
§Year of study	1st and 2nd year	153 (66.0)	140 (91.5)	13 (8.5)	0.812
	3rd and 4th year	79 (34)	73 (92.4)	6 (7.6)	
Residence	College/rented hostel	192 (79.3)	180 (93.8)	12 (6.2)	0.026*
	With family	50 (20.7)	42 (84.0)	8 (16.0)	
Ever attended boarding school	Yes	203 (16.1)	188 (92.6)	15 (7.4)	0.259
	No	39 (83.9)	34 (87.2)	5 (12.8)	
Main source of finances	Parents/guardians	137 (56.6)	127 (92.7)	10 (7.3)	0.692
	Employment	65 (26.9)	58 (89.2)	7 (10.8)	
	Bursary/scholarship	40 (16.5)	37 (92.5)	3 (7.5)	
Had smartphone at time of the study	Yes	216 (89.3)	196 (90.7)	20 (9.3)	0.105
	No	26 (10.7)	26 (100.0)	0 (0.0)	
Sexual orientation	Gay	153 (63.2)	140 (91.5)	13 (8.5)	0.655
	Bisexual	80 (33.1)	73 (91.3)	7 (8.7)	
	Heterosexual	9 (3.7)	9 (100.0)	0 (0.0)	
Gender identity	Cisgender male	219 (90.5)	201 (91.8)	18 (8.2)	0.937
	Transgender female	23 (9.5)	21 (91.3)	2 (8.7)	
Sexual behaviour characteristics					
Ever had vaginal sex with a woman	Yes	130 (53.7)	123 (94.6)	7 (5.4)	0.080
	No	112 (46.3)	99 (88.4)	13 (11.6)	
Age at first anal sex with a man	≤ 18 years	137 (57.0)	124 (90.5)	13 (9.5)	0.455
	> 18 years	103 (43.0)	96 (93.2)	7 (6.8)	
Preferred age of sex partner	Same/younger age	187 (77.6)	178 (95.2)	9 (4.8)	0.001*
	Any age	36 (15.0)	29 (80.6)	7 (19.4)	
	Older	18 (7.4)	14 (77.8)	4 (22.2)	
Age of last sexual partner (years)	15 – 24	204 (84.7)	193 (94.6)	11 (5.4)	<0.001*
	≥25	37 (15.3)	28 (75.7)	9 (24.3)	
Sexual role at first anal sex with a man	Insertive	103 (42.8)	95 (92.2)	8 (7.8)	0.514
	Receptive	83 (34.4)	74 (89.2)	9 (10.8)	
	Versatile	55 (22.8)	52 (94.6)	3 (5.4)	
Preferred sexual role	Insertive	117 (48.6)	109 (93.2)	8 (6.8)	0.512
	Versatile	75 (31.1)	69 (92.0)	6 (8.0)	

	Receptive	49 (20.3)	43 (87.8)	6 (12.2)	
Nature of first anal sex with a man	Consensual	201 (83.4)	182 (90.6)	19 (9.4)	0.145
	Coerced/forced	40 (16.6)	39(97.5)	1 (2.5)	
Number of men had anal sex within last 12 months	One (1)	69 (28.7)	68 (98.6)	1 (1.4)	0.015*
	More than one (1)	172 (71.3)	153 (89)	19 (11.0)	
Participated in group sex within last 12 months	No	202 (83.8)	186 (92.0)	16 (8.0)	0.628
	Yes	39 (16.2)	35 (89.7)	4 (10.3)	
Ever used app to find a sex partner	Yes	112 (46.5)	95 (84.8)	17 (15.2)	<0.001*
	No	129 (53.6)	126 (97.7)	3 (2.3)	
Where last sex partner was met	Offline	160 (66.4)	153 (95.6)	7 (4.4)	0.002*
	Online	81 (33.6)	68 (84.0)	13 (16.0)	
Used condom with last sex partner	Yes	159 (65.7)	145 (91.2)	14 (8.8)	0.673
	No	83 (34.3)	77 (92.8)	6 (7.2)	
Received money from last sex partner	Yes	51 (21.2)	47 (92.2)	4 (7.8)	0.894
	No	190 (78.8)	174 (91.6)	16 (8.4)	
Alcohol/other drug use during last sexual encounter	Yes	99 (40.9)	89 (89.9)	10 (10.1)	0.388
	No	143 (59.1)	133 (93.0)	10 (7.0)	
Contextual characteristics (sexually transmitted infections test results)					
Chlamydia trachomatis	Negative	100 (41.3)	94 (94.0)	6 (6.0)	0.283
	Positive	142 (58.7)	128 (90.1)	14 (9.9)	
Mycoplasma genitalium	Negative	217 (89.7)	202 (93.1)	15 (6.9)	0.024*
	Positive	25 (10.3)	20 (80.0)	5 (20.0)	
Neisseria gonorrhea	Negative	206 (85.1)	194 (94.2)	12 (5.8)	0.001*
	Positive	36 (14.9)	28 (77.8)	8 (22.2)	
Trichomonas vaginalis	Negative	239 (98.8)	219 (91.6)	20 (8.4)	0.601
	Positive	3 (1.2)	3 (100.0)	0 (0.0)	

*Significant difference in proportions; [§]Ten (10) missing values not included in the analysis.
TSMSM: tertiary student men who have sex with men.

Table 3.2: Multivariate logistic regression of factors associated with HIV positive serostatus among TSMSM in Nairobi, Kenya (N=239[§])

Variable	Category	Unadjusted Odds Ratio (95% CI)	P value	Adjusted Odds Ratio (95% CI)	P value
Sociodemographic characteristics					
Type of institution	Public	1			Ref
	Private	3.5 (1.4-9.0)	0.008	6.0 (1.2-30.0)	0.027*
Residence	College/rented hostel	1			Ref
	With family	2.9 (1.1-7.4)	0.031	3.0 (0.7-13.2)	0.572
Sexual behaviour characteristics					
Age at first anal sex with a man	≤ 18 years	1			Ref
	> 18 years	0.7 (0.3-1.8)	0.457	0.6 (0.2-2.4)	0.516
Preferred age of sex partner	Same/younger age	1			Ref
	Any age	4.8 (1.6-13.8)	0.004	5.2 (1.1-25.2)	0.041*
	Older	5.7 (1.5-20.7)	0.009	1.1 (0.1-9.2)	0.948
Age of last sexual partner	15 – 24	1			Ref
	≥25	5.6 (2.1-14.8)	<0.001	6.4 (1.2-34.6)	0.030*
Sexual role at first anal sex with a man	Versatile	1			Ref
	Insertive	1.4 (0.4-5.7)	0.588	4.9 (0.7-32.7)	0.097
	Receptive	2.1 (0.5-8.2)	0.280	2.0 (0.3-12.7)	0.476
Preferred sexual role	Insertive	1			
	Versatile	1.2 (0.4-3.6)	0.763	0.5 (0.1-2.4)	0.380
	Receptive	1.9 (0.6-5.8)	0.259	1.6 (0.3-8.6)	0.572
Nature of first anal sex with a man	Coerced/forced	1			Ref
	Consensual	4.1 (0.5-31.3)	0.177	0.1 (0.1-1.5)	0.090
Number of men had anal sex with in last 12 months	One	1			Ref
	More than one	8.4 (1.1-64.4)	0.040	8.3 (0.7-94.6)	0.088
Participated in group sex within last 12 months	No	1			Ref
	Yes	1.3 (0.4-4.2)	0.629	0.9 (0.2-4.3)	0.877
Where last sex partner was met	Offline	1			Ref
	Online	4.2 (1.6-11.0)	0.004	4.2 (1.1-17.0)	0.043*
Used condom with last sex partner	No	1			Ref
	Yes	1.2 (0.5-3.4)	0.673	4.3 (0.9-20.3)	0.065
Received money from last sex partner	Yes	1			Ref
	No	1.1 (0.3-3.4)	0.894	3.5 (0.7-18.7)	0.139
Alcohol/other drug use during last sexual encounter	No	1			Ref
	Yes	1.5 (0.6-3.7)	0.390	2.3 (0.6-8.7)	0.214
Sexually transmitted infections test results					
Mycoplasma genitalium	Negative	1			Ref
	Positive	3.3 (1.1-10.2)	<0.001	2.1 (0.5-9.1)	0.293
Neisseria gonorrhea	Negative	1			
	Positive	4.6 (1.7-12.3)	<0.001	7.8 (2.0-29.9)	0.003*

[§] Three records had missing values and were excluded from the logistic regression; *Independent risk factor for HIV infection; TSMSM: tertiary student men who have sex with men

3.4 Discussion

We found an estimated HIV prevalence of 8.3% among study participants and a weighted HIV prevalence of 3.6% (95 % CI: 1.3% - 6.0%) among TSMSM in Nairobi. The weighted HIV prevalence observed among TSMSM in our study (96% of whom were 18-24 years old) was six times higher than that of young Kenyan men in the general population aged 18-24 years, which is 0.6%(6). Accordingly, the recent call to have programming that caters for the HIV prevention needs of YMSM in Africa(29), is quite relevant for TSMSM in Nairobi. The weighted HIV prevalence observed is comparable to the 4.1% HIV prevalence found among TSMSM in both China(10) and South Africa(11). Notably, with only 77.3% of study participants knowing their HIV status to be seropositive before the study, there is a needs gap prompting scale up of discreet HIV counselling and testing opportunities in this population in order to reach the first 95 (that 95% of those living with HIV know their status) of the UNAIDS fast-track 95-95-95(30). Noteworthy, 22.7% of the HIV infections we found were reportedly new diagnoses, highlighting the critical role that representation of YMSM in research can play in assisting YMSM access services and better understand their HIV status. Consequently, more research and services among diverse groups of YMSM such as those in high school, out of school and work may be needed to accelerate identification of new HIV cases and linkage to care among these populations. HIV self-testing is readily available and acceptable in Kenya (31), and is one of the strategies that can be harnessed to increase testing rates among these and other groups of YMSM.

Higher HIV prevalence was observed among TSMSM studying in private institutions and staying at home with their families. We hypothesize that most TSMSM who study in private institutions and stay with their families have predominantly lived most of their lives in the city, which is more liberal than the rural areas of the country. Therefore, it is likely that these TSMSM could have started experimenting with both receptive and insertive anal sex at an earlier age than their rural counterparts who may be more conservative initially and due to costs, mostly tend to join the public institutions and stay either in campus or rented accommodation outside their campuses. For these reasons, there could be an increased exposure period for the former, leading to the elevated risk of HIV infection. This increased risk of HIV infection that possibly stems from the liberalism that comes with living in the city, may further be compounded by other vulnerabilities such as inadequate life skills and agency, sexual coercion, stigma and social exclusion(15). Indeed, even

higher HIV prevalence (30.3%) than we found, has been observed among YMSM in urban Indonesia(32), a country where unlike Kenya, homosexuality is not criminalized but there are persistent calls for its criminalization, frequent police crackdowns and marginalization of MSM.

Meeting sex partners online was significantly associated with HIV infection. This finding is consistent with that of a previous study in Kenya which showed that MSM who sought sex partners online had four-fold greater odds of having HIV infection compared to those who sought sex partners from physical sites(33). Additional research in sub-Saharan Africa has demonstrated that MSM who seek sex partners online are more likely to be younger(34), like many of our study participants. YMSM, including TSMSM who use the internet to find sex partners are a critical population to target for HIV interventions, since they are inclined to have increased levels of risky sexual behaviour, and the internet itself may be a promising mechanism to deliver interventions (35). Like in our study where 89.6% owned a smart phone, another study showed that 95.6% of tertiary students in Kenya own smart phones(36), and use the phones to access the internet. Future YMSM-focused risk reduction interventions should leverage the internet to host campaigns and safe sex messaging efforts to directly and discreetly reach TSMSM who predominantly seek sex partners online. This is necessary since criminalization of homosexuality, societal stigma and discrimination, may cause TSMSM to be afraid of seeking services from programs that largely depend on physical locations, thus resulting in missed opportunities for HIV prevention options.

Another significant risk factor identified for HIV infection was having reported the last sex partner being >25 years. This is consistent with the findings of a study in the USA which showed that among YMSM, the odds of HIV infection were significantly elevated as the age of sex partners increased(37). This could be explained by the fact that risk of HIV infection generally increases with age, thus increasing the risk of HIV infection among YMSM who have sex with older male partners. In addition, practices that increase the risk of HIV infection such as CAS have been shown to be common in age-disparate sexual relationships among MSM, and are significantly associated with unrecognized HIV infection(38). Previous research has shown that YMSM are motivated to seek older MSM partners for economic and social support(39). Subsequently, the economic power imbalance between YMSM and older MSM may diminish the former's ability to negotiate for safer sex(40), with evidence suggesting that YMSM experience sexual coercion by older MSM(41). Since the YMSM – older MSM partnerships are more likely to persist than wane, HIV prevention programs for YMSM should include information about the HIV risk associated

with older MSM partners, and skills for negotiating for safer sex, particularly the correct and consistent use of condoms. Additionally, TSMSM should be provided with more tools for HIV prevention, including oral PrEP which is available in Kenya(42), and offers YMSM more control on usage as compared to condoms which need negotiation between sex partners. Since YMSM may choose more pleasurable condomless sex over safer sex, PrEP would offer them the opportunity to enjoy sex without fear of HIV infection, though with less regard for the paired risk of acquiring other STIs(43).

A notable independent risk factor for HIV infection that was observed in our study was testing positive for gonorrhea infection. This coupled with the high prevalence of chlamydia infection observed (58.7%) has implications for HIV control and prevention. The causal relationship between prevalent gonorrhea/chlamydia infection and incident HIV has previously been established, with these two STIs shown to increase both the risk of HIV acquisition and transmission(44). Among MSM, rectal gonorrhea/chlamydia re-infection has been associated with increased risk of HIV seroconversion(45), with modelling studies demonstrating that 10.4% of incident HIV infections are attributable to rectal and urethral gonorrhea/chlamydia infection(46). Even in the absence of symptoms, TSMSM should therefore be encouraged to have diagnostic STIs screening often, depending on sexual activity and risk-taking, and receive appropriate care. This would help mitigate the deleterious synergy between these STIs and HIV co-infections, as well as forestall morbidities such as infertility that may occur secondary to infection with these STIs.

Although not independently associated with HIV infection in our study, other behaviours that increase the risk of HIV infection were common. These include engaging in CAS, group sex, transactional sex, alcohol and drug use during sex, as well as having multiple sex partners. These findings are consistent with what has been observed among TSMSM in China(10) and South Africa(13). Behavioural change or modification efforts are therefore urgently needed in this population to augment the biomedical tools available for HIV prevention.

Though a recent RDS-based study in Kenya estimated the HIV burden and its correlates among the general MSM population in Kenya(5), to our knowledge, this study was the first one to assess HIV prevalence and associated risk factors among TSMSM in Kenya using the RDS method. These findings should be viewed in light of some limitations. Firstly, RDS is not a classical

probabilistic sampling method. To offset this limitation, when calculating our sample size, we applied a design effect of three to account for the clustering that occurs due to homophily and minimize the traditional bias associated with snowball sampling. We also excluded from analysis the six seeds who were purposely selected to start off recruitment. Secondly, since we asked about what happened in the past year, there was a possibility of recall bias. To mitigate this, we aimed to include in our questionnaire either single or multiple choice questions and have very few instances where participants needed to type out answers. We also limited the number of questions about events that happened more than 12 months before the study. Thirdly, we asked questions about sexual behaviour which may be affected by social desirability bias. To minimize this, participants self-administered the survey on an online platform accessed through tablet computers, since this has been shown to be more effective in offsetting this kind of bias, as compared to face-to-face interviews(47). Fourthly, the cross-sectional nature of the study limits causal inference of the independent risk factors identified for HIV infection. Finally, though we used a comprehensive set of variables in the logistic regression analysis, we cannot rule out the possibility of residual confounding from other variables such as experiences of stigma, discrimination and violence. Despite these limitations, this survey offers valuable lessons on the burden of HIV and associated risk factors among TSMSM, and hopefully portends the development of tailored interventions for the HIV response in this key yet understudied population.

3.5 Conclusion

HIV prevalence among TSMSM in Nairobi is six times higher than that of Kenyan young men from the general population of comparable age, prompting urgent efforts to develop bespoke HIV prevention and control interventions for this often marginalized key population. Such interventions should seek to enhance discreet HIV testing (including through HIV self-testing), as well as promote STIs screening and treatment. TSMSM should be provided with education messages on the potential risk of HIV infection in age-disparate relationships, and empowered to practice safer sex through use of both condoms and oral PrEP. Further, there is need for collaboration between tertiary institutions and relevant agencies of the ministry of health such as NASCOP, in providing HIV prevention and control services to TSMSM so as to avert new HIV infections in this population. Furthermore, given their widespread availability and use in Kenya, smartphones as a

means of accessing internet-based interventions privately on geospatial apps may be an innovative tool that could be harnessed for delivery of these interventions.

References

1. Global Burden of Disease 2019 HIV Collaborators. Global, regional, and national sex-specific burden and control of the HIV epidemic, 1990-2019, for 204 countries and territories: the Global Burden of Diseases Study 2019. Lancet HIV. 2021;8(10):e633–51.
2. National AIDS Control Council (NACC). The second Kenya AIDS strategic framework II, 2020/21, 2024/25 - sustain gains, bridge gaps and accelerate progress [Internet]. Nairobi: Government of Kenya. 2020 [cited 2021 Nov 11]. Available from: https://nacc.or.ke/wp-content/uploads/2021/01/KASFII_Web22.pdf.
3. Joint United Nations Programme on HIV/AIDS (UNAIDS). In Danger: UNAIDS Global AIDS Update 2022. Geneva, Switzerland: UNAIDS; 2022.
4. Hessou PHS, Glele-Ahanhanzo Y, Adekpedjou R, Ahouada C, Johnson RC, Boko M, et al. Comparison of the prevalence rates of HIV infection between men who have sex with men (MSM) and men in the general population in sub-Saharan Africa: a systematic review and meta-analysis. BMC Public Health. 2019;19(1):1634.
5. Smith AD, Kimani J, Kabuti R, Weatherburn P, Fearon E, Bourne A. HIV burden and correlates of infection among transfeminine people and cisgender men who have sex with men in Nairobi, Kenya: an observational study. Lancet HIV. 2021 May 1;8(5):e274–83.
6. National AIDS and STI Control Programme (NASCOP) Kenya. Preliminary Kenya Population-Based HIV Impact Assessment (KENPHIA) Report. Nairobi, Kenya: NASCOP; 2020.
7. Kenya National AIDS Control Council. Kenya HIV Prevention Response and Modes of Transmission Analysis Report. Nairobi, Kenya: NASCOP; 2009.
8. National AIDS and STI Control Programme (NASCOP) Kenya. National AIDS and STI Control Programme Organogram [Internet]. [cited 2022 Jul 9]. Available from: https://www.nascop.or.ke/organogram/.
9. Musyoki H, Bhattacharjee P, Sabin K, Ngoksin E, Wheeler T, Dallabetta G. A decade and beyond: learnings from HIV programming with underserved and marginalized key populations in Kenya. J Int AIDS Soc. 2021;24 (Suppl 3):e25729–e25729.

10. Fan S, Yang Z, Hou F, Yu M, Luo Z, Liao M, et al. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: A systematic review and meta-analysis. Sex Health. 2019;16(6):554–65.
11. Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV Prevalence and Related Factors: Higher Education Sector Study South Africa [Internet]. Johannesburg, South Africa; 2009.
12. Renn K. LGBTQ Students on Campus: Issues and Opportunities for Higher Education Leaders [Internet]. Higher Education Today. 2017 [cited 2021 Jun 10]. Available from: https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/.
13. Brink JG, Unit E, Africa S. Considerations for South African Higher Education: A National Student Men who Have Sex with Men Sexual Behavior Survey. South African J High Educ. 2017;31(4):184–207.
14. The Government of Kenya. Laws of Kenya Cap 63: The Penal Code. Kenya: Kenya Law; 1930.
15. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. J Int AIDS Soc. 2015;18(Suppl 1):19833.
16. Joint United Nations Programme on HIV/AIDS (UNAIDS). AIDS and the Sustainable Development Goals [Internet]. UNAIDS. [cited 2021 May 6]. Available from: https://www.unaids.org/en/AIDS_SDGs.
17. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal. 2021;9:619694.
18. Study in Kenya. Universities and Colleges in Nairobi County [Internet]. 2021 [cited 2022 Jun 24]. Available from: https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1
19. WHO, CDC, UNAIDS F 360. Biobehavioural Survey Guidelines for Populations at Risk for HIV. Geneva: World Health Organization. 2017.
20. Cochran WG. Sampling Techniques. 3rd ed. New York: John Wiley & Sons, Ltd; 1977.
21. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. “My Friends Would Believe My

Word": Appropriateness and Acceptability of Respondent-Driven Sampling in Recruiting Young Tertiary Student Men Who Have Sex with Men for HIV/STI Research in Nairobi, Kenya. Int J Environ Res Public Health. 2022;19(12):7331.

22. Respondent Driven Sampling [Internet]. [cited 2021 Sep 24]. Available from: http://www.respondentdrivensampling.org/
23. University of California San Francisco (UCSF). Integrated HIV Bio-behavioural Surveillance Toolbox [Internet]. [cited 2021 Sep 24]. Available from: https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox.
24. National AIDS and STI Control Programme (NASCOP) Kenya. Kenya HIV Testing Services Guidelines. Nairobi, Kenya; 2016 [cited 2022 Jan 11]. Available from: https://www.nascop.or.ke/hiv-testing-services/.
25. Handcock M, Fellows I, Gile K. RDS Analyst: Software for the Analysis of Respondent-Driven Sampling Data, Version 0.72 . [cited 2021 Oct 7]. Available from: http://wiki.stat.ucla.edu/hpmrg/index.php/RDS_Analyst_Install.
26. Gile KJ. Improved Inference for Respondent-Driven Sampling Data With Application to HIV Prevalence Estimation. J Am Stat Assoc. 2011 Mar 1;106(493):135–46.
27. UNAIDS (Joint United Nations Programme on HIV/AIDS). Recommended Population Size Estimates of Men who have Sex with Men. 2020 [cited 2021 Oct 7]. Available from: https://www.unaids.org/sites/default/files/media_asset/2020-recommended-population-size-estimates-of-men-who-have-sex-with-men_en.pdf.
28. Avery L, Rotondi N, McKnight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: Results from a simulation study. BMC Med Res Methodol. 2019;19(1):1–13.
29. Bekker L-G. HIV control in young key populations in Africa. Lancet Child Adolesc Heal. 2019 Jul 1;3(7):442–4.
30. UNAIDS (Joint United Nations Programme on HIV/AIDS). Fast-Track: Accelerating Action to End the AIDS Epidemic by 2030. Geneva, Switzerland: UNAIDS; 2014.
31. Mugo PM, Micheni M, Shangala J, Hussein MH, Graham SM, Rinke de Wit TF, et al. Uptake and Acceptability of Oral HIV Self-Testing among Community Pharmacy Clients

in Kenya: A Feasibility Study. PLoS One. 2017;12(1):e0170868.

32. Johnston LG, Soe P, Widihastuti AS, Camellia A, Putri TA, Rakhmat FF, et al. Alarmingly High HIV Prevalence Among Adolescent and Young Men Who have Sex with Men (MSM) in Urban Indonesia. AIDS Behav. 2021;25(11):3687–94.
33. Bhattacharjee P, Isac S, Musyoki H, Emmanuel F, Olango K, Kuria S, et al. HIV prevalence, testing and treatment among men who have sex with men through engagement in virtual sexual networks in Kenya: a cross-sectional bio-behavioural study. J Int AIDS Soc. 2020;23(S2):e25516.
34. Stahlman S, Grosso A, Ketende S, Mothopeng T, Taruberekera N, Nkonyana J, et al. Characteristics of men who have sex with men in southern Africa who seek sex Online: A cross-sectional study. J Med Internet Res. 2015;17(5):1–12.
35. Zou H, Fan S. 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. Arch Sex Behav. 2017;46(4):885–94.
36. Ojino R, Mich L. Mobile Applications in University Education: the case of Kenya. J E-Learning Knowl Soc. 2018 Feb 1;14(1):111–25.
37. Hurt CB, Matthews DD, Calabria MS, Green KA, Adimora AA, Golin CE, et al. Sex With Older Partners Is Associated With Primary HIV Infection Among Men Who Have Sex With Men in North Carolina. JAIDS J Acquir Immune Defic Syndr. 2010;54(2):185-190.
38. Ding Y, Zhou Y, Liu C, Liu X, He N. Sex with older partners, condomless anal sex and unrecognized HIV infection among Chinese men who have sex with men. AIDS Care. 2018;30(3):305–11.
39. Arrington-Sanders R, Leonard L, Brooks D, Celentano D, Ellen J. Older Partner Selection in Young African-American Men Who Have Sex With Men. J Adolesc Heal. 2013;52(6):682–8.
40. Anema A, Marshall BDL, Stevenson B, Gurm J, Montaner G, Small W, et al. Intergenerational Sex as a Risk Factor for HIV Among Young Men Who Have Sex with Men: A Scoping Review. Curr HIV/AIDS Rep. 2013;10(4):398–407.
41. Braun V, Schmidt J, Gavey N, Fenaughty J. Sexual Coercion Among Gay and Bisexual Men in Aotearoa/New Zealand. J Homosex. 2009;56(3):336–60.
42. AVAC (AIDS Vaccine Advocacy Coalition). PrEP Watch Kenya [Internet]. [cited 2022 Jan

18]. Available from: https://www.prepwatch.org/country/kenya/

43. Traeger MW, Cornelisse VJ, Asselin J, Price B, Roth NJ, Willcox J, et al. Association of HIV Preexposure Prophylaxis With Incidence of Sexually Transmitted Infections Among Individuals at High Risk of HIV Infection. JAMA. 2019;321(14):1380–90.

44. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Health. 1999;75:3–17.

45. Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. JAIDS J Acquir Immune Defic Syndr. 2010;53(4):537–43.

46. Jones J, Weiss K, Mermin J, Dietz P, Rosenberg ES, Gift TL, et al. Proportion of Incident HIV Cases among Men Who Have Sex with Men Attributable to Gonorrhea and Chlamydia: A Modeling Analysis. Sex Transm Dis. 2019;46(6):357–63.

47. Adebajo S, Obianwu O, Eluwa G, Vu L, Oginni A, Tun W, et al. Comparison of audio computer assisted self-interview and face-to-face interview methods in eliciting HIV-related risks among men who have sex with men and men who inject drugs in Nigeria. PLoS One. 2014;9(1):1–6.

Chapter 4: Prevalence of Five Curable STIs and Associated Risk Factors

Publication:

Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. Prevalence of five curable sexually transmitted infections and associated risk factors among tertiary student men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Sex Health. 2023;20(2):105–17. Available from: https://doi.org/10.1071/SH22114

Abstract

Background: Young gay, bisexual and other men who have sex with men (MSM), are a key population at high risk of sexually transmitted infections (STIs). We conducted a respondent-driven sampling (RDS) bio-behavioural survey to estimate the prevalence of five curable STIs, namely: chlamydia, gonorrhea, syphilis, trichomoniasis and *Mycoplasma genitalium* infection, and associated risk factors among tertiary student MSM (TSMSM) in Nairobi, Kenya.

Methods: Between February and March 2021, we recruited 248 TSMSM aged ≥18 years who self-reported engaging in anal and/or oral sex with another man in the past year. Samples collected included urine, anorectal and oropharyngeal swabs for pooled *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhea* and *Trichomonas vaginalis* testing using multiplex nucleic acid amplification tests, and venous blood for serological *Treponema pallidum* screening and confirmation of current infection. Participants completed an electronically self-administered behavioural survey on REDCap digital platform. Data analysis was done using RDS-Analyst (v0.72) and Stata (v15). Differences in proportions were examined using the chi-square (χ^2) test, and unweighted multivariate logistic regression was used to assess factors associated with STIs prevalence.

Results: Median age of participants was 21 years (interquartile range 20-22), with 96.3% aged ≤24 years. RDS-adjusted prevalence of at least one of the five STIs, chlamydia, gonorrhea, *Mycoplasma genitalium* infection, trichomoniasis and latent syphilis were 58.8%, 51.0%, 11.3%, 6.0%, 1.5% and 0.7%, respectively. Factors independently associated with STIs prevalence were inconsistent condom use (adjusted odds ratio [AOR] = 1.89, 95% confidence interval (CI): 1.03-3.47, p = 0.038) and the last sex partner being a regular partner (AOR = 2.35, 95% CI: 1.12-4.92, p = 0.023).

Conclusion: STIs prevalence among TSMSM in Nairobi is disturbingly high, and is associated with having a regular sex partner and inconsistent condom use. There is urgent need for tailored testing, treatment and prevention interventions for this population. Accurate, affordable and timely point of care tests for agents of STIs are required to optimize treatment and control. Interventions that increase condom use efficacy and offer risk reduction counseling are also requisite.

4.0 Introduction

Worldwide, compared to men in the general population, gay, bisexual and other men who have sex with men (collectively referred to as MSM) experience higher rates of sexually transmitted infections (STIs) such as chlamydia, gonorrhea and syphilis(1). Data from sub-Saharan African (SSA) countries have shown high prevalence of these and other STIs among MSM, including chlamydia in Tanzania – 7.5%(2) and Kenya – 26%(3); gonorrhea in Tanzania – 14.4%(2) and Kenya – 26%(3); syphilis in Malawi – 12.3%(4) and Uganda – 9%(5); *Mycoplasma genitalium* infection in Nigeria – 36.8%(6); and trichomoniasis in South Africa – 9%(7).

In terms of sexual behaviour, MSM may engage in both receptive and insertive anal and oral sex, making them susceptible to anorectal and oropharyngeal STIs besides the usual urogenital STIs. Unlike the urogenital STIs, extra-genital STIs are often asymptomatic and thus remain largely undiagnosed and untreated(8). The World Health Organization (WHO) recommends offering MSM periodic testing for asymptomatic STIs using serological tests for syphilis and nucleic acid amplification tests (NAATs) for chlamydia and gonorrhea(9). Whereas serological tests are affordable and easy to use, NAATs require expensive technology and personnel with technical training, and are thus not routinely used in SSA. As a result, management of STIs in most SSA countries including Kenya is largely syndromic(10), leading to asymptomatic cases being missed and inadequate management compounding elevated risk of acquisition and transmission of human immunodeficiency virus (HIV)(11), and future complications such as infertility(12). Simulation studies have shown that this sub-optimal treatment of STIs plays a significant role in HIV infection among young MSM (YMSM) aged 18-24 years(13). MSM infected with asymptomatic STIs may unknowingly infect sex partners thus spreading the infections. Further, commensal oropharyngeal *Neisseria spp.* may transfer genetic material to pathological oropharyngeal *Neisseria gonorrhea*, leading to the development of resistance to extended spectrum cephalosporins(14). Taken together, these factors make surveillance of STIs in in both urogenital and extra-genital anatomic sites

critical, especially among MSM at heightened risk of infection due to diverse sexual behaviours. Though more expensive than culturing of bacterial microorganisms, NAATs are currently the gold standard for detecting asymptomatic extra-genital bacterial STIs given their high sensitivity and specificity(15). Pooling samples from different anatomic sites from an individual and testing them together may be used to lower the cost of NAATs(16), and has been shown to perform as well as single-anatomic site testing for *Chlamydia trachomatis* and *Neisseria gonorrhea* among MSM in various settings(17–22).

At the onset of the developmental stage of emerging adulthood (18-25 years), in-school individuals transition from secondary to tertiary institutions(23). In tertiary institutions, most students find themselves in an environment with limited direct supervision of their behaviour, and increased freedom and opportunities to engage in behavioural risks such as casual sex(24). For tertiary student MSM (TSMSM), exposure to peers with similar sexual orientation and behaviour provides an environment with more socializing opportunities compared to their secondary school days(25). There is evidence to suggest that TSMSM may seek casual sex partners online, have sex more often, and engage in condomless sex, group sex and sex work(26). Moreover, TSMSM have been shown to have early sexual debuts, forced sex experiences, high sex partner turnover, concurrent sex partners, inconsistent condom use, and alcohol and drug use(27). As well, structural factors such as criminalization of homosexuality in Kenya, and societal stigma and discrimination towards individuals with same-sex sexual behaviour further limit healthcare engagement for TSMSM(28), making it difficult to access services for prevention, screening and treatment of STIs. In sum, these behavioural and structural factors increase the risk of STIs among TSMSM, making them an important population to focus on for STIs research. In Kenya, little is known about the prevalence of STIs and associated risk factors among YMSM, including TSMSM. As part of the effort to bridge this knowledge gap, the current study examined the prevalence of five curable STIs (chlamydia, gonorrhea, syphilis, trichomoniasis and *Mycoplasma genitalium* infection), and associated demographic, behavioural and contextual risk factors among TSMSM in Nairobi, Kenya.

4.1 Methods and materials

The study methods are detailed in the published study protocol(29), and summarized below:

4.1.1 Study design and setting

A cross-sectional bio-behavioural survey was conducted between February and March 2021, just after stringent COVID-19 prevention and control restrictions were eased in Kenya, and tertiary institutions resumed in-person learning. Nairobi, Kenya's capital, was selected due to its large population of tertiary students, with approximately 150 campuses of various universities, and technical and vocational education training institutions (TVETs) within its metropolis (30). These tertiary institutions are within a radius of approximately 25 kilometres (16 miles) from the Nairobi central business district. This area extends to the neighboring counties of Kiambu, Kajiado and Machakos as shown in **Figure 4.1**. The actual study was conducted in an office within the Nairobi central business district, where a similar study among the general MSM population had taken place in 2017.

4.1.2 Participants, sampling and recruitment

TSMSM were eligible to participate if they were willing and able to provide written informed consent for study participation, were aged ≥18 years, provided proof of registration as a student in a university or college in Nairobi, were assigned male sex at birth, and reported consensual receptive or insertive anal and/or oral sexual intercourse with another man in the last 12 months. The sample size was primarily calculated to estimate the prevalence of HIV among TSMSM, based on WHO 2017 guidelines for bio-behavioural surveys among populations at higher risk of HIV infection(31). Using the Cochran formula(32), a design effect of three to account for clustering, estimated HIV prevalence of 4.1% based on a previous study among TSMSM in South Africa(33), a level of precision of 0.05 and 10% non-response, we determined that a minimum sample size of 200 TSMSM would be required. The results of the primary objective of the study are reported elsewhere(34). Respondent-driven sampling (RDS) was used following findings from formative qualitative research which showed that this sampling method was appropriate and acceptable for recruiting TSMSM into HIV/STI research(35). From the TSMSM who took part in the formative research, six seeds were purposely selected based mainly on their self-reported personal network sizes and ability to recruit their peers. The seeds completed half a day training during which they were briefed on the purpose of the study, study procedures, eligibility criteria for prospective participants and types of incentives that would be offered. In addition, the seeds were offered a recruitment script which if needed would be used to inform their peers about the study. The self-administered questionnaire was also piloted among the seeds and any discrepancies noted such as

inconsistent skip patterns were corrected before the seeds recruited the first wave of participants. Upon completing the study procedures, each seed was issued three coupons to recruit their peers. A member of the study team used a prescribed form to screen prospective participants recruited by the seeds and subsequent participants. The screening involved checking the validity of the coupons (based on a unique code for each coupon linked to the seed starting off each recruitment chain), and fulfillment of the other set eligibility criteria. Upon completing the study procedures, each participant was briefed on how to recruit their peers into the study, issued three coupons and a recruitment script similar to the one issued to the seeds. Coupons were valid for a period of two weeks. Each seed and subsequent participant could recruit only a maximum of three peers into the study. Issuing of three coupons went on until the survey had recruited 120 participants (inclusive of seeds). Subsequently, two coupons were issued until the 150th participant, after which no more coupons were issued. The study remained open for recruitment for two weeks after the last coupons were issued, and closed with 248 TSMSM having participated. Each participant was reimbursed 1000 Kenyan shillings (equivalent to US$ 10 at that time) for their time and expenses related to transport to and from the study site, and 300 Kenyan shillings (equivalent to US$ 3) for every peer they recruited into the study. In addition, participants were offered condoms and water-based lubricants.

4.1.3 Data collection tools and procedures

The behavioural survey was conducted through self- administered interviews on tablets using a questionnaire set up on REDCap software (Vanderbilt University, TN, USA). The questionnaire was adapted from a validated questionnaire available from the integrated HIV bio-behavioural surveillance toolbox(36). The questionnaire contained questions on sociodemographic characteristics, sexual behaviour and other contextual characteristics (symptoms of STIs, use of geosocial networking applications and condom affordability and accessibility), and was administered in English, the language of instruction in Kenyan tertiary institutions. The self-administered questionnaire was piloted among the six seeds. This opportunity was used to address any discrepancies noted such as inconsistent skip patterns. Additionally, any text that was unclear was further simplified. During the survey, a member of the study team was present to assist participants who encountered any difficulties navigating the digital platform. This assistance was

limited to technical issues only, and did not extend to helping participants interpret or select responses on the questionnaire.

4.1.4 Biological specimen collection and testing

After completing the behavioural survey, participants were offered testing for HIV(34) and other STIs. Each participant provided approximately 3-4 ml of venous blood for serological syphilis testing using Rapid plasma reagin (RPR) test for screening and Treponema pallidum haemagglutination assay (TPHA) test for confirmation of current syphilis infection. Blood samples were collected by a clinician who had worked for other studies at the study office and was also specifically trained on the procedures for the current study. Additionally, each participant provided approximately 20-30ml of first void urine, one oropharyngeal, and one anorectal swab for testing for *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhea* and *Trichomonas vaginalis*. Participants self-collected the urine sample in a sterile jar after receiving instructions from the clinician. All oropharyngeal swabs were collected by the clinician. A majority (approximately three-quarters) of the anorectal swabs were collected by the clinician, while a quarter was self-collected by participants after receiving instructions from the clinician. The option of self-collecting the anorectal swab was offered to participants for privacy reasons. Oropharyngeal swabs were collected by swabbing the tonsils and the posterior pharynx using flocked swabs. Anorectal swabs were collected by inserting a flocked swab 3 cm into the anus and gently rotating for 5-10 seconds. Each swab was placed in a separate tube containing universal transport medium. Sample collection by the clinician was done in a private room within the study office with only the clinician and one participant present at the time of collection. Participants self-collected samples in a private washroom based at the study office. All samples were transported to the laboratory within 24 hours. Urine, oropharyngeal and anorectal samples from each individual were pooled within 24 hours. As per literature(21,37), the tubes containing the oropharyngeal and anorectal swabs were robustly shaken for 15 seconds, the swabs pressed firmly on the sides of the tube to get rid of fluid, and then discarded. Subsequently, 1ml of fluid from each of these tubes was mixed with 1 ml of urine in a sterile tube to make a volume of 3 ml. Samples were stored at 2-8 ºC as per the NAAT manufacturer's instructions and tested within 72 hours from collection. Deoxyribonucleic acid (DNA) extraction was done using the QIAamp® kit (Qiagen®, Germany) and DNA detection was done using multiplex real time polymerase chain reaction (PCR) test kit for *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhea*

and *Trichomonas vaginalis* (Sacace Biotechnologies®, Italy) on a Rotor-Gene Q (Qiagen®, Germany) thermocycler. Testing was done in a commercial laboratory within the Nairobi central business district (CA Medlynks Kenya Ltd. ISO 15189:2022 accredited).

4.1.5 Ethical considerations

Participants provided written informed consent before taking part in the study. The study protocol was reviewed and approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number: M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number: P990/12/2019). The study also received a letter of support from the Key Populations Program of the National AIDS and STI Control Program (NASCOP), Ministry of Health, Government of Kenya.

4.1.6 Data analysis

Data analysis excluded 6 seeds who were purposely selected to begin the RDS recruitment, and among whom the self-administered questionnaire was piloted. Weighted STIs prevalence with 95% confidence intervals (CI) were calculated using RDS-Analyst (RDS-A) software version 0.72(38). Weighting was done using Gile's successive sampler estimator, which takes to account the self-reported participant network size, recruitment patterns, and estimated size of the study population(39). We asked the following question to estimate a participant's network size: "How many TSMSM who study and live in Nairobi, who know you by name, and you know them by name, have you spoken to in the last four weeks/one month?" Due to the COVID-19 restrictions in place just before the survey, we added the following clarification: "By speaking we mean either talking face-to-face or communicating on the phone whether through calling, texting or voice notes". As per the Joint United Nations Programme on HIV/AIDS recommendations(40), an estimated population size of 8406 for TSMSM (1.45% of male tertiary students in the Nairobi metropolis) was used, with 95% CI and 1000 bootstraps.

Stata version 15 (College Station, TX: StataCorp LLC) was used for further analysis of the unweighted data. Some continuous variables such as age and self-reported number of sex partners were converted into binary categories and analyzed as such. Categorical variables were summarized using proportions, and differences in proportions examined using the chi-square ($\chi 2$) test. Multivariate logistic regression models were used to measure associations between various factors and STIs prevalence. Testing positive for at least one of the five STIs was used as the

primary outcome variable. All exposure variables with a p<0.1 in bivariate analysis and without missing values were included in the multivariate model. Unweighted regression models were used since they have been shown to perform better than weighted regression models for RDS data(41). Both adjusted odds ratio (AOR) and 95% CI were calculated for each exposure variable in the final model. All statistical tests were two-sided. Variables with p-value <0.05 were considered statistically significant.

4.2 Results

4.2.1 Sociodemographic, sexual behaviour and contextual characteristics of TSMSM

Six seeds recruited 242 participants in eight waves, resulting in a total of 248 TSMSM. The details of the recruitment networks are depicted in **Figure 4.1**. The characteristics of participants in total and by STIs status (proportion that tested positive for at least one of the five STIs in any of the assessed anatomic sites) are shown in **Table 4.1**. Median age was 21 years (interquartile range [IQR] 20-22), with 96.3% of participants aged ≤24 years. More than half (58.3%) attended university, close to three quarters (71.9%) were in public institutions, and four-fifths (79.3%) resided in hostels inside or outside their institutions, away from their families. A majority (89.3%) owned a smart phone at the time of the study, almost half (46.5%) had ever used a mobile phone geosocial networking application (app) for MSM such as Grindr® for finding a sex partner, and a third (33.6%) had met their last sex partner online. Sexual behaviours that may increase the risk of STIs at the urogenital, anorectal and oropharyngeal anatomic sites were also common among participants in the 12 months preceding the survey. Almost three-quarters (70.2%) had engaged in both receptive and insertive anal-penile intercourse, more than three-quarters (78.1%) had engaged in both receptive and insertive oral-penile intercourse and more than half (58.7%) had had engaged in both receptive and insertive oral-anal intercourse.

4.2.2 STIs prevalence, differences in proportions and associated factors

The unweighted and RDS-weighted prevalence of various STIs among study participants is shown in **Table 4.2**. In RDS-weighted estimates, more than half (58.8%, 95% CI: 50.4 – 67.3%) of study participants tested positive for at least one of the five STIs, with chlamydia (51.0%, 95% CI: 42.3-59.8%) followed by gonorrhea (11.3%, 95% CI: 6.1-16.5%) then *Mycoplasma genitalium* infection (6.0%, 95% CI: 2.6-9.4%) being the three most prevalent STIs. Co-infection with more than one STI was also observed with chlamydia/gonorrhea (5.7%, 95% CI: 2.7 – 8.7%) being the

most common type of co-infection, followed by chlamydia/*Mycoplasma genitalium* infection (4.5%, 95% CI: 2.3 – 6.7%) then gonorrhea/*Mycoplasma genitalium* infection and chlamydia/gonorrhea/*Mycoplasma genitalium* (both at 1.7%, 95% CI: 0.1 – 3.3%).

Table 4.1 also shows the results of bivariate analysis. These results revealed that STIs prevalence (testing positive for at least one of the five STIs) was statistically significantly higher among participants who used condoms inconsistently when having sex with a man during the 12 months preceding the survey (χ^2=6.30, p=0.012), who met their last sex partner online (χ^2 =3.86, p=0.049), whose last sex partner was a regular partner (χ^2=6.95, p=0.008), who tested positive for HIV at the time of the study (χ^2=4.01, p=0.045) and who had ever used a geosocial networking app for MSM to find a sex partner (χ^2=9.70, p=0.002).

The results of multivariate logistic regression analysis are shown in **Table 4.3**. As shown by the AOR, independent factors associated with testing positive for at least one of the five STIs were: inconsistent condom use when having sex with a man within the 12 months preceding the survey (AOR 1.89, 95% CI: 1.03-3.47, p=0.038) and the last sex partner being a regular partner (AOR=2.35, 95% CI: 1.12-4.92, p=0.023).

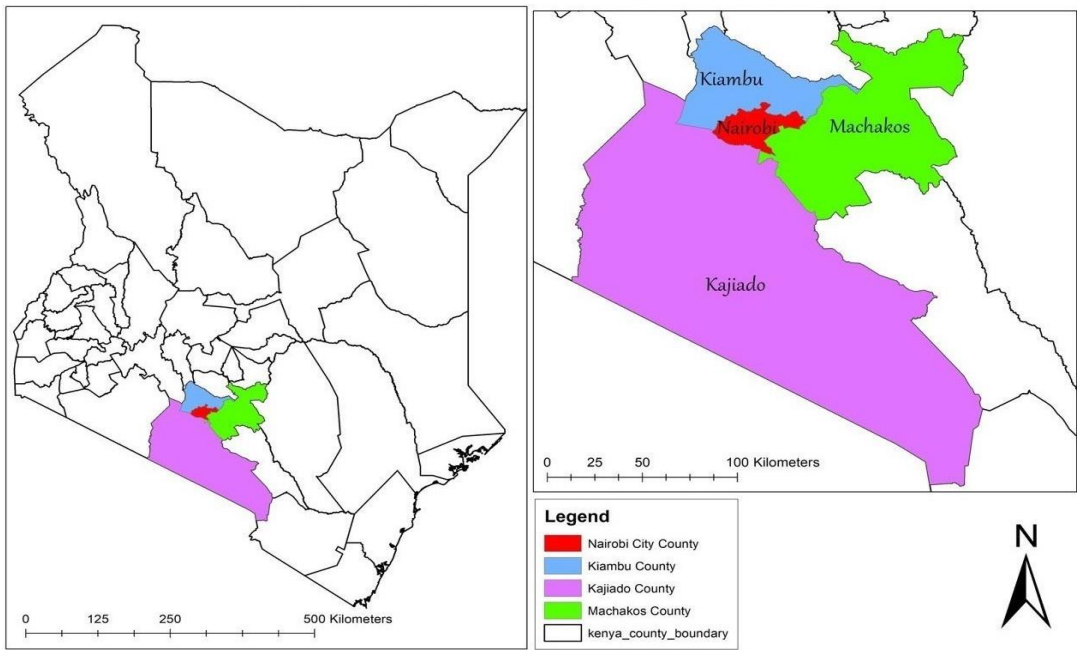


Figure 4.1: Map showing the study catchment area

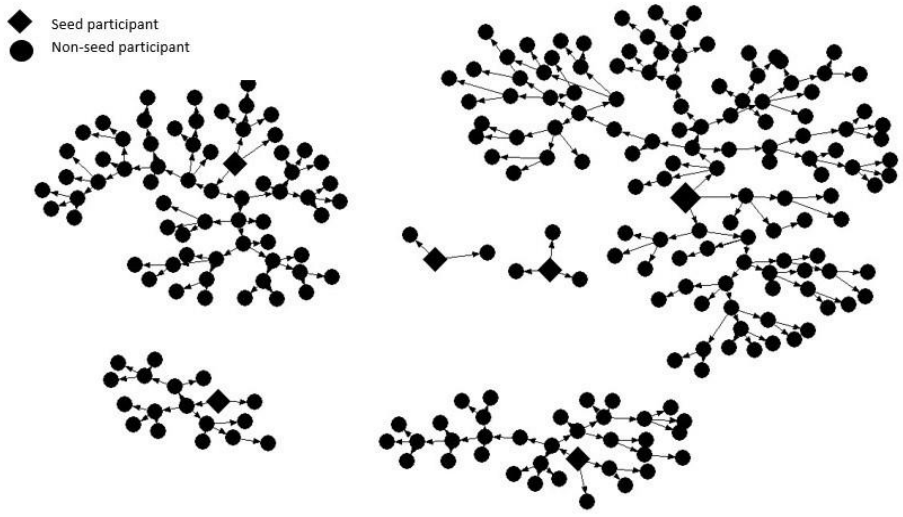


Figure 4.2: Recruitment networks of TSMSM in Nairobi, Kenya (N = 248)

Recruitment was initiated by six seeds who were issued with 418 coupons, 244 coupons were returned and out of these, 242 met the eligibility criteria for study participation and were subsequently enrolled into the study. The waves of recruitment per seed ranged from 1 to 8. Diamonds and circles indicate seed and non-seed participants, respectively.

Table 4.1: Sociodemographic, sexual behaviour and contextual characteristics of TSMSM in Nairobi, Kenya (N=242)

Variable	**Category**	**Total number (%)**	**Number STI positive (%)**	**Chi-square (χ^2)**	**p value**
Sociodemographic characteristics					
Age (years)	18-20	89 (36.8)	57 (64.0)	0.01	0.917
	21-30	153 (63.2)	99 (64.7)		
Gender identity	Cisgender male	219 (90.5)	139 (63.5)	0.99	0.320
	Transgender female	23 (9.5)	17 (74.0)		
Sexual orientation identity	Gay	153 (63.2)	102 (66.7)	2.16	0.339
	Bisexual	80 (33.1)	47 (58.8)		
	Heterosexual	9 (3.7)	7 (77.8)		
Institution attended	University	141 (58.3)	92 (65.2)	0.09	0.763
	College	101 (41.7)	64 (63.4)		
Ownership of institution attended	Public	174 (71.9)	111 (63.8)	0.12	0.728
	Private	68 (28.1)	45 (66.2)		
Type of course studied	Science, technology, engineering and mathematics	156 (64.5)	94 (60.3)	3.40	0.066
	Arts, business and humanities	86 (35.5)	62 (72.1)		
§Year of study at university/college	1st and 2nd year	153 (66.0)	102 (66.7)	0.80	0.372
	3rd and 4th year	79 (34)	48 (60.8)		
Residence	College/rented hostel	192 (79.3)	120 (62.5)	1.56	0.211
	With family	50 (20.7)	36 (72.0)		
Ever attended boarding school	Yes	203 (16.1)	131 (64.5)	<0.01	0.959
	No	39 (83.9)	25 (64.1)		
Main source of financial support	Parents/guardians	137 (56.6)	87 (63.5)	0.64	0.724
	Employment	65 (26.9)	41 (63.0)		
	Bursary/scholarship	40 (16.5)	28 (70.0)		
Had smartphone at time of the study	Yes	216 (89.3)	137 (63.4)	0.94	0.331
	No	26 (10.7)	19 (73.1)		
General sexual behaviour characteristics					
Ever had vaginal sex with a woman	Yes	130 (53.7)	77 (59.2)	3.36	0.067
	No	112 (46.3)	79 (70.5)		
Age at first anal sex with a man	<18 years	79 (32.9)	50 (63.3)	0.04	0.843
	≥ 18 years	161 (67.1)	104 (64.6)		
Sexual role at first anal sex with a man	Insertive	103 (42.8)	62 (60.2)	1.82	0.402
	Receptive	83 (34.4)	54 (65.1)		
	Versatile	55 (22.8)	39 (70.9)		
Nature of first anal sex with a man	Consensual	201 (83.4)	131 (65.2)	0.39	0.533
	Coerced/forced	40 (16.6)	24 (60.0)		
Preferred age of sex partner	Same/younger age	187 (77.6)	116 (62.0)	2.26	0.323
	Any age	36 (15.0)	27 (75.0)		
	Older	18 (7.4)	12 (66.7)		
Preferred sexual role	Insertive	117 (48.6)	68 (58.1)	4.08	0.130

	Versatile	75 (31.1)	54 (72.0)		
	Receptive	49 (20.3)	33 (67.4)		
Sexual behaviour characteristics with men during last 12 months					
Number of men had anal sex with	One (1)	69 (28.7)	40 (58.0)	1.70	0.193
	More than one (1)	172 (71.3)	115 (66.9)		
Participated in group sex	No	202 (83.8)	129 (63.9)	0.11	0.783
	Yes	39 (16.2)	26 (66.7)		
Had insertive anal intercourse	Yes	222 (92.1)	140 (63.1)	1.92	0.165
	No	19 (7.9)	15 (79.0)		
Had receptive anal intercourse	Yes	187 (77.6)	125 (66.8)	2.33	0.127
	No	54 (22.4)	30 (55.6)		
Had both insertive and receptive anal intercourse	Yes	170 (70.2)	44 (61.1)	0.50	0.478
	No	72 (29.8)	112 (65.9)		
Had insertive oral intercourse	Yes	220 (91.3)	142 (64.6)	0.06	0.809
	No	21 (8.7)	13 (61.9)		
Had receptive oral intercourse	Yes	197 (81.7)	131 (66.5)	2.24	0.135
	No	44 (18.3)	24 (54.6)		
Had both insertive and receptive oral intercourse	Yes	189 (78.1)	125 (66.1)	1.06	0.304
	No	53 (21.9)	31 (58.5)		
Had insertive oral-anal intercourse	Yes	158 (65.6)	102 (64.6)	0.01	0.914
	No	83 (34.4)	53 (63.9)		
Had receptive oral-anal intercourse	Yes	175 (72.6)	116 (66.3)	1.08	0.298
	No	66 (27.4)	39 (59.1)		
Had both insertive and receptive oral-anal intercourse	Yes	142 (58.7)	92 (64.8)	0.02	0.900
	No	100 (41.3)	64 (64.0)		
Always used a condom	Yes	74 (30.7)	39 (52.7)	6.30	0.012*
	No	167 (69.3)	116 (69.5)		
Gave money/goods/services to a sex partner	Yes	116 (51.9)	75 (64.7)	0.01	0.916
	No	125 (48.1)	80 (64.0)		
Received money/goods/services from a sex partner	Yes	141 (58.5)	93 (66.0)	0.40	0.527
	No	100 (41.5)	62 (62.0)		
Both gave and received money/goods/services to and from a male sex partner, respectively	Yes	109 (44.8)	73 (67.0)	0.55	0.460
	No	133 (55.2)	83 (62.4)		
Sexual behaviour characteristics with last sex partner					
Age of partner (years)	15 – 24	204 (84.7)	126 (61.8)	3.77	0.052
	≥25	37 (15.3)	29 (78.4)		
Where partner was met	Offline	160 (66.4)	96 (60.0)	3.86	0.049*
	Online	81 (33.6)	59 (72.8)		
Used condom	Yes	159 (65.7)	100 (62.9)	0.50	0.480
	No	83 (34.3)	56 (67.5)		
Gave money/goods/services to partner	Yes	25 (10.4)	16 (64.0)	<0.01	0.936
	No	216 (89.6)	140 (64.8)		
Received money/goods/services from partner	Yes	51 (21.2)	31 (60.8)	0.44	0.507
	No	190 (78.8)	125 (65.8)		
Had taken alcohol/other drug before sex	Yes	99 (40.9)	63 (63.6)	0.05	0.823
	No	143 (59.1)	93 (65.0)		
Type of partner	Regular	200 (83.0)	136 (68.0)	6.95	0.008*
	One time	41 (17.0)	19 (46.3)		
Contextual characteristics					
HIV serostatus					
HIV serostatus at time of study	HIV negative	222 (91.7)	139 (62.6)	4.01	0.045*
	HIV positive	20 (8.3)	17 (85.0)		
STI symptoms experienced during last 12 months					

Urethritis	Yes	39 (16.2)	25 (64.1)	<0.01	0.959
	No	203 (83.8)	131 (64.5)		
Anal discharge	Yes	20 (8.3)	15 (75.0)	1.06	0.304
	No	222 (91.7)	141 (63.5)		
Ulcer on or near penis or anus	Yes	29 (12.0)	19 (65.5)	0.02	0.885
	No	212 (88.0)	136 (64.2)		
Pre-exposure prophylaxis use					
Ever taken	Yes	27 (11.2)	20 (74.1)	1.23	0.268
	No	215 (88.8)	136 (63.3)		
Currently taking	Yes	14 (5.8)	11 (78.6)	1.30	0.256
	No	228 (94.2)	145 (63.6)		
Use of geosocial networking applications (apps) for MSM					
Ever used apps to find a sex partner	Yes	112 (46.5)	84 (75.0)	9.70	0.002*
	No	129 (53.5)	72 (55.8)		
Condoms					
Perceived affordability	Affordable	141(58.3)	97 (68.8)	2.77	0.096
	Not affordable	101(41.7)	59 (58.4)		
Perceived ease of getting condoms in campus	Easy	104 (43.0)	71 (68.3)	1.15	0.283
	Not easy	138 (57.0)	85 (61.6)		

[§]10 missing values, *Significant difference in proportions, STIs: sexually transmitted infections, TSMSM: tertiary student men who have sex with men

Table 4.2: Prevalence of STIs among TSMSM in Nairobi, Kenya (N=242)

STIs	**Unadjusted prevalence n (%)**	**RDS-adjusted prevalence % (95% CI)**
At least one STI	156 (64.5)	58.8 (50.4 – 67.3)
Chlamydia	142 (58.7)	51.0 (42.3-59.8)
Gonorrhea	36 (14.9)	11.3 (6.1-16.5)
Mycoplasma genitalium infection	25 (10.3)	6.0 (2.6-9.4)
Latent syphilis (RPR+ve and TPHA-ve)	5 (2.0)	0.7 (-0.1 – 1.5)
Trichomoniasis	3 (1.2)	1.5 (-0.3-3.3)
HIV	20 (8.3)	3.6 (1.3 - 6.0)
Co-infections		
At least one STI and HIV	17 (7.0)	2.9 (0.8-4.9)
Chlamydia and gonorrhea	26 (10.7)	5.7 (2.7 – 8.7)
Chlamydia and *Mycoplasma genitalium* infection	22 (9.1)	4.5 (2.3 – 6.7)
Mycoplasma genitalium infection and gonorrhea	8 (3.3)	1.7 (0.1 – 3.3)
Chlamydia, *Mycoplasma genitalium* infection and gonorrhea	8 (3.3)	1.7 (0.1 – 3.3)
Chlamydia, *Mycoplasma genitalium* infection, gonorrhea and trichomoniasis	0 (0.0)	0
Chlamydia, *Mycoplasma genitalium* infection, gonorrhea, trichomoniasis and latent syphilis	0 (0.0)	0

STI: sexually transmitted infection, TSMSM: tertiary student men who have sex with men, RPR: Rapid plasma reagin test for screening for syphilis antibodies, TPHA: Treponema pallidum haemagglutination assay for confirmation of current syphilis infection

Table 4.3: Multivariate logistic regression of factors associated with STIs among TSMSM in Nairobi, Kenya (N=240[§])

Variable	Category	Unadjusted odds ratios (95% CI)	p value	Adjusted odds ratio (95% CI)	p value
Type of course	Science, technology, engineering and mathematics	Ref	0.067	Ref	0.125
	Arts, business and humanities	1.70 (0.96-3.01)		1.60 (0.87-3.03)	
Ever had vaginal sex with a woman	Yes	Ref	0.068	Ref	0.448
	No	1.64 (0.96-2.81)		1.26 (0.70-2.26)	
Consistently used a condom when having sex with a man within last 12 months	Yes	Ref	0.013	Ref	0.038*
	No	2.04 (1.16-3.58)		1.89 (1.03-3.47)	
Age of last sex partner (years)	15 – 24	Ref	0.057	Ref	0.313
	≥25	2.24 (0.97-5.16)		1.60 (0.65-3.92)	
Where last sex partner was met	Offline	Ref	0.051	Ref	0.434
	Online	1.78 (0.99-3.20)		1.31 (0.67-2.58)	
Type of last sex partner	One time	Ref	0.010	Ref	0.023*
	Regular	2.46 (1.24-4.86)		2.35 (1.12-4.93)	
HIV serostatus at time of study	HIV negative	Ref	0.057	Ref	0.434
	HIV positive	3.38 (0.96-11.89)		1.71 (0.44-6.58)	
Ever used a geosocial networking app for MSM to seek sex partner	No	Ref	0.002	Ref	0.184
	Yes	2.38 (1.37-4.12)		1.55 (0.81-2.94)	
Perception of affordability of condoms	Not affordable	Ref	0.097	Ref	0.146
	Affordable	1.56 (0.92-2.67)		1.54 (0.86-2.76)	

STI: sexually transmitted infection, TSMSM: tertiary student men who have sex with men, [§] Number of observations without missing values, *Factors independently associated with STI prevalence ($p<0.05$)

4.3 Discussion

We aimed to estimate the prevalence of five curable STIs and associated risk factors among TSMSM in Nairobi, Kenya. We found that based on samples pooled from urogenital, anorectal and oropharyngeal anatomic sites, more than half (58.8%) of study participants had at least one of the five STIs, with the descending order of prevalence being chlamydia, gonorrhea, *Mycoplasma genitalium* infection, trichomoniasis and syphilis. In terms of co-infection, the combination of chlamydia/gonorrhea was the most common followed by chlamydia/*Mycoplasma genitalium* infection, and gonorrhea/*Mycoplasma genitalium* infection at the same rate as chlamydia/gonorrhea/*Mycoplasma genitalium* infection. Co-infection with at least one of the five STIs and HIV was at the rate of 2.9% (95% CI: 0.8-4.9%). Co-infection with multiple STIs has implications for public health and requires urgent addressing. Co-occurring STIs may translate to increased morbidity as a result of the multiple pathologies caused by the different agents of STIs. As well, since STIs biologically potentiate the transmission and acquisition of HIV, co-infection

with multiple STIs may further heighten the risk of HIV infection. Further, co-occurring STIs among HIV immune-comprised individuals may be difficult to treat and symptomatic periods may linger, leading to increased morbidity and decreased quality of life for these individuals. The high burden of STIs observed may necessitate the need for sentinel surveillance so as to determine trends in prevalence of STIs and evaluate the impact of programs that may be implemented between surveys. However, sentinel surveillance is resource-intensive and may not be feasible in resource-limited settings such as Kenya. Emphasis should thus be placed on prevention, early detection and treatment of STIs to reduce morbidity and the risk of HIV infection due to prevalent STIs.

The prevalence of chlamydia was almost double that observed among MSM in Coastal Kenya – 26%(3), and more than double that observed among YMSM in Vietnam – 22%(42). We found a prevalence of gonorrhea (11%) less than half that observed among MSM in Coastal Kenya – 26%(3) and similar to that seen among YMSM in Vietnam – 12%(42). Overall, the higher prevalence of chlamydia compared to gonorrhea in our study is consistent with evidence from systematic reviews that has shown that despite chlamydia and gonorrhea being the most prevalent STIs among MSM, chlamydia is more prevalent than gonorrhea(43), possibly due to chlamydia's longer duration of infection and higher transmissibility as compared to gonorrhea(44). For *Mycoplasma genitalium* infection and trichomoniasis, the observed prevalence was a sixth of that seen among MSM Nigeria – 37%(6) and South Africa – 9%(7), respectively. The observed prevalence of latent syphilis was seven times less than that found among TSMSM in China – 4.7%, where evidence suggests that the syphilis epidemic among TSMSM has been growing, and is fueled by a high prevalence of risky sexual behaviours(26).

The overall prevalence of STIs among TSMSM in our study was higher than that in the general population in Kenya, as shown by a study that found the prevalence of chlamydia, *Mycoplasma genitalium* infection, gonorrhea, trichomoniasis and at least one of the four aforementioned STIs was 16.8%, 28.6%, 7.1%, 7.1% and 49.5%, respectively(45). Therefore, while not neglecting the general population, there is need to focus more attention on the prevention and control of STIs among key populations such as MSM, including TSMSM. This approach may further foster benefits for the prevention and control of STIs in the general population, given that MSM who

also have sex with women (36.8% in our study) may also transmit STIs to women and these women in turn transmit to men in the general population, thus amplifying the HIV and STIs epidemics.

In the present study, inconsistent condom use and having a regular sex partner were independently associated with STIs prevalence. The inconsistent condom use observed in our study could have been due to problems with affordability and accessibility of condoms, with 41.7% and 57.0% of study participants finding condoms 'not affordable' and 'not easy' to access in campus, respectively. Inconsistent condom use has also been seen among TSMSM in China and YMSM in Sweden and New Zealand, and is attributed to having a regular sex partner and believing that condoms reduce sexual pleasure (46–48). Another study of YMSM in Hong Kong revealed that despite knowledge of the risk of condomless anal sex (CAS), socio-cultural norms and expectations relating to sexual positioning (insertive partner/top or receptive partner/bottom) contribute to inconsistent condom use, with CAS and condomless internal ejaculation considered a demonstration of intimacy and commitment(49). Interestingly, in our study, the last sex partner being a regular partner was a risk factor for STIs and this could be linked to reduced condom use with regular partners as revealed in the foregoing studies(46–48).

This study has several implications for future research and development of interventions in the response to STIs among YMSM, including TSMSM. Since condoms remain the leading STIs prevention tool, public health practitioners should ensure affordability, availability and accessibility of condoms for YMSM, including to those in tertiary learning institutions. Additionally, practitioners should aim to provide more compelling condom awareness, education and training so as to promote condom use among YMSM. Most importantly, to ensure condom use and effectiveness, interventions need to speak to perceptions of pleasure, relationships and sexual positioning issues that have been shown to negatively impact on consistent condom use, despite YMSM being aware of the risk of CAS. In the case of Kenya, further research is needed to ascertain whether the studded/dotted condoms routinely distributed by the government and popularized under the tag 'prevention with pleasure'(50), appeal to and meet the needs of YMSM, including TSMSM. Behaviours such as CAS that put MSM at risk of infection with STIs also put them at risk of HIV infection. Indeed, a 2019 modelling study among MSM in the USA showed that 10.4% of incident HIV infections were attributable to prevalent chlamydia and gonorrhea infections(51). Given the observed high prevalence of STIs in our sample, it is important to

reinforce the need for interventions such as oral pre-exposure prophylaxis (PrEP) to prevent new HIV infections among TSMSM. From our study sample, only a lower than ideal 11.2% and 5.8% had ever taken and were currently taking PrEP, respectively. Further research is required to understand the low use of PrEP in this population, despite PrEP being freely available in Kenya. However, we note that while the use of PrEP decreases the risk of HIV infection, there is evidence to suggest that it may also lead to a high incidence of STIs among MSM, as a result of additional risk compensation – sexual disinhibition leading to increased risky sexual behaviour such as CAS(52). Accordingly, since PrEP does not prevent other STIs, we thus recommend its use as part of a comprehensive sexual health package which should also include STIs screening and treatment, condom use promotion and risk reduction counseling.

Our findings revealed that 89.3% of our study participants owned a smart phone at the time of the survey. This finding is consistent with previous work which demonstrated that 95% of Kenyan tertiary students own a smart phone, and are regular and savvy users of the internet(53). In addition, almost half (46.5%) of our study participants had used a geosocial networking mobile phone application for MSM (such as Grindr) to find a sex partner, and a third (33.6%) had met their last sex partner online. As such, online platforms could potentially be used for reaching TSMSM with interventions that promote and provide STIs testing, treatment and prevention services. A systematic review conducted in 2017 showed that online interventions have the potential to address STIs among YMSM(54), and such interventions have also been recommended by others following a study which found that most MSM in Kenya and South Africa regularly socialize online(55). Online interventions are particularly recommended due to their private and discreet nature, that may enable TSMSM bypass some of the barriers they encounter while seeking services in physical health facilities, especially the experiences of stigma and discrimination by healthcare providers(28,56). Indeed, a consortium of universities within the Nairobi metropolis has developed and deployed for use, a mobile phone app called RADA [“be alert” in slang](57). Among other things, the app provides information on sexual and reproductive health matters to tertiary students, but its design and content is largely heteronormative. Considerations should therefore be made for the development of an app that suits and meets the needs of TSMSM. This could be achieved through collaboration with, and support from various stakeholders, including researchers, policy makers, practitioners, funders, and TSMSM as the eventual app users.

To our knowledge, our study is the first one to investigate the prevalence and associated risk factors of five curable STIs among TSMSM in Kenya using the RDS method. Besides the traditional STIs (chlamydia, gonorrhea and syphilis), we also investigated two emerging STIs (*Mycoplasma genitalium* infection and trichomoniasis) that are key for MSM. Pooling of samples from the three anatomic sites offered us a cost-effective way to detect extra-genital agents of STIs that would otherwise be undetected due to their usually asymptomatic nature(8). Nevertheless, even with the pooling of samples, detection of agents of STIs using NAATs is still costly and not routinely available in resource-limited settings such as Kenya. In the absence of NAATs, treatment of STIs in SSA is likely to continue being syndromic. For MSM, quarterly screening that includes physical examination for urogenital, anorectal and oropharyngeal STIs, and assessment of risky sexual behaviours, can complement the syndromic management of STIs. To further support early diagnosis and hence appropriate treatment of STIs, we suggest that policy makers and providers consider the use of accurate, affordable and timely point of care tests for STIs among MSM(58).

Our findings should be viewed in light of some limitations. RDS is a peer-referral probability-based sampling method that is susceptible to underestimation or overestimation of study outcomes. To offset this limitation, when calculating our sample size, we applied a design effect of three to account for the clustering that occurs due to homophily and minimize the traditional bias associated with snowball sampling, and used RDS-weighted analysis to estimate the prevalence of various STIs. To minimize the effect of seed selection bias, we excluded from analysis the six seeds who were purposely selected to start off recruitment. Since we asked about past life events and experiences, there was a possibility of recall bias. To mitigate this, most of our questions focused on events and experiences that occurred within 12 months before the study, with only a few questions focusing on periods longer than 12 months. In addition, we asked questions about sexual behaviour which may be affected by social desirability bias. To minimize this, participants privately self-administered the behavioural survey questionnaire on a tablet computer as this has been shown to be more effective in offsetting this kind of bias, compared to face-to-face interviews(59). Approximately three-quarters of anorectal samples were collected by the clinician and the other quarter by participants after they received instructions from the clinician. This could potentially lead to variability in the test results of the various STIs. However, evidence suggests that when participants are given and are able to follow clear instructions on self-collection of anorectal samples, clinician-collected and self-collected samples yield concordant results(60). The

cross-sectional nature of the study limits inference about the direction of causality. However, the factors we identified to be associated with STIs prevalence are plausibly causal based on findings from previous studies(46–48). Finally, though we used a comprehensive set of variables in the logistic regression analysis, we cannot rule out the possibility of residual confounding from other variables that were not assessed such as experiences of stigma, discrimination and violence. Despite these limitations, this study offers valuable lessons on the burden of five curable STIs and associated risk factors among TSMSM, and hopefully will be useful in informing further research, and development of interventions for the prevention and control of STIs in this key but understudied population, both in Kenya and other similar settings.

4.4 Conclusion

We found a high prevalence of STIs among TSMSM that was associated with inconsistent condom use and regular sex partners. Accordingly, tailored interventions for testing, treatment and prevention of STIs are urgently called for in this population. Particularly, accurate, affordable and timely point of care tests for agents of STIs are required to optimize treatment and control. Given the high prevalence of STIs observed and their plausible association with incident HIV infection, there is need to implement modern HIV prevention interventions such as PrEP in this population. Further, interventions that increase condom use efficacy and offer risk reduction counseling are requisite, with online platforms being a potential avenue for the delivery of such interventions.

References

1. World Health Organization (WHO). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Geneva, Switzerland: WHO; 2021.
2. Ross MW, Nyoni J, Ahaneku HO, Mbwambo J, McClelland RS, McCurdy SA. High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania. BMJ Open. 2014;4(8):e006175.
3. Sanders EJ, Thiong AN, Okuku HS, Mwambi J, Priddy F, Shafi J, et al. High prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae infections among HIV-1 negative men who have sex with men in coastal Kenya. Sex Transm Infect. 2010;86:440–1.
4. Wirtz AL, Trapence G, Kamba D, Gama V, Chalera R, Jumbe V, et al. Geographical disparities in HIV prevalence and care among men who have sex with men in Malawi: results from a multisite cross-sectional survey. Lancet HIV. 2017;3018(17):30042–5.

5. Kim EJ, Hladik W, Barker J, Lubwama G, Sendagala S, Ssenkusu JM, et al. Sexually transmitted infections associated with alcohol use and HIV infection among men who have sex with men in Kampala, Uganda. Sex Transm Infect. 2016;92(3):240–5.
6. Crowell TA, Lawlor J, Lombardi K, Nowak RG, Hardick J, Odeyemi S, et al. Anorectal and Urogenital Mycoplasma genitalium in Nigerian Men Who Have Sex with Men and Transgender Women: Prevalence, Incidence, and Association with HIV. Sex Transm Dis. 2020;47(3):202–6.
7. Hoffman CM, Fritz L, Radebe O, Dubbink JH, Mcintyre JA, Kock MM, et al. Rectal Trichomonas vaginalis infection in South African men who have sex with men. Int J STD AIDS. 2018;29(14):1445–7.
8. Dudareva-Vizule S, Haar K, Sailer A, Wisplinghoff H, Wisplinghoff F, Marcus U, et al. Prevalence of pharyngeal and rectal Chlamydia trachomatis and Neisseria gonorrhoeae infections among men who have sex with men in Germany. Sex Transm Infect. 2014;90(1):46–51.
9. World Health Organization. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people. Geneva, Switzerland: World Health Organization; 2011.
10. National AIDS and STI Control Programme (NASCOP). Kenya National Guidelines for Prevention, Management and Control of Sexually Transmitted Infections. Nairobi, Kenya; 2018.
11. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Health. 1999;75:3–17.
12. Aral SO. Sexually transmitted diseases: magnitude, determinants and consequences. Int J STD AIDS. 2001;12(4):211–5.
13. Beck EC, Birkett M, Armbruster B, Mustanski B. A Data-Driven Simulation of HIV Spread Among Young Men Who Have Sex With Men: Role of Age and Race Mixing and STIs. JAIDS J Acquir Immune Defic Syndr. 2015;70(2):186-194.
14. Lewis DA. Will targeting oropharyngeal gonorrhoea delay the further emergence of drug-resistant Neisseria gonorrhoeae strains? Sex Transm Infect. 2015;(91):234–7.
15. Barbara VDP, Max C, A. GC, W. HE, M. JA, Katherine C, et al. Multicenter Comparison

of Nucleic Acid Amplification Tests for the Diagnosis of Rectal and Oropharyngeal Chlamydia trachomatis and Neisseria gonorrhoeae Infections. J Clin Microbiol. 2022;60(1):e01363-21.

16. Aboud L, Xu Y, Chow EPF, Wi T, Baggaley R, Mello MB, et al. Diagnostic accuracy of pooling urine, anorectal, and oropharyngeal specimens for the detection of Chlamydia trachomatis and Neisseria gonorrhoeae: a systematic review and meta-analysis. BMC Med. 2021;19(1):285.
17. Sultan B, White JA, Fish R, Carrick G, Brima N, Copas A, et al. The "3 in 1" Study: Pooling Self-Taken Pharyngeal, Urethral, and Rectal Samples into a Single Sample for Analysis for Detection of Neisseria gonorrhoeae and Chlamydia trachomatis in Men Who Have Sex with Men. J Clin Microbiol. 2016;54(3):650–6.
18. Speers DJ, Chua IJ, Manuel J, Marshall L. Detection of Neisseria gonorrhoeae and Chlamydia trachomatis from pooled rectal, pharyngeal and urine specimens in men who have sex with men. Sex Transm Infect. 2018;94:293–7.
19. Thielemans E, Wyndham-Thomas C, Henrard S, De Vleeschouwer A, Steensels D, Montesinos I, et al. Screening for Chlamydia trachomatis and Neisseria gonorrhoeae Infections in Men Who Have Sex With Men: Diagnostic Accuracy of Nucleic Acid Amplification Test on Pooled Urine, Anorectal, and Pharyngeal Specimens. Sex Transm Dis. 2018;45(3):195-198.
20. De Baetselier I, Osbak KK, Smet H, Kenyon CR, Crucitti T. Take three, test one: a cross-sectional study to evaluate the molecular detection of Chlamydia trachomatis and Neisseria gonorrhoeae in pooled pharyngeal, anorectal and urine samples versus single-site testing among men who have sex with men in Belgium. Acta Clin Belg. 2020;75(2):91–5.
21. Duygu D, H. RTR, S. BC, K. FC, A. WD, Vesna DP, et al. Pooling Pharyngeal, Anorectal, and Urogenital Samples for Screening Asymptomatic Men Who Have Sex with Men for Chlamydia trachomatis and Neisseria gonorrhoeae. J Clin Microbiol. 2020;58(5):e01969-19.
22. Almeria J, Pham J, Paris KS, Heskett KM, Romyco I, Bristow CC. Pooled 3-Anatomic-Site Testing for Chlamydia trachomatis and Neisseria gonorrhoeae: A Systematic Review and Meta-Analysis. Sex Transm Dis. 2021;48(12):e215-e222.
23. Arnett JJ. Emerging Adulthood: A Theory of Development From the Late Teens Through

the Twenties. Am Psychol. 2000;55(5):469–80.

24. Fromme K, Corbin WR, Kruse MI. Behavioural Risks During the Transition From High School to College. Dev Psychol. 2008;44(5):1497–504.
25. Renn K. LGBTQ Students on Campus: Issues and Opportunities for Higher Education Leaders [Internet]. Higher Education Today. 2017 [cited 2021 Jun 10]. Available from: https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/
26. Fan S, Yang Z, Hou F, Yu M, Luo Z, Liao M, et al. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: A systematic review and meta-analysis. Sex Health. 2019;16(6):554–65.
27. Brink JG, Unit E, Africa S. Considerations for South African Higher Education: A National Student Men who Have Sex with Men Sexual Behaviour Survey. South African J High Educ. 2017;31(4):184–207.
28. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. Res Sq [Internet]. 2022;v1. Available from: https://www.researchsquare.com/article/rs-1994768/v1
29. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioural Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal. 2021;9:619694.
30. Study in Kenya. Universities and Colleges in Nairobi County [Internet]. 2021 [cited 2022 Jun 24]. Available from: https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1
31. WHO, CDC, UNAIDS F 360. Biobehavioural Survey Guidelines for Populations at Risk for HIV. Geneva: World Health Organization. 2017.
32. Cochran WG. Sampling Techniques. 3rd ed. New York: John Wiley & Sons, Ltd; 1977.
33. Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV Prevalence and Related Factors: Higher Education Sector Study South Africa. Johannesburg, South Africa; 2009.
34. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi,

Kenya: a respondent-driven sampling survey. AIDS Res Ther. 2023;20:7.

35. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "My Friends Would Believe My Word": Appropriateness and Acceptability of Respondent-Driven Sampling in Recruiting Young Tertiary Student Men Who Have Sex with Men for HIV/STI Research in Nairobi, Kenya. Int J Environ Res Public Health. 2022;19(12):7331.
36. University of California San Francisco (UCSF). Integrated HIV Bio-behavioural Surveillance Toolbox [Internet]. [cited 2021 Sep 24]. Available from: https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioural-surveillance-toolbox
37. Dean JA, Bell SFE, Coffey L, Debattista J, Badman S, Redmond AM, et al. Improved sensitivity from pooled urine, pharyngeal and rectal specimens when using a molecular assay for the detection of chlamydia and gonorrhoea near point of care. Sex Transm Infect. 2021;97(6):471-2.
38. Handcock M, Fellows I, Gile K. RDS Analyst: Software for the Analysis of Respondent-Driven Sampling Data, Version 0.72 [Internet]. [cited 2021 Oct 7]. Available from: http://wiki.stat.ucla.edu/hpmrg/index.php/RDS_Analyst_Install
39. Gile KJ. Improved Inference for Respondent-Driven Sampling Data With Application to HIV Prevalence Estimation. J Am Stat Assoc. 2011;106(493):135–46.
40. UNAIDS (Joint United Nations Programme on HIV/AIDS). Recommended Population Size Estimates of Men who have Sex with Men [Internet]. 2020 [cited 2021 Oct 7]. Available from:https://www.unaids.org/sites/default/files/media_asset/2020-recommended-population-size-estimates-of-men-who-have-sex-with-men_en.pdf
41. Avery L, Rotondi N, McKnight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: Results from a simulation study. BMC Med Res Methodol. 2019;19(1):1–13.
42. Adamson PC, Bhatia R, Tran KDC, Bui HTM, Vu D, Shiraishi RW, et al. Prevalence, anatomic distribution, and correlates of Chlamydia trachomatis and Neisseria gonorrhoeae infections among a cohort of men who have sex with men in Hanoi, Vietnam. Sex Transm Dis. 2022;49(7):504-510.
43. Dewart CM, Bernstein KT, DeGroote NP, Romaguera R, Turner AN. Prevalence of Rectal

Chlamydial and Gonococcal Infections: A Systematic Review. Sex Transm Dis. 2018;45(5):287–93.

44. Chow EPF, Camilleri S, Ward C, Huffam S, Chen MY, Bradshaw CS, et al. Duration of gonorrhoea and chlamydia infection at the pharynx and rectum among men who have sex with men: a systematic review. Sex Health. 2016;13(3):199–204.
45. Maina AN, Mureithi MW, Ndemi JK, Revathi G. Diagnostic accuracy of the syndromic management of four STIs among individuals seeking treatment at a health centre in Nairobi, Kenya: a cross-sectional study. PAMJ. 2021;40(138).
46. Wang H, Yu S, Cross W, Lam L, Banik B, Zhang K. Condom use consistency and associated factors among college student men who have sex with men from seven colleges in changsha city: A cross-sectional survey. HIV/AIDS - Res Palliat Care. 2021;13:557–69.
47. Johansson K, Persson KI, Deogan C, El-Khatib Z. Factors associated with condom use and HIV testing among young men who have sex with men: A cross-sectional survey in a random online sample in Sweden. Sex Transm Infect. 2018;94(6):427–33.
48. Lachowsky NJ, Saxton PJW, Hughes AJ, Dickson NP, Summerlee AJS, Milhausen RR, et al. Younger gay and bisexual men's condom use with main regular sexual partner in New Zealand. AIDS Educ Prev. 2015;27(3):257–74.
49. Yeo TED, Fung TH. Between '0' and '1': safer sex and condom use among young gay men in Hong Kong. Cult Heal Sex. 2016;18(3):294–307.
50. Kilonzo E. Kenya set for free studded condoms ahead of Valentine's Day. Nation Africa [Internet]. 2017 Feb 13; Available from: https://nation.africa/kenya/news/Kenya-free-studded-condoms-Valentine-s-Day-HII-Aids/1056-3810724-la49guz/index.html
51. Jones J, Weiss K, Mermin J, Dietz P, Rosenberg ES, Gift TL, et al. Proportion of Incident HIV Cases among Men Who Have Sex with Men Attributable to Gonorrhea and Chlamydia: A Modeling Analysis. Sex Transm Dis. 2019;46(6):357–63.
52. Scott HM, Klausner JD. Sexually transmitted infections and pre-exposure prophylaxis: challenges and opportunities among men who have sex with men in the US. AIDS Res Ther. 2016;13(5).
53. Ojino R, Mich L. Mobile Applications in University Education: the case of Kenya. J E-Learning Knowl Soc. 2018;14(1):111–25.
54. Knight R, Karamouzian M, Salway T, Gilbert M, Shoveller J. Online interventions to

address HIV and other sexually transmitted and blood-borne infections among young gay, bisexual and other men who have sex with men: a systematic review. J Int AIDS Soc. 2017;20(3):e25017.

55. Fearon E, Bourne A, Tenza S, Palanee-Phillips T, Kabuti R, Weatherburn P, et al. Online socializing among men who have sex with men and transgender people in Nairobi and Johannesburg and implications for public health-related research and health promotion: an analysis of qualitative and respondent-driven sampling survey data. J Int AIDS Soc. 2020;23(S6):e25603.
56. Bowen D, Jabson J, Kamen C. mHealth: an avenue for promoting health among sexual and gender minority populations? mHealth. 2016;2(36).
57. Google Play. Rada University of Nairobi [Internet]. [cited 2022 May 11]. Available from: https://play.google.com/store/apps/details?id=com.radauon.radauon2&hl=en&gl=US
58. Unemo M. Accurate, rapid, point-of-care tests for sexually transmitted infections. Lancet Infect Dis. 2021;5:584–6.
59. Adebajo S, Obianwu O, Eluwa G, Vu L, Oginni A, Tun W, et al. Comparison of audio computer assisted self-interview and face-to-face interview methods in eliciting HIV-related risks among men who have sex with men and men who inject drugs in Nigeria. PLoS One. 2014;9(1):1–6.
60. Helm JJ, Hoebe CJPA, Rooijen MS, Brouwers EEHG, Fennema HSA, Thiesbrummel HFJ, et al. High Performance and Acceptability of Self-Collected Rectal Swabs for Diagnosis of Chlamydia trachomatis and Neisseria gonorrhoeae in Men Who Have Sex With Men and Women. Sex Transm Dis. 2009;36(8):493–7.

Chapter 5: Healthcare Engagement among TSMSM

Manuscript under review:

Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. Res Sq [Internet]. 2022.

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Abstract

Background: Young gay, bisexual and other men who have sex with men (YMSM) experience a disproportionate burden of disease compared to young men in the general population and older MSM. However, YMSM experience major inequities in access and use of healthcare services. There is a paucity of knowledge on the healthcare engagement experiences of YMSM, including tertiary student MSM (TSMSM) in Kenya. We sought to gain a detailed understanding of TSMSM's healthcare engagement experiences across public, private, institution-based and MSM-friendly health facilities in Nairobi, Kenya.

Methods: In September 2021, in-person qualitative in-depths interviews were conducted among 22 TSMSM purposely drawn from among 248 TSMSM who had previously participated in a respondent-driven sampling integrated bio-behavioural survey. Interviews were done in English, transcribed verbatim and analyzed thematically using NVivo version 12.

Results: Participants were 18 – 24 years old, all identified as cisgender male, three-quarters as gay and a quarter as bisexual. Themes that emerged from the analysis included: TSMSM's experiences during healthcare seeking in the various clinical settings, priority healthcare needs, desired healthcare provider (HCP) characteristics and the potential role of digital health interventions in improving access and use of healthcare services. Participants relayed experiences of prejudice, stigma and discrimination when seeking services in public and institution-based health facilities, unlike in community pharmacies, private and MSM-friendly health facilities where they felt they were handled equitably. Healthcare needs prioritized by TSMSM centered on issues around sexual and mental health. Participants desired to have HCPs who were empathetic, non-judgmental and knowledgeable about the unique healthcare needs of MSM. Participants highlighted the usefulness

of digital media in offering telehealth doctor consultations and health education on subjects such as prevention of HIV and sexually transmitted infections.

Conclusion: During engagement with healthcare, TSMSM experience various barriers that may prompt them to postpone or avoid seeking care, resulting in poor health outcomes. These findings underscore the need for equipping HCPs with knowledge, skills and cultural competencies to enable them offer equitable and quality services to TSMSM. Considerations should also be made for use of digital interventions in reaching TSMSM with the much needed sexual and mental health services.

5.0 Introduction

Globally, gay, bisexual and other men who have sex with men (referred to here as MSM) experience a disproportionate burden of disease compared to men in the general population. These include but are not limited to: human immuno-deficiency virus (HIV)(1), sexually transmitted infections (STIs)(2) and mental health issues such as anxiety, depression, suicidal ideation and substance abuse(3). Among MSM, the subgroup of young MSM (YMSM) aged 18-24 years, experience comparatively higher disease burdens than young men in the general population and older MSM(4). Despite the clear need for reliable services, major inequities persist in access to HIV/STIs prevention, care, and treatment(5), and mental health(6) services for MSM, with YMSM reporting significantly lower levels of access to MSM-focused HIV prevention programs, low-cost STI testing and treatment, and mental health services(7). Healthcare-related stigma and discrimination are major drivers of these disparities(8), especially in countries such as Kenya where same-sex sexual relations between men are criminalized(9), and MSM are at increased risk of experiencing violence from the community(10).

Sexual stigma which is defined as negative regard, inferior status, and relative powerlessness that society collectively accords to any non-heterosexual behaviour, identity, relationship, or community(11), may contribute to health disparities for MSM. Fear of judgment, condescension and other expressions of condemnation from HCPs resulting from sexual stigma, are known to deter YMSM from actively and consistently seeking services(12). Additionally, YMSM who do not feel comfortable disclosing their sexual practices to a HCP for fear of stigmatization are less motivated to seek healthcare services especially if they feel that they must hide or otherwise disguise some part of their sexual orientation, identity and/or behaviour during encounters with

HCPs(13). Discrimination, which is closely related to stigma, is the practice of treating a particular group in a society less fairly than others(14), worsens these health inequities. A global survey of YMSM found that discrimination by HCPs deterred YMSM from seeking HIV/STIs testing, counseling and treatment(15). Results from a study at a South African university indicated that student MSM try to avert stigma and discrimination by hiding their true sexual orientation and behaviour(16). Failure to disclose same-sex sexual behaviour makes it difficult for TSMSM to find sex partners leading to sharing of sex partners from the small group of people who are out about their sexual orientation and behaviour, engaging in condomless sex with casual sex partners and having concurrent multiple sex partners(16) – factors which increase the risk of infection with HIV/STIs.

Disregarding the health of YMSM can lead to long-term health disparities, which consequently increases pressure on healthcare systems, such as costs of HIV/STIs care or managing mental health issues(17). For instance, our previous work found high prevalence of HIV(18) and STIs(19) among TSMSM in Nairobi, Kenya, indicating an urgent need for concerted efforts to address these conditions and other health challenges in this young population, so as to help prevent long-standing deleterious effects on their health status. The Nairobi metropolis has an abundance of public and private health facilities(20), community pharmacies(21), and a few non-governmental/community-based MSM–friendly health facilities(22) where MSM can seek care when needed. Besides, various tertiary institutions within the metropolis have health facilities that offer care to their student population(23–25). Although awareness and knowledge exists on the experiences and challenges in accessing sexual health service among the general MSM population in Kenya(26), the experiences of YMSM, including TSMSM with healthcare engagement from the wide array of the healthcare service providers is less documented in scientific literature. We sought to address this gap in literature by conducting a qualitative study with TSMSM to understand their healthcare engagement experiences with services offered across public, private, institution-based and MSM-friendly health facilities in Nairobi, Kenya.

5.1 Methods and materials

Study methods are detailed in the published study protocol(27), and summarized below:

5.1.2 Study design and setting

This was a qualitative study in which data was collected through in-depth in person qualitative interviews with TSMSM. Data collection and analysis was guided by the Andersen's behavioural model of health services use(28), with modifications for vulnerable populations(29). Specifically, we looked at the construct of characteristics of the population at risk, that takes into account the predisposing, enabling and need factors that determine healthcare engagement. The study was conducted in Nairobi, the capital city of Kenya and home to approximately 150 campuses of various universities and mid-level colleges(30), some of which have health facilities that serve their student population(23–25). The Nairobi metropolis also hosts more than 1,000 legally registered public and private health facilities(20), approximately five recognized non-governmental/community-based MSM-friendly clinics(22), as well as several community pharmacies(21).

5.1.2 Participants, sampling and recruitment

TSMSM (n=22) were selected from a larger sample (n=248) that had previously taken part in a quantitative respondent-driven sampling (RDS)-based HIV/STIs integrated bio-behavioural survey, whose details are described elsewhere(18,19,27,31). TSMSM were eligible for the qualitative study if they had taken part in the RDS-based survey, reported interacting with a healthcare provider (HCP) in the 12 months preceding the RDS-based survey, and tested negative for HIV during the RDS-based survey. Fifty-two TSMSM met the set eligibility criteria, from which 25 (10% of the 248 in the RDS-based survey) were selected from each of the RDS recruitment waves, with the number of TSMSM selected from each wave being proportional to the size of the wave. Subsequently, these 25 TSMSM were invited for the in-depth interviews, out of which 22 took part, with the remaining three unable to participate due to time constraints. Since saturation was reached by the 18th participant, we did not find it necessary to replace the three who could not take part in the study.

5.1.3 Data collection procedures

Demographic information was collected through a short survey administered through the REDCap® digital platform (Vanderbilt University, TN, USA). The interview guide was developed by the researchers based on the aim of the study, and covered four main topics, namely: general college/ university life, healthcare seeking, HCPs' handling of MSM, and healthcare needs

analysis. Interviews were conducted in September 2021 by the first and second authors. Interviews were conducted away from the TSMSM's institutions of study, at the Partners in Health and Development in Africa (PHDA) study site within Nairobi central business district, where the RDS-based survey had previously taken place. Interviews were carried out in a private room where only the interviewer and one participant were present at the time of every interview. The interviews lasted an average of 45 minutes and were conducted in English which is the language of instruction in the Kenyan education system. In a few instances, participants responded in Kiswahili. All interviews were audio-recorded, transcribed verbatim and translated to English as needed. The interviewer then read the transcripts while listening to the audio-recordings to ensure the accuracy of transcription and translation.

5.1.4 Data analysis and reporting

Data in from of transcripts was managed using NVivo software version 12 (QSR International). Analysis followed the content analysis theoretical framework, that systematically organizes qualitative data in a structured manner(32). Analysis was done both deductively and inductively, using themes set a priori and coding emerging ones, respectively. Coding was done independently by two members of the study team, who then compared codes for agreement until a consensus was reached on whether to merge some codes, get rid of others or come up with new ones. Themes and sub-themes were described and supported with illustrative excerpts from the interviews. Excerpts were attributed to participants using pseudonyms and age in years. Reporting of the study followed the consolidated criteria for reporting qualitative studies (COREQ)(33).

5.1.5 Data trustworthiness

Four criteria (credibility, dependability, transferability and confirmability) were used to ensure trustworthiness of the data(34). For credibility, the study used well-founded methods for qualitative investigation. Prior to data collection the interviewers had created a working rapport with the participants from prior interactions during the quantitative survey. At the data collection stage, iterative investigation was used by rephrasing previously asked questions to confirm and acquire deeper understanding of the information provided by participants from their initial responses to questions. Member checking was done "on the spot" by paraphrasing and summarizing what the participants said at intervals and at the end of each topic of discussion, respectively. To address dependability, the study processes have been reported in sufficient detail

to enable future researchers reproduce the study. For transferability, details about the study methods have been provided to help comprehend and compare/contrast the findings of this study with those of similar studies. Confirmability has been catered for by supporting the findings with verbatim quotes from study participants.

5.1.6 Ethical considerations

The study protocol was approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number. M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number. P990/12/2019). Participants provided written informed consent before taking part in the study. Participants received Kenyan shillings 1,000 (approximately $10 at the time) for travel-related expenses to and from the study site, and their time.

5.2 Results

5.2.1 Participants' characteristics

The sociodemographic characteristics of study participants are summarized in **Table 5.1**.

Table 5.1: Sociodemographic characteristics of TSMSM (N=22)

Variable	**Category**	**n (%)**
Age	18 – 20	10 (45.5)
	21 – 24	12 (54.5)
Gender identity	Cisgender male	22 (100.0)
Sexual orientation identity	Gay	16 (72.7)
	Bisexual	6 (27.3)
Institution attended	University	11 (50.0)
	College	11 (50.0)
Ownership of institution attended	Public	13 (59.1)
	Private	9 (40.9)
Type of course studied	Science, technology, engineering and mathematics	12 (54.5)
	Arts, business and humanities	10 (45.5)
Year of study	1st and 2nd year	13 (59.1)
	3rd and 4th year	9 (40.9)
Residence	College housing/ rented hostel	16 (72.7)
	With family	6 (27.3)
Ever attended boarding school	Yes	19 (86.4)
	No	3 (13.6)
Main source of financial support	Parents/guardians	14 (63.6)
	Employment	8 (36.4)
Had smartphone at time of study	Yes	21 (95.5)
	No	1 (4.5)

The following sections explore the main themes that emerged from the analysis of the interviews with the TSMSM. The themes include experiences with healthcare services use, priority healthcare needs, desired healthcare provider (HCP) characteristics and possible role of digital health interventions in improving access to and use of healthcare services.

5.2.2 Experiences with healthcare services

Four sub-themes emerged under this theme. Participants reported experiencing prejudice, stigma and discrimination that manifested in various ways in public and institution-based health facilities. In contrast, participants reported perceptions of being handled fairly in private health facilities, community pharmacies and MSM-friendly clinics.

Experiences in public health facilities

Participants reported experiences of negative behaviours by HCPs in public facilities either directly or by participants' peers, and considered these sort of behaviours and trends as being the cause of their dislike for seeking care from or visiting these facilities. One participant recounted how a friend who had been sodomized was ridiculed and victim-shamed by a HCP.

> "There's a time I took my friend, because he had been raped… and then this person (HCP) asks, "Are you sure you were raped or it was your deal gone wrong?" So you are like, "this person is traumatized, why are you even asking such questions?" "That is why I hate public hospitals by the way. I would rather die." Bobby, 23 years

Other unpleasant behaviour in public health facilities entailed HCPs pressurizing participants to disclose having engaged in anal sex, then using this information to gossip with other HCPs about a client when the client was still in the health facility. One episode was relayed by a participant as follows:

> "My friend had some wound in the anus. When he went to the hospital, he found a lady… but the lady was just triggering him with questions so that he may tell her the truth… she created a friendly environment so that he may come out openly... So after that, he told her it was a guy (he had sex with). So on telling her, suddenly the lady changed… she became silent then asked him some other questions that are health related then she went out. After that, another doctor came in…. she pretended as though she was looking for something… have you ever seen a person looking for something but it is your eyes they are looking at?

> Yeah… then she left. Another one, now a male doctor came in…the male doctor is (sic) pretending to be looking at those testing kits and such but then when he left he looked at him. Then after a while the old lady now came back… so it was just obvious that she went outside there to gossip… they (HCPs) gossiped and gossiped about him!" Dylan, 24 years

Such experiences made participants afraid of being made to feel marginalized and thus deterred them from visiting the same place in future if they needed services, even if the required services were not related to sexual health needs.

> "He wasn't taken through a very good experience… so, he will be afraid…the fear of going to that place, that those people know who I am. So, I won't go there...even if you are going to get normal (non-sexual health-related) services, it will stop you…yeah." Dylan, 24 years

These experiences also caused participants to view the HCPs with suspicion and mistrust, resulting to non-disclosure of same-sex sexual behaviour to HCPs. Participants feared HCPs could share this information with other people such as participants' neighbors, thereby negatively impacting on the well-being and safety of participants.

> "If I go to a health centre near where I live, and I am exposed by anybody working there that I normally sleep with other men, if the information leaks to the public in the area where I am staying, it will affect me because I am normally considered to be a straight person. It will just affect my being in the area and I won't feel safe anymore." Damian, 21 years

There were also instances where HCPs used derogatory terms against participants, causing the participants to leave the facilities without receiving services.

> 'My friend chose to go to a public hospital. So the doctor that he got was a man…so he was asked what's wrong with him and he said he has anal warts. Then he (the doctor) asked him, "Wewe ni shoga (are you gay)?" That word (shoga) is what he told me hurt him the most because there is when your friend who is an MSM and they call you 'shoga', you will understand. But if it's someone let's say someone in an office and they tell you that…you will feel you are not comfortable at all. He told me he felt that he had been condemned so much…so he just left. He said he will never go back there." Cedric, 22 years

However, despite these negative experiences, there were instances when participants stood up for themselves, confronted the HCPs, insisted and received the services they needed at the time.

> "I have had an instance where my friend was telling me how when he went to a public clinic and the doctors were kind of discriminating… because when they were treating him for an anal STI they were like, "for you to get this (STI) you must have had sex with a man so you must also bring him." It was a terrible experience. … but he was like, "yeah this is a government facility; I should seek services here as you are supposed to give me the services." I mean, he made it clear and they just gave him the services without having to bring his partner." Benny, 18 years

Though the treatment of STIs rightly requires partner tracing and treatment, it is not a mandatory requirement for the treatment of the individual seeking care. In the above instance, the HCP seemed to make it a mandatory requirement and their tone was perceived by the client as being harsh and condescending.

Participants were also highly sensitive to external cues such as the way other clients at the facilities looked at them, which made the participants feel as if the other clients knew the participants were MSM. The effect of such cues elicited feelings of marginalization among the participants to the extent of deciding to leave the facilities without getting the care they needed.

> "In the public facilities, there is abuse, there is harassment, so even when you are on that queue the looks you get from other people you will just feel you are the odd one out. So if they know you are MSM, you'll just have to go away." Poppy, 22 years

Experiences in institution-based health facilities (campus clinics)

Though participants noted that the institution-based health facilities (campus clinics) were open for all students, they felt these clinics did not focus on their needs such as anal STIs. If and when they visited these clinics, they had to conceal their same-sex sexual behaviour from the HCPs so as to be able to receive the services they needed and avoid ill treatment by the HCPs. If they felt they had to disclose their same-sex sexual behaviour to the HCPs, then they would rather not visit the clinics.

> "Our facility is accessed by everyone, like it's not specifically for MSMs. When you go there, you will have to go like any other person. With your secret hidden so far, you will get very good services and no one will treat you awfully. But when you slip and go and say, I am an MSM... or you have some symptoms related to MSM like an anal STI… the

environment won't be safe for you anymore because people will be looking at you with those burning (hostile) eyes." Harley, 21 years

"It (campus clinic) doesn't focus on people like me, LGBTs, you know... So when you are going to tell the nurse some sensitive information it's like you are exposing yourself, so I would rather stay like that (without seeking services). I can't, I can't risk." Jones, 22 years

To support the lack of focus on MSM specific health needs, one participant narrated how his friend was not able to obtain services for treatment of anal warts. Though the nurse told the friend they did not treat such conditions, the perceived dismissive way in which he was handled by the nurse made him believe it was a denial and not the unavailability of the service.

"I have a friend… he belongs to the community (MSM). So, he went to seek for services at the school hospital. He was having an MSM issue… anal warts. So, when the nurse found out how it happened, she told him they don't deal with STIs of such nature. She told him maybe he seeks treatment outside school. And it's not that they (HCPs) can't (treat anal warts) ... it is just because of the fact that he is from the community (MSM). He didn't even get to see the doctor. He was just dismissed verbally without anything… it was like an entire scene." Soy, 20 years

For these reasons, participants sought services for general healthcare needs from the campus clinics but if they had a sexual health-related need, then they opted to visit the MSM-friendly clinics.

"If I have let's say a cough, stomach upset, I usually go to the clinic in campus… but if I'm sexually sick I won't go there… I will go to the clinics that support MSM." Dylan, 24

Experiences in private health facilities

Participants who had medical insurance or who could afford to pay out of pocket, opted to seek services from private facilities and community pharmacies where service provision is for profit. Participants reported that HCPs in these facilities did not discriminate, express judgmental attitudes nor gossip about their clients. Participants also appreciated the perceived high quality of services offered in these facilities.

"I have an insurance cover under my parents. If I am sick, I go to a branch of a private hospital near where I stay. Their services are excellent. They don't discriminate. I really like the place." Soy, 20 years

"If it is a private clinic where you have to pay, no one will ever judge… I mean your money talks. You pay and you are like if they start gossiping you go find another clinic. So if it is private clinics it's so good." Benny, 18 years

"If you are good (have money), you can go to the chemist (community pharmacy), explain your problem and they will sort you out… as long as you are paying, they have no problem." Damian, 21 years

Experiences in MSM-friendly clinics

In MSM-friendly clinics, participants found a reprieve from the negative experiences in public facilities and campus clinics, and the cost implication of seeking services from private facilities and or community pharmacies. HCPs in MSM-friendly clinics were perceived as non-judgmental and services were offered at no cost to clients.

"As per now, MSM are very aware of the friendly facilities, more so my friends… because even I, it is a friend who told me. He told me, "by the way, if you ever want anything, anything like STI treatment or these commodities… lubes, condoms, there's a place where you can get without being asked anything". And I was very interested because before that, I was very afraid… so even though like you have not yet felt unwell but you would ask yourself, what if I get sick? where shall I go?" – Dylan, 24 years

"If I had an STI, I would go to the MSM facilities since it is a non-judgmental place… and a friendlier place… also, you can be treated for free, there are no other costs." Damian, 21 years

The negative experiences in the hands of other HCPs in public health facilities and campus clinics, and the ensuing loss of trust, drove away some participants from seeking services, even at MSM-friendly clinics. This in turn led to aggravation or worsening of symptoms related to health conditions.

'If you go to a public hospital and get a bad experience, there's that trust that someone loses. They can't trust anyone. So, it's hard for them. You have to convince them too

much… I've had friends who have waited until their warts have become worse because they think, even if I go to an MSM-friendly clinic, how are they going to see me?" Bobby, 23 years

5.2.3 Priority healthcare needs

Participants identified HIV/STIs prevention and control, mental health services and, substance abuse prevention and control as their priority healthcare needs. For HIV/STIs, participants felt that they needed health education on various prevention strategies such as pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP) and condoms, and control strategies such as HIV self-testing and screening for STIs.

> "The health facilities should reach out to educate us on PrEP, PEP, on use of condoms, lubricants and self-test kits (for HIV). We also need regular screening for STIs because as young adults we are very sexually active." Jamie, 21 years

Participants also strongly expressed the need for mental health services, especially counseling services to help them cope with the various life situations they were experiencing.

> "For me, mental health should be like the first priority. We need to have a lot of counselors because people are going through a lot in campus. Some people it's struggling with accepting themselves as gay, some it's their family not accepting them, some have health problems, money, peer pressure, break ups… and all this stuff which you know can lead to depression." Benny, 18 years

There was also need to address issues of substance abuse since participants noted that this was rampant among them, mostly due to peer pressure and the trend of using the substances during sexual encounters.

> **"**Yeah…because we are a small community I would say the influence (to use drugs) is infectious… there is a lot of peer pressure… you ask yourself, everyone does it, why not me? That's what people say… it is now becoming a culture because some people can't have sex without using drugs… weed (marijuana), alcohol, cigarettes… all those. If we could have services that would help out with these issues, that would be really great." Ayan, 21 years

5.2.4 Desired healthcare provider characteristics

Participants were asked to describe the characteristics of their preferred HCP. The trend that emerged showed that participants were more interested in their HCP's inter-personal skillset than in demographic characteristics such as gender, sex and sexual orientation. For instance, participants wanted a HCP who could create a good rapport with them, communicate effectively and be willing to help, over needing the HCP to be of the same sexual orientation as the participant.

> "The doctor doesn't have to be LGBTQ. He or she just has to be open-minded, have the heart of helping… like be passionate about what they do and attend to everyone no matter their sexuality." Aiden, 20 years

> "I think they (HCPs) should be very professional and have that rapport with the MSM students, and always be there to help them and guide them….. so they (MSM students) feel like they are talking to a friend. They (HCPs) should be taught on how to communicate with young adults and make them feel comfortable with expressing themselves." Jamie, 21 years

Participants also expressed the desire to have HCPs who are knowledgeable about existence of MSM in the society and their unique healthcare needs, and able to provide MSM with the needed services without discrimination.

> "I think all doctors should go through a program that teaches them that there are these kind of people (MSM) and this is how you are supposed to deal with them and they are actually normal… it's not like a case out of the ordinary." Benny, 18 years

> "They (HCPs) should know that there are those diseases like anal warts that mostly affect MSMs and they should help them… even if they're queer, do not discriminate, just give them the services they are looking for." Cedric, 22 years

Noteworthy, participants pointed out the need for HCPs to avoid judgmental attitudes and gossiping about clients, as well as respect clients' privacy and choices. This way, the health facility climate would be conducive for everyone seeking care, including non-MSM clients.

> "They should stop judging people, stop talking about people and respect people's privacy. That way, the whole healthcare system will be good for everyone, not just gay people." Jones, 22

5.2.5 Potential role of digital interventions in improving access and use of services

Participants offered various suggestions on how digital interventions could help improve healthcare access and use for them. Participants were of the opinion that, unlike traditional educational materials such as pamphlets and brochures, social media is more appealing to use, has the capacity to reach more people and could be used as a discreet platform to advertise HCPs' services, and provide health education on various sexual health matters such as PrEP and condom use.

> "I have seen these online posters that you make... pretty posters that MSM will know are meant for them but not the other people… so when you send them out there, they (MSM) will repost on their statuses (on social media platforms) so people will have the information on where they can access the services… and it will spread fast." Jones, 22 years

> "Most people nowadays don't have the time to read. You cannot give them like a pamphlet on PrEP to go read. They will just trash it in the dustbin because also they do not want to be seen with it. If the clinics can share short videos on Instagram or YouTube on how to like properly use condoms… the benefits of PrEP… one can watch the videos privately and the videos can go viral and reach most of the MSM people and educate them." Jamie, 21 years

Participants also felt that mobile phone applications that provide for online consultation with a HCP (telemedicine), could help TSMSM access services in a non-judgmental way, since the nature of the online HCP-patient interaction is anonymous.

> "And then there are the online doctors. They can give you services if you don't like going to a facility where you might be judged. The good thing is that the internet never judges you." Myles, 19 years

Compared to in-person purchasing at the community pharmacies, online shopping also presented a discreet and convenient way to purchase health commodities such as condoms and lubricants.

> "You know people fear to go out to chemists (community pharmacies) and buy condoms and lube… so you can go to apps like Jumia and order then they bring at your doorstep or any other place you agree. So the internet really helps in that way." Harley, 21 years

Participants also felt that interactions between MSM on MSM-focused geosocial networking applications such as Grindr could help in locating facilities that offer health services such as HIV/STIs testing.

> "There's an app called Grindr… people are always like I last tested (for HIV) on 1st May, so you would be like, "where did you test" … so I mention clinic X and they are like "where is it?" I say it is in town… so even if you don't get to meet, the person will know there is a clinic in town where they can get tested." Aiden, 20 years

Participants observed that online platforms could also be useful in giving HCPs anonymous feedback that the HCPs could use to improve service provision.

> "If there is a way a clinic has a platform online where it doesn't reveal who texted this or that thing, yeah it can be good because they (clients) will give out their grievances and that will help the clinic to improve the services that they provide." Cedric, 22 years

Lastly, participants noted that meeting peers online, sharing experiences with and learning from them how to navigate various issues in life, offered social support that was beneficial for their overall well-being.

> "Meeting other people online who are like you, who are undergoing the same problems like you, and sharing the experiences of how they dealt with it, and knowing you are not alone, and you will overcome, is really helpful." Benny, 18 years

5.3 Discussion

This study provides numerous insights about healthcare engagement among tertiary student MSM (TSMSM) in Nairobi, Kenya. We found out that TSMSM experienced prejudice, stigma and discrimination in public and institution-based health facilities, but were handled fairly in community pharmacies, private and MSM-friendly health facilities. TSMSM mainly sought services for sexual health needs, but also mentioned needing mental health services as well as help with issues related to substance abuse. TSMSM expressed a desire to have healthcare providers (HCPs) who were knowledgeable about the unique sexual health needs of TSMSM, and willing to offer services in a non-judgmental way. The discreet nature, appeal and potential of digital media to reach more people compared to traditional media, was considered a collective strength that could be leveraged on to improve access and use of healthcare services by TSMSM.

To navigate the unfair handling by HCPs in public and institution-based health facilities, participants used these facilities for general healthcare needs but visited community pharmacies, private and MSM-friendly health facilities when they needed sexual health services. This coping strategy has also been observed with YMSM in the USA(35). Despite its benefits as observed in this study, the practice of separating healthcare seeking may not serve the best interest for the overall health and well-being of TSMSM. Ideally, like the other students, TSMSM should be able to access the services they need from their campus clinics and be referred appropriately when the services are not available. Seeking sexual health services outside their campuses has cost implications arising from paying out of pocket in private health facilities and/or community pharmacies, especially given that more than a third (34.3%) of Kenyans live below the poverty line(36), and a majority of Kenyans (89%) are not covered by the most affordable public medical health insurance scheme(37), with both scenarios likely replicated among the tertiary student community. Even when the services are offered free of charge in MSM-friendly clinics, students must allocate time and incur transport costs to get to these clinics, given that there is only a handful of such clinics in the Nairobi metropolis. We therefore suggest training and sensitizing HCPs working in the campus clinics on the unique healthcare needs of TSMSM, and how to provide the latter with culturally competent services in a non-judgmental way, and thus offset the costs and inconveniences borne by TSMSM when seeking services externally. Previous sensitization and skills training for HCPs in Kenya has indeed been shown to improve service provision for MSM clients(38).

The findings from this study have implications for clinical practice and training. Previous studies have demonstrated the importance of MSM disclosing same-sex sexual behaviour to HCPs as this may facilitate appropriate healthcare engagement including risk assessment for HIV and other STIs(39,40). In the current study, participants often spoke of experiencing challenges with healthcare engagement when they sought treatment for anal STIs. Disclosure of same-sex sexual behaviour whether voluntary or through coercion by HCPs generated stigma and discrimination which manifested in various ways including verbal abuse, gossip and denial of services, as has been observed in other settings in sub-Saharan Africa (41–46). Even in instances where HCPs sought to do the right thing such as asking a client seeking treatment for an anal STI to bring his sex partner for treatment, providers seemed to make it a pre-condition for treatment, with their tone perceived as both harsh and condescending by the client. This finding further reinforces the

need for sensitization and training of HCPs in the public and institution-based health facilities on the provision of comprehensive, affirming and equitable services for TSMSM. For instance, HCPs when appropriately trained in partner services have the potential to reach out to more at risk TSMSM who when appropriately counselled and shown the benefit, would be more willing to bring their sex partners for testing and treatment of STIs. Since Kenya has a dedicated national program that leads the HIV response among key populations (including MSM)(47), we propose that tertiary institutions pig back on this program to provide such sensitization and training for their HCPs. Through the key populations program, the ministry of health and other stakeholders should also offer similar sensitization and training to HCPs in public health facilities. In addition to imparting knowledge on the healthcare needs of MSM, training should also seek to equip HCPs with skills and attributes that participants desire them to have such as effective communication, empathy and a willingness to help. There is also the opportunity to make the training much more comprehensive and encompassing more targeted skills building to support MSM healthcare needs – covering not only sexual health services but also other participant-identified priority healthcare needs, including mental health and substance abuse management services. The scope of training should also possibly be extended to the healthcare needs of other sexual and gender diverse tertiary students. Previous work done in Kenya found out that sexual health counseling by HCPs commonly addresses only heterosexual behaviour, partly because training curricula do not include issues around same-sex sexual behaviours(48). The reported behaviour of HCPs in our study possibly lends credence to this earlier finding. As a result, we propose that training curricula for health professions students should include modules on sexual and gender diversity health so that as the students transition to becoming HCPs, they have already been introduced to the topic and this could serve as a foundation for further capacity building.

This study also highlights the potential role digital interventions could play in improving healthcare access and use for TSMSM. Participants observed that digital platforms allow them to bypass some of the barriers they encounter while seeking services from physical health facilities, especially the experiences of stigma and discrimination, as has been highlighted in a previous commentary(49). The use of digital platforms could also confer other benefits such as allowing TSMSM to purchase health commodities (lubricants and condoms) anonymously and interact with their peers for social support. The appeal of digital media is pertinent in ensuring that information contained in such media reaches a large audience, and this could be helpful for HCPs seeking to

advertise or offer their services online. This is particularly important since students joining the tertiary institutions especially from areas outside the city may not be familiar with physical places where they can access MSM-friendly services, and may also be less aware of what constitutes behaviours that may put them at risk for various health conditions such as HIV/STIs, mental health illness and substance abuse. Anonymized digital platforms could also be useful for users in giving feedback to HCPs that could help improve service provision. Work done by researchers in Kenya has demonstrated that tertiary students are regular and savvy users of the internet, with approximately 95% owning smart phones (50). Accordingly, HCPs should seek to meet the tertiary students where they are – online. As seen from our sample, 95.5% of participants owned a smart phone at the time of the study. Previous research has demonstrated the usefulness of digital interventions in addressing various health challenges such as HIV/STIs(51–53), mental health(54) and substance use(55) among YMSM, as well as accessing social support in coming out and finding a community to belong to(56). We suggest such interventions should be considered for TSMSM in Kenya given their potential usefulness(57), and the ubiquitous use of smart phones among this population.

Findings from this study also necessitate the need to address health inequities experienced by TSMSM as a result of the Kenyan legal framework and its impact on healthcare delivery for sexual and gender minority citizens. As noted by the participants, the hostile health climates in public health facilities and campus clinics caused TSMSM to postpone healthcare seeking until symptoms worsened, resulting in poor health outcomes. Additionally, ill treatment by HCPs in these facilities caused some TSMSM to distrust the healthcare system as a whole and become skeptical about seeking services even from the affirming MSM-friendly clinics. Perhaps the HCPs who exhibited stigma and discrimination were emboldened to treat TSMSM with partiality due to the criminalization of same-sex sexual relations through the colonial Kenyan penal code(9). Nevertheless, the Constitution of Kenya guarantees every Kenyan citizen the right to the highest attainable standard of health(58). HCPs as duty bearers and TSMSM as services users need to be made aware and/or reminded of this right as both have a duty towards ensuring the enjoyment of the right.

As our study only focused on MSM who were above 18 and in tertiary academic institutions, there is still a knowledge gap of healthcare engagement among MSM under the age of 18 years or those at the secondary school level. We did not explore directly in this study the student experiences

prior to emerging adulthood. However, based on our findings from the current study, we could postulate that access to health services among this population is hindered by barriers similar to those reported by TSMSM. The quote in the heading, "What if I get sick, where shall I go?", was the reflection by a third-year student from his first-year days at the university, wondering where he would go if he got unwell as he had no knowledge of which facilities could attend to him without discrimination. While further studies are needed to better understand access for these younger MSM, reseachers in countries such as Kenya would be guided to exercise caution and discretion when working with this population . Aside from the legal barriers related to the criminalization of same sex relationships in Kenya, being under the legal age of independent consent would be a further barrier to navigate when attempting to engage safely with younger MSM. Unless protocols paired with waivers of parental consent through local institutional review boards or ethics committees could be secured , it would prove challenging to ensure safe and discrete access to this marginalised group. Nevertheless, it is an area that requires addressing and the various stakeholders, including the younger MSM themselves, researchers as well as ethics committees need to find innovative ways to ensure this population is represented in research, to better understand the challenges they face, as part of targeted efforts to identify mechanisms to address these challenges.

One of the strengths of this study is that it was conducted in the capital Nairobi which has a range of HCPs based in various clinical settings including public, private and MSM-friendly, as well as community pharmacies. Consequently, it was possible to obtain and compare information on healthcare engagement experiences from each of these settings hence increasing the robustness of the study. Nevertheless, this study is not devoid of limitations. For example, the findings may not be representative of other urban centers in the country with different settings. In addition, the study recruited participants from a larger sample that had previously been engaged in health research. As such, the views expressed here may not reflect those of participants without prior research engagement. We mitigated this potential source of bias by asking participants to share their own healthcare engagement experiences, as well as those of their friends, who may have or not engaged with research beforehand. Even so, we note that participants predominantly shared their friends' experiences and whereas this could be the true reflection, it is possible that due to social desirability bias, some of the experiences shared as coming from friends could actually have been the participants' own experiences. Despite these limitations, the study adds to the scarce body of

knowledge on healthcare engagement among YMSM in general, and TSMSM specifically, in Kenya and sub-Saharan Africa. These findings may be used to improve access and use of services among TSMSM, and inform the design of future studies.

5.4 Conclusion

Tertiary student MSM in this study reported experiencing more prejudice, stigma and discrimination in the hands of HCPs based in public and institution-based health facilities compared to those in community pharmacies, private and MSM-friendly health facilities. To address these disparities, there is urgent need to train and sensitize HCPs in public and institution-based health facilities so as to equip them with knowledge and skills required to offer culturally competent services that meet the unique needs of TSMSM. Since change in the attitudes of public sector and institution-based HCPs towards TSMSM may take time, there is possibly a need to increase the number of MSM-friendly health facilities within the Nairobi metropolis since as it is now, there are only a few and far in between compared to the large number of TSMSM estimated to be studying and living within the metropolis. An ideal package of care for TSMSM should include but not be limited to sexual and mental health services. Digital health interventions such as apps that provide health education that suits and meets the needs of TSMSM, and link TSMSM to services are also requisite.

References

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). 2021 Global AIDS Update - Confronting Inequalities. Geneva, Switzerland; 2021.
2. World Health Organization (WHO). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Geneva, Switzerland: WHO; 2021.
3. Plöderl M, Tremblay P. Mental health of sexual minorities: a systematic review. Int Rev Psychiatry. 2015;27(5):367–85.
4. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. J Int AIDS Soc. 2015;18(Suppl 1):19833.
5. World Health Organization. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people. Geneva, Switzerland: World Health Organization; 2011.

6. Batchelder AW, Safren S, Mitchell AD, Ivardic I, O'Cleirigh C. Mental health in 2020 for men who have sex with men in the United States. Sex Health. 2017;14(1):59–71.
7. Beck J, Santos G-M, Ayala G. Young Men Who Have Sex with Men : Health, Access , and HIV. The Global Forum on MSM and HIV (MSMGF); 2013.
8. Mbeda C, Ogendo A, Lando R, Schnabel D, Gust DA, Guo X, et al. Healthcare-related stigma among men who have sex with men and transgender women in sub-Saharan Africa participating in HIV Prevention Trials Network (HPTN) 075 study. AIDS Care. 2020;32(8):1052–60.
9. The Government of Kenya. Laws of Kenya Cap 63: The Penal Code. Kenya: Kenya Law; 1930.
10. Bhattacharjee P, Morales GJ, Kilonzo TM, Dayton RL, Musundi RT, Mbole JM, et al. Can a national government implement a violence prevention and response strategy for key populations in a criminalized setting ? A case study from Kenya. J Int AIDS Soc. 2018;21(S5):109–14.
11. Herek GM. Confronting Sexual Stigma and Prejudice: Theory and Practice. J Soc Issues. 2007;63(4):905–25.
12. Rounds K, Mcgrath BB, Walsh E. Perspectives on provider behaviors: A qualitative study of sexual and gender minorities regarding quality of care. Contemp Nurse. 2014;44(1):99–110.
13. Wall KM, Khosropour CM, Sullivan PS. Offering of HIV Screening to Men Who Have Sex With Men by Their Health Care Providers and Associated Factors. J Int Assoc Physicians AIDS Care. 2010;9(5):284–8.
14. Hornby A. Oxford Advanced Learner's Dictionary. United Kingdom: Oxford University Press; 2010.
15. Wilson, Patrick; Santos, Glenn-Milo; Pato, Herbert ; Ayala G. Access to HIV Prevention Services and Attitudes about Emerging Strategies : A Global Survey of Men Who Have have sex with Men and their Healthcare Providers. The Global Forum on MSM and HIV (MSMGF); 2011.
16. Mavhandu-Mudzusi AH. Impact of Stigma and Discrimination on Sexual Wellbeing of LGBTI Students in a South African Rural University. South African J High Educ. 2017;31(4):208–18.

17. The Lancet: Editorial. Meeting the unique healthcare needs of LGBTQ people. Lancet. 2016;387(10014):95.
18. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi, Kenya: a respondent-driven sampling survey. AIDS Res Ther. 2023;20:7.
19. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. Prevalence of five curable sexually transmitted infections and associated risk factors among tertiary student men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Sex Health. 2023;20(2):105–17.
20. Omulo C. 7,900 clinics operating illegally in Nairobi, committee reports. Daily Nation [Internet]. 2020 Jun 29; Available from: https://nation.africa/kenya/counties/nairobi/7900-clinics-operating-illegally-/1954174-5065806-vkdmjmz/index.html.
21. Toroitich AM, Dunford L, Armitage R, Tanna S. Patients Access to Medicines – A Critical Review of the Healthcare System in Kenya. Risk Manag Healthc Policy. 2022;15(3):361–74.
22. Daily Active. Nairobi's very own gay clinic with a surprising number of patients. Daily Active [Internet].[cited 2019 May 24]; Available from: https://dailyactive.info/2019/05/24/a-look-at-nairobis-very-own-gay-clinic-with-a-surprising-number-of-same-sex-patients/.
23. University of Nairobi. University of Nairobi Health Services [Internet]. [cited 2022 Apr 29]. Available from: http://healthservices.uonbi.ac.ke/.
24. Kenyatta University. Kenyatta University Health Unit [Internet]. [cited 2022 Apr 29]. Available from: http://www.ku.ac.ke/healthunit/.
25. Jomo Kenyatta University of Agriculture and Technology. Jomo Kenyatta University of Agriculture and Technology Health Services Department [Internet]. [cited 2022 Apr 29]. Available from: http://www.jkuat.ac.ke/departments/hospital/.
26. Bourne A, Carman M, Kabuti R, Nutland W, Fearon E, Liku J, et al. Experiences and challenges in sexual health service access among men who have sex with men in Kenya. Glob Public Health. 2021; 17(8):1626-1637.
27. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men

in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal. 2021;9:619694.

28. Aday LA, Andersen R. A framework for the study of access to medical care. Health Serv Res. 1974;9(3):208–20.
29. Gelberg L, Andersen RM, Leake BD. The Behavioral Model for Vulnerable Populations: application to medical care use and outcomes for homeless people. Health Serv Res. 2000;34(6):1273–302.
30. Study in Kenya. Universities and Colleges in Nairobi County [Internet]. 2021 [cited 2022 Jun 24]. Available from: https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1.
31. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "My Friends Would Believe My Word": Appropriateness and Acceptability of Respondent-Driven Sampling in Recruiting Young Tertiary Student Men Who Have Sex with Men for HIV/STI Research in Nairobi, Kenya. Int J Environ Res Public Health. 2022;19(12):7331.
32. Liamputtong P. Qualitative Research Methods. 5th ed. Docklands, Victoria, Australia: Oxford University Press; 2020.
33. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Heal Care. 2007;19(6):349–57.
34. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. Educ Inf. 2004;22(2):63–75.
35. Griffin M, Krause KD, Kapadia F, Halkitis PN. A Qualitative Investigation of Healthcare Engagement Among Young Adult Gay Men in New York City: A P18 Cohort Substudy. LGBT Heal. 2018;5(6):368–74.
36. The World Bank. Kenya Macro Poverty Outlook 2022. Washington DC: The World Bank; 2022.
37. Ouma PN, Masai AN, Nyadera IN. Health coverage and what Kenya can learn from the COVID-19 pandemic. J Glob Health. 2020;10(2):020362.
38. Elst EM Van Der, Kombo B, Gichuru E, Omar A, Musyoki H, Graham SM, et al. The green shoots of a novel training programme: progress and identified key actions to providing services to MSM at Kenyan health facilities. J Int AIDS Soc. 2015;18:20226.

39. Metheny N, Stephenson R. Disclosure of Sexual Orientation and Uptake of HIV Testing and Hepatitis Vaccination for Rural Men Who Have Sex With Men. Ann Fam Med. 2016;14(2):155-158.
40. Kokogho A, Amusu S, Baral SD, Charurat ME, Adebajo S, Nowak RG, et al. Disclosure of Same - Sex Sexual Practices to Family and Healthcare Providers by Men Who Have Sex with Men and Transgender Women in Nigeria. Arch Sex Behav. 2021;50(4):1665–76.
41. Risher K, Adams D, Sithole B, Ketende S, Kennedy C, Mnisi Z, et al. Sexual stigma and discrimination as barriers to seeking appropriate healthcare among men who have sex with men in Swaziland. J Int AIDS Soc. 2013;16(Suppl 2):18715.
42. Wanyenze RK, Musinguzi G, Matovu JKB, Kiguli J, Nuwaha F, Mujisha G, et al. "If You Tell People That You Had Sex with a Fellow Man, It Is Hard to Be Helped and Treated " : Barriers and Opportunities for Increasing Access to HIV Services among Men Who Have Sex with Men in Uganda. PLoS One. 2016;11(1):1–19.
43. Kushwaha S, Lalani Y, Maina G, Ogunbajo A, Wilton L, Agyarko-Poku T, et al. "but the moment they find out that you are MSM ⋯": a qualitative investigation of HIV prevention experiences among men who have sex with men (MSM) in Ghana's health care system. BMC Public Health. 2017;17(770).
44. Rispel LC, Metcalf CA, Cloete A, Moorman J, Reddy V, Moormand J. You become afraid to tell them that you are gay: Health service utilization by men who have sex with men in South African cities. J Public Health Policy. 2011;32(Supplement 1):137–51.
45. Duby Z, Nkosi B, Scheibe A, Brown B, Bekker L-G. 'Scared of going to the clinic': Contextualising healthcare access for men who have sex with men, female sex workers and people who use drugs in two South African cities. South Afr J HIV Med. 2018;19(1):701.
46. Lane T, Mogale T, Struthers H, Mcintyre J, Kegeles SM. "They see you as a different thing": The Experiences of Men Who Have Sex with Men with Health Care Workers in South African Township Communities. Sex Transm Infect. 2009;84(6):430–3.
47. National AIDS and STI Control Programme (NASCOP) Kenya. National AIDS and STI Control Programme Organogram [Internet]. [cited 2022 Jul 9]. Available from: https://www.nascop.or.ke/organogram/.
48. Taegtmeyer M, Davies A, Mwangome M, Elst EM Van Der, Graham SM, Price MA, et al. Challenges in Providing Counselling to MSM in Highly Stigmatized Contexts : Results of

a Qualitative Study from Kenya. PLoS One. 2013;8(6):e64527.

49. Bowen D, Jabson J, Kamen C. mHealth: an avenue for promoting health among sexual and gender minority populations? mHealth. 2016;2(36).
50. Ojino R, Mich L. Mobile Applications in University Education: the case of Kenya. J E-Learning Knowl Soc. 2018;14(1):111–25.
51. Knight R, Karamouzian M, Salway T, Gilbert M, Shoveller J. Online interventions to address HIV and other sexually transmitted and blood-borne infections among young gay, bisexual and other men who have sex with men: a systematic review. J Int AIDS Soc. 2017;20(3):e25017.
52. Garofalo R, Adetunji A, Kuhns LM, Omigbodun O, Johnson AK, Kuti K, et al. Evaluation of the ICARE Nigeria pilot intervention using social media and peer navigation to promote HIV testing and linkage to care among high-risk young men a nonrandomized controlled trial. JAMA Netw Open. 2022;5(2):e220148.
53. Farquhar C, Masyuko S, Mugo P. Social Network–Based Strategies to Improve Uptake of HIV Testing and Linkage to Care Among Men Who Have Sex With Men in Sub-Saharan Africa. JAMA Netw Open. 2022 Feb 22;5(2):e220155.
54. Lucassen MFG, Merry SN, Hatcher S, Frampton CMA. Rainbow SPARX: A Novel Approach to Addressing Depression in Sexual Minority Youth. Cogn Behav Pract. 2015;22(2):203–16.
55. Schwinn TM, Thom B, Schinke SP, Hopkins J. Preventing Drug Use Among Sexual-Minority Youths: Findings From a Tailored, Web-Based Intervention. J Adolesc Heal. 2015 May 1;56(5):571–3.
56. Craig SL, McInroy L. You Can Form a Part of Yourself Online: The Influence of New Media on Identity Development and Coming Out for LGBTQ Youth. J Gay Lesbian Ment Health. 2014 Jan 1;18(1):95–109.
57. Gilbey D, Morgan H, Lin A, Perry Y. Effectiveness, Acceptability, and Feasibility of Digital Health Interventions for LGBTIQ+ Young People: Systematic Review. J Med Internet Res. 2020;22(12):e20158.
58. The Government of Kenya. The Constitution of Kenya 2010. Kenya: Kenya Law; 2010.

Chapter 6: Providers' Attitudes and Perspectives on Care for TSMSM

Manuscript under review:

Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "We must help them despite who they are…": Healthcare providers' attitudes and perspectives on care for tertiary student men who have sex with men in Nairobi, Kenya. Res Sq [Internet]. 2022. Pre-print available from: https://doi.org/10.21203/rs.3.rs-2411273/v1

(Manuscript under review at *BMC Health Services Research* journal)

Abstract

Background: Young gay, bisexual and other men who have sex with men (YMSM) face disproportionate burdens of sexual, mental and physical ill health compared to young men in the general population and older MSM. This disparity is mainly related to stigma and criminalization of same sex relationships. It is partly also a result of YMSM's perception of limited access to non-judgmental and non-discriminatory health services, and challenges associated with healthcare delivery. We explored the attitudes and perspectives of tertiary institution-based healthcare providers (HCPs) in Nairobi, Kenya as relates to provision of services to tertiary student MSM (TSMSM).

Methods: In September 2021, six in-person focus group discussions (FGDs) were held with 36 HCPs drawn from six public tertiary academic institutions within the Nairobi metropolis. HCPs were drawn from six cadres: front office staff, nurses, clinicians, counselors, laboratory technologists, and pharmaceutical technologists. Discussions were conducted in English, transcribed verbatim and analyzed thematically using NVivo version 12.

Results: Findings revolved around three themes, namely: attitudes of HCPs towards TSMSM, perspectives of HCPs related to service delivery challenges, and possible opportunities for improving care. HCPs demonstrated general readiness and willingness to serve TSMSM, though some acknowledged having attitudes, beliefs and values that would hinder care for TSMSM. HCPs identified religious principles such as the golden rule of "treating others as one would want to be treated" as a facilitator of care for TSMSM. Care delivery challenges reported included inadequate knowledge and skills; HCP versus parental role conflict that tended to divert attention to attempts to 'converting' TSMSM to heterosexual instead of attending to their presenting health needs;

secondary stigma from other HCPs; and failure by TSMSM to disclose same-sex sexual practices. Suggestions for improving care comprised sensitization and training of HCPs, encouraging more HCP interaction with MSM clients, providing TSMSM-friendly and inclusive services, and advocacy for MSM services.

Conclusion: Despite their readiness and willingness to provide services to TSMSM, HCPs faced challenges while doing so, but also offered proposals for improving access and use of services for TSMSM. There is need to sensitize and train HCPs so as to equip them with cultural competencies, skills and knowledge to address the unique health needs of TSMSM. Healthcare settings and services should also be made inclusive and friendly, respectively, to improve access and use by TSMSM.

6.0 Introduction

During the developmental stage of emerging adulthood (18-25 years), individuals establish their identities, develop values, form new relationships with peers and test new levels of independence(1). It is also during this period that experimentation which began in adolescence intensifies, and may involve risky behaviours such as substance use and casual sex(1). For all young people, overindulgence in these risky behaviours may result in harmful effects on their physical, sexual and mental health. Young gay, bisexual and other men who have sex with men (referred to here as YMSM) experience particular social stressors including low levels of parental support(2), school-based victimization(3) and gender role strain(4); factors which in combination with the vulnerabilities of the emerging adulthood developmental phase, act synergistically to compromise their health and well-being(5). As a result, there is evidence to suggest that YMSM are overwhelmingly burdened by psychosocial health disparities that include depression, substance abuse, intimate partner violence, self-harm as well as suicide ideation and attempts(6,7). YMSM are also at increased risk of human immuno-deficiency virus (HIV) and other sexually transmitted infections (STIs) such as chlamydia, gonorrhea and syphilis(8). At the cusp of emerging adulthood (age of 18 years), many students transition from secondary to tertiary educational institutions, where they find themselves in an environment with decreased direct supervision of their behaviour and increased freedom(9). For tertiary student MSM (TSMSM), this involves a sudden exposure to peers with similar sexual orientation and more opportunities and freedom to socialize(10). Subsequently, they may engage in risky behaviours such as

condomless anal sex (CAS), sex work, group sex and substance abuse(11), hence increasing their risk for HIV/STIs infection. Other structural factors such as criminalization of male same-sex intimate sexual behaviour(12), arbitrary arrests and convictions of MSM(13), homophobia(14) as well as violence against MSM(15), work in concert to further negatively impact the health and well-being of YMSM, including TSMSM.

Moreover, the plethora of health challenges experienced by YMSM are amplified by inadequate access to appropriate health services that address the unique health needs of this population(16). At the centre of this inequity in access to healthcare are factors such as discomfort in disclosing and discussing same-sex sexual behaviour with healthcare providers (HCPs)(17), lack of provider knowledge on the unique health needs of YMSM(18), as well as experiences of stigma and discrimination in healthcare settings(19). Disclosing same-sex sexual behaviour to HCPs is important as this may facilitate appropriate healthcare engagement including risk assessment for HIV and other STIs(20,21), but may also lead to experiences of stigma and discrimination from the HCPs, as observed in studies carried out in various countries within sub-Saharan Africa(22–27). Additionally, HCPs in Africa receive limited or no training in sensitive management of the sexual health needs of MSM, further hindering the scope and efficacy of HIV/STIs control measures in this population(28). Within the African continent, debates in the general public about the legality and morality of same-sex practices focus deleterious attention on MSM, thereby compounding the aforesaid barriers to care seeking by MSM and service provision by HCPs(29).

Some of the aforementioned health challenges resonate with our recent HIV/STIs bio-behavioural survey among TSMSM in Nairobi, Kenya(30,31). We estimated HIV prevalence among TSMSM at 3.6% , six times higher than that of young Kenyan men in the general population aged 18-24 years which is 0.6%(32). We also observed pervasive rates of STIs, with more than half (58.8%) of study participants testing positive for at least one of five curable STIs (chlamydia, *Mycoplasma genitalium* infection, gonorrhea, trichomoniasis and syphilis)(33). During qualitative in-depth interviews, TSMSM relayed experiences of prejudice, stigma and discrimination from HCPs when seeking care in public and tertiary institution-based health facilities, but reported being fairly treated in community pharmacies, private and MSM-friendly health facilities(34). In light of these earlier outcomes, there is a critical need to better understand the attitudes and perspectives of HCPs towards provision of care to TSMSM, so as to inform development of interventions aimed at improving healthcare services for TSMSM. In the current study, we sought to assess the attitudes

and perspectives of HCPs towards provision of services to TSMSM, a sub-set of the YMSM population, in Nairobi, Kenya.

6.1 Methods and materials

The study methods are detailed in the published study protocol(30), and summarized below:

6.1.2 Study design and setting

We conducted a qualitative study in which data was collected through focus group discussions (FGDs) with HCPs. FGDs were selected for their demonstrated usefulness in exploratory research in under-researched topics(35), and their effectiveness in helping participants to constructively speak about a research topic that is usually difficult to talk about (36). The study was conducted in Nairobi, the capital city of Kenya, where the preceding studies that estimated the prevalence rates of HIV/STIs and investigated healthcare engagement among TSMSM were conducted(32–34). The capital city and its metropolis is home to approximately 150 campuses of various universities and mid-level colleges(37), some of which have health facilities that serve the student population(38–40).

6.1.3 Participants, sampling and recruitment

HCPs were eligible if they directly provided services to students in a health facility based in a tertiary institution within the Nairobi metropolis, and provided informed consent to participate in the study. HCPs were drawn from the following cadres of staff: health records personnel (who usually work as front office staff and thus have first contact with clients), nurses, clinicians, counselors, pharmaceutical technologists and laboratory technologists. HCPs were approached and recruited purposely through the heads of their health facilities. HCPs were recruited from six public universities that have health facilities which provide services to the student population. One HCP per cadre per site was invited to participate, though some facilities were allowed to nominate two participants from one cadre in cases where they did not have a HCP in another cadre to attend. Thirty-six (36) HCPs took part in the study.

6.1.4 Data collection procedures

Demographic information was collected through a short paper-based survey. The FGD guide was developed by the researchers in line with the aims of the study. The guide covered two main topics, namely attitudes and perspectives of HCPs towards providing care to TSMSM. The FGDs were

held in the month of September 2021, at a private conference centre within the Nairobi central business district. Focus groups were facilitated by the first and second authors, who were each assisted by a co-facilitator who took notes and highlighted areas where the facilitators needed to prompt participants further to obtain deeper and clearer understanding of the discussion topics. A single FGD consisted of HCPs from one cadre to ensure homogeneity, minimize the effects of group power dynamics and encourage more openness during discussions. One FGD was held for every cadre, resulting in six FGDs in total. Six FGDs were deemed adequate since previous research has shown that the most prevalent themes within a dataset can be identified with up to three FGDs(41). Each FGD had five to seven participants, and lasted an average of two hours with a 15 minutes break in between the hours. The FGDs were conducted in English which is the language of instruction in the Kenyan education system. During the discussions, participants were provided with an A4 white paper on which they wrote an allocated number by which they used to refer to one another as the discussions went on, in order to conceal one another's identity. Participants were reassured to feel free to engage, and that there was no right nor wrong answer. They were asked to keep what they heard during the discussions to themselves and not to divulge this outside the group. At the end of every FGD, the facilitators and co-facilitators held a 15-20 minutes debrief session to discuss preliminary findings and identify opportunities for improving subsequent sessions. All FGDs were audio-recorded and transcribed verbatim. The facilitators then read the transcripts while listening to the audio-recordings to ensure that the transcripts were accurate.

6.1.5 Data analysis and reporting

Data was managed using NVivo software version 12 (QSR International). Analysis followed the content analysis theoretical framework which systematically organizes qualitative data in a structured manner(42). Analysis adopted both deductive and inductive approaches where themes set a priori and emerging ones were coded respectively. Coding was done independently by two members of the study team, who then compared codes for agreement until a consensus was reached on whether to merge some codes, get rid of others or come up with new ones. Themes and sub-themes were described and supported with illustrative excerpts from the interviews. Excerpts were attributed to participants using their cadres and sex. Reporting of the study followed the consolidated criteria for reporting qualitative studies (COREQ)(43).

6.1.5 Data trustworthiness

Four criteria (credibility, dependability, transferability and confirmability) were used to ensure trustworthiness of the data(44). For credibility, the study used well-grounded methods for qualitative investigation. Prior to data collection, the first author held meetings with the heads of the tertiary institution-based health facilities to familiarize himself with how the health facilities conducted their operations and the roles played in the continuum of care for students by the HCPs from the different cadres of staff. During these meetings, the heads of the health facilities were also briefed on the findings of the prior HIV/STIs bio-behavioural survey, and qualitative investigation on healthcare engagement among TSMSM(32–34). This helped in obtaining a buy-in from these leaders, whose support was enlisted in recruiting HCPs from their respective facilities to the study. During data collection, iterative investigation was deployed by rephrasing previously asked questions to confirm and obtain deeper understanding of the information provided by participants during their initial responses to questions. Member checking was done "on the spot" by paraphrasing and summarizing what the participants said at intervals and at the end of each topic of discussion, respectively. To address dependability, the study processes have been reported in sufficient detail to enable future researchers reproduce the study, even if not necessarily to obtain similar results. For transferability, details about the study methods have been provided to help comprehend and compare/contrast the findings of this study with those of similar studies. Confirmability has been established by supporting the findings with verbatim quotes from study participants. Additionally, a reflexive approach was used to address positionality(45) of the authors involved in data collection.

6.1.6 Ethical considerations

The study protocol was approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number P990/12/2019). Participants provided written informed consent before taking part in the study. Participants received Kenyan shillings 1,000 (approximately $10 at the time) for travel-related expenses to and from the study site, and were offered refreshments.

6.2 Results

6.2.1 Participants' characteristics

The sociodemographic characteristics of study participants are shown in **Table 6.1**. Majority of the participants were female (63.9%), more than half (52.7%) were between the ages of 25-40 years, and most (94.4%) indicated Christianity as the religion they most closely identified with. Distribution across cadres was almost similar with each cadre having 5-7 participants. More than half (55.5%) had a bachelor's degree or higher. More than half (52.8%) had a work experience of 11-20 years post-first college graduation, with a similar proportion having worked in a tertiary institution-based health facility for 6-10 years, indicating that a significant proportion had worked in a place other than a tertiary institution-based health facility.

Table 6.1: Sociodemographic characteristics of healthcare providers (N=36)

Variable	**Category**	**n (%)**
Sex	Female	23 (63.9)
	Male	13 (36.1)
Age in years	25-40	19 (52.7)
	41-50	17 (47.3)
Religion	Christianity	34 (94.4)
	Islam	2 (5.6)
Cadre	Clinician	7 (19.4)
	Nurse	7 (19.4)
	Counsellor	6 (16.7)
	Health records information officer (front office)	6 (16.7)
	Laboratory technologist	5 (13.9)
	Pharmaceutical technologist	5 (13.9)
Highest level of education attained	Diploma	12 (33.3)
	Higher national diploma	4 (11.1)
	Bachelor's degree	17 (47.2)
	Master's degree	3 (8.3)
Work experience in years since first qualification from college/university	1-10	9 (25.0)
	11-20	19 (52.8)
	Above 20	8 (22.2)
Work experience in years in a tertiary institution-based health facility	1-5	8 (22.2)
	6-10	19 (52.8)
	11-20	9 (25.0)

6.2.2 Attitudes towards provision of services to TSMSM

A majority of HCPs noted that they were professionally trained and had a duty to offer services to, and treat all clients equally, in spite of the clients' sexual orientation and/or behaviour. As such, they perceived themselves as having a positive attitude towards providing care to TSMSM.

> "As health workers, we have to accept these people (TSMSM) as our clients and treat them the way we treat other clients and give them help as we ought to, because when we were trained, we were not told that we should only treat those who we think are straight. So I think our attitude is positive because these are people who have come for help and we must help them despite who they are." – Clinician, female

Most HCPs also noted that they had no beliefs nor opinions that would hinder them from offering services to TSMSM, as long as they had the requisite resources to offer the services.

> "Personally, I think there is no belief or opinion that will hinder me from offering services to such a person (TSMSM) because I don't see the reason why they shouldn't be able to get services. I wouldn't be uncomfortable in any way, so long as I have everything that I need to help such a person, I will do it." – Laboratory technologist, female

However, some HCPs observed that homosexuality was against their personal values, as well as cultural and religious beliefs. Nevertheless, they were able to compartmentalize their values and beliefs on one side and their professional obligation to offer services on the other. In doing so, they were able to offer services to MSM, and treat them with dignity.

> "Professionally, I would serve this patient the way I would serve any other patient. Ethically, how we have been brought up and according to my own judgement, whatever this person is doing (having sex with other men) is not right. Still, I would treat this patient with the dignity they deserve." – Front office staff**,** male

> "My Christianity background does not allow me to accept that (homosexuality) as a way of life… I believe even Muslims don't accept it. But I have agreed that I'll bend backwards to accommodate the other person because of my profession… to do the best that I can to help where I can." **–** Pharmaceutical technologist, female

Notably, some HCPs noted that in fact it is the application of religious values such as the 'golden rule' (treating others the way one would like to be treated), and accepting those rejected by society,

that had helped them come to a place where they were comfortable providing services to TSMSM without judging.

> "I have come to accept everybody the way they are … and to do unto others what I would like to be done unto me. So I just assist where I can and without judgment." – Clinician, female

> "I am guided by Christian principles because the person who I follow, the Christ, was a person who basically came here for those people who were considered the scum of the earth. So, I act in a very professional manner so that no kind of prejudice comes up, and give the service that is due to them (TSMSM)." – Nurse, male

Nevertheless, some HCPs who strongly held to their beliefs emphasized the importance of keeping those beliefs, but acknowledged the need to change judgmental attitudes towards TSMSM, and seeking to understand TSMSM and their needs, so as to facilitate better service provision.

> "Changing what I believe because of someone's behaviour (same-sex sexual behaviour) is a no. I think what needs to be changed is the attitude… we need to be open minded and instead of judging them (TSMSM), seek to understand them." – Front office staff, female

Of note, while HCPs were aware of the criminalization of same-sex sexual behaviour in the Kenyan law, this did not appear to be a hindrance to offering services to TSMSM clients. HCPs were clear of their responsibility to provide services to all in an equitable manner, drawing on the analogy of other 'criminals' that they usually attend to. They also noted that they had no role with the criminal part of clients' same-sex sexual behaviour, but their interest was in handling the health problem at hand.

> "If a student came to you after getting beaten for stealing, are you going to apply the same principle and say stealing is illegal and so I am not going to treat you? Or does it just apply to TSMSM? No. You have to treat everyone equally. Ours is to offer the services as we are required to do. The criminal part is really none of our business." – Front office staff**,** male

6.2.3 Challenges in providing services to MSM

It emerged that HCPs faced various challenges when providing services to MSM, challenges which fell into five major categories as described below:

Inadequate knowledge and skills to serve TSMSM clients

Despite their willingness and readiness to provide services to TSMSM clients, HCPs noted that they felt limited by lack of the requisite knowledge and skills, for instance in the occurrence and management of anal STIs among TSMSM. They attributed this to the little pre-service training that is offered on addressing health issues faced by clients with same-sex sexual behaviour.

> "I have always felt I am incapable in terms of knowledge and skills... I don't feel I have the capacity to integrate MSM services into my daily work, I find I am incapable because the knowledge that is given to us in college is very minimal and so sketchy. For instance, I never heard about anal STIs in college." – Nurse, female

Parental/provider role conflict

With the perception that same-sex sexual behaviour was deviant, older and mostly female HCPs felt conflicted between their roles as parents and HCPs. They assumed a parental role over TSMSM and felt the need to ask them to stop same-sex sexual behaviour and convert to the socially accepted heterosexual behaviour. However, HCPs on the recognition of their professional obligation to provide care were able to separate their parental and HCP roles, and thus provide services to TSMSM in a non-judgmental manner.

> "The first time I met these guys (TSMSM), I was left wondering, "what if this was my son? Will I encourage him to continue with whatever he is doing (having sex with men), or ask him to stop?" It was a challenge to me and I felt bad. But later on, I realized I am a counsellor and from there on I learned how to walk with them without judging." – Counselor, female

Focusing on "converting" TSMSM at the expense of attending to their health needs

Once they learnt of a client's same-sex sexual behaviour, some HCPs expressed a desire and attempts to 'convert' TSMSM clients to being heterosexual. The HCPs did this at the expense of addressing the health needs, which may not have been related to the client's same-sex sexual behaviour. In the process, HCPs were likely to be overly inquisitive about the sexual behaviour of TSMSM, asking sensitive questions, not to help the client but to satisfy their curiosity.

> "But what I have realized, in the counselling centre, mostly, the first thing we do with MSM is trying to convert them (to heterosexual). We try to make them feel that this

behaviour (same-sex) is not right, even if they have come to seek help for unrelated issues. Maybe they just have general issues like any other client, but you find that we want to know, what is this? How did you become? When did you start? We start asking these type of questions for our own benefit, not for their needs." – Counselor, female

Experiences of secondary stigma from other HCPs

It also became evident that HCPs were concerned about negative attitudes or discrimination from their colleagues, if these HCPs were constantly sought out by TSMSM clients. To avoid this secondary stigma, the TSMSM-friendly HCPs were occasionally forced to attend to TSMSM clients at health facilities outside the institutions.

"You fear. How will the other staff see me if I am interacting with these people (TSMSM) so much? Will they misjudge me and say I am also gay? So that hinders us sometimes from caring for these students and sometimes we might give them an appointment somewhere else outside the university clinic." – Nurse, male

Failure by TSMSM to disclose same-sex sexual behaviours to HCPs

Due to the non-acceptance of MSM in society, HCPs noted that it was difficult for TSMSM to seek care. When they did, TSMSM were unwilling to disclose that they had engaged in same-sex sexual practices. This, the HCPs felt limited their ability to offer optimum care to TSMSM clients.

"Because MSM are not accepted in the society, they find it very hard to seek medical attention and even if they do, they are not willing to come out clean (disclose they had sex with another man) so that you can help them appropriately." **–** Clinician, female

6.2.4 Proposals for improving health services for TSMSM

Participants suggested various strategies that could be deployed to improve access to and use of health services by TSMSM. Analysis revealed five strategies targeted at providers, facilities, TSMSM clients and the public.

Sensitization and training of HCPs on healthcare needs of TSMSM

The need to sensitize HCPs on how to handle TSMSM within the academic institutions was highlighted. It was noted that HCPs need to treat TSMSM in a non-prejudicial and non-stigmatizing manner, so that TSMSM would feel free to seek services.

> "We need to sensitize staff that some of our students are MSM and we need to embrace them... when they come to your office don't judge them, just serve them the way they come… because they are really stigmatized. If we continue to judge and stigmatize them, then they might not want to come to seek help." – Clinician**,** male

In addition, HCPs pointed out that they needed to be trained on the healthcare needs of TSMSM and how to treat them when they come to seek care.

> "We need to be trained on MSM, how to treat them based on their health needs so that when they come to the clinic, even the health worker who is going to attend to them knows what to do." – Nurse, female

Encouraging more HCP interaction with MSM clients

HCPs felt that more interaction with MSM in the line of duty would be helpful in changing their attitudes towards MSM, and fostering an understanding that MSM have a right to be who they are.

> "I think time can make us change our opinions and attitudes. Because, as time goes by, you encounter more MSM than the ones you have encountered before, and also get to understand that it is their human right to have whatever sexual orientation they have." **–** Laboratory technologist, female

Reaching out to TSMSM

HCPs observed that it was paramount to reach out to prospective and continuing students with messages that TSMSM were welcome to seek health services within the institutions. The orientation program for first year students was underscored as an apt opportunity to pass this information.

> "During our orientation programs, we usually share about various issues with the students who are coming in because they are coming into a place where there is freedom and they have these kind of things happening… MSM, lesbianism and all that… So I think one of the things we can improve is to tell them that in our clinics we do not discriminate against them, so that they don't miss an opportunity for healthcare because they're afraid of how they will be perceived if they come to seek help." **–** Nurse, male

The other outreach strategy that was suggested was the use social media to deliver creative messages inviting TSMSM to seek services. This would be an appropriate avenue since students in general are ardent users of social media.

> "We should come out creatively through the social media. It is the easiest way because they actually identify with social media and use it a lot. We can be sending some attractive messages to encourage them (TSMSM) to come out and access services." – Counselor, female

Offering TSMSM-friendly health services

Participants conceptualized TSMSM-friendly health services as comprising three components: having friendly HCPs, offering integrated services, and creating an inclusive climate. HCPs noted that when TSMSM were treated well at the clinic, they referred their partners and friends to visit the health facilities and look out for the TSMSM-friendly HCPs.

> "By being friendly to them (TSMSM) and serving them well, they realize they are not rejected. They feel "yes, I can come if I need help." In turn, they normally tell their friends and partners that, "if you go, ask for so and so" because they know that they will get friendly services from this person." – Counselor, female

One HCP gave an example of how their friendliness resulted in many TSMSM being referred to them for treatment of anal warts, even from other universities.

> "I once treated one who had perianal warts. I knew it was an STI so I didn't bother to ask him many questions about how he got the warts. I just treated him and followed up with him until he recovered fully. After that, they started coming in so many even from other universities. I just treated all of them. Some of the warts were really bad. I imagined how hard it must have been for them to access treatment out there. So I just did what I could to help." – Clinician, male

While it could be tempting to segregate services for TSMSM in a bid to improve quality, HCPs felt keeping services integrated is better in terms of maintaining anonymity.

> "If somebody is an MSM and you have a youth-friendly clinic where most services are integrated, it can be a solution to encourage MSM to seek services as nobody will know what they are coming for except the MSM and providers." – Nurse, male

Further, having an inclusive climate was proposed as one of the ways of increasing uptake of services by TSMSM. First, HCPs suggested having information, educational and communication materials in the health facilities that spoke to the needs of TSMSM and not just those of heterosexual students.

> "Do they (TSMSM) feel comfortable? Do they feel welcome? For example, the posters that we put in our clinics? Are they inclusive, or just for straight people? Or do they read the message that "here I think we are not needed". So the setup of our clinics needs to be inclusive." – Pharmaceutical technologist, female

Second, HCPs suggested collecting data on sexual practices during on-campus health camps. By having a section in data forms that asks if the student has same-sex sexual relations, the attending HCP would know that they are attending to a TSMSM. This could also make TSMSM feel recognized, which could possibly encourage them to seek services at the health facilities in future.

> "I think to encourage MSM to come for services, maybe during the campus outreaches we hold, we can have questionnaires then students can fill them out as they come for testing (for HIV). You can have a question that asks 'if you are a man who has sex with men'… or something like that. So, instead of us guessing whether they are MSM, if we can include some of those questions in those questionnaires, then maybe they can come out and access the services even after the outreaches are over." – Laboratory technologist, female

Awareness creation and advocacy for MSM services

HCPs suggested vigorous awareness creation and advocacy efforts, akin to those at the onset of the HIV epidemic which created awareness about the epidemic at all levels of society and made several calls for action geared towards responding to the epidemic. This could increase the acceptance of MSM and at the institutional level, and reassure TSMSM that they are free to seek health services.

> "Perhaps the approach should be like how it was with HIV. It's been through years of training, political goodwill, policy changes and even being outspoken at the grassroots in mosques and churches… so that MSM know they are accepted, they are not stigmatized and they can seek services." – Clinician, male

6.3 Discussion

Our study of healthcare services for TSMSM at tertiary educational institutions revealed three main themes, namely healthcare providers' attitudes towards TSMSM, service delivery challenges, and opportunities for improving care. The attitudes of HCPs towards TSMSM were mixed, with majority articulating positive attitudes. The expression of positive and/or negative attitudes in our study did not seem to follow a gender nor age pattern, with both positive and/or negative attitudes being expressed by male and female, as well as younger and older HCPs. Challenges encountered included inadequate knowledge about the health needs of TSMSM and skills to address these needs, parental versus HCP role conflict that tends to divert attention to attempts to converting TSMSM to heterosexual instead of attending to their presenting health needs, secondary stigma from other HCPs, and failure by TSMSM to disclose same-sex behaviour. Proposals for improving care focused on: sensitization and training of HCPs on how to provide non-stigmatizing and competent care to YMSM, encouraging more HCP interaction with MSM clients, reaching out to TSMSM, providing TSMSM-friendly services and advocating for MSM services.

Our finding that majority of HCPs had an overall positive attitude towards TSMSM, and no beliefs nor values that would hinder them from providing care to TSMSM, was similar to a study conducted among HCPs in Malawi in 2019(46). Some HCPs in our study noted that while they did not accept homosexuality as a way of life, they were still able to put aside their personal beliefs, biases and values and respond to their duty of providing care to TSMSM. Besides their professional call of duty, HCPs were motivated to provide care to TSMSM because "TSMSM are human beings who have a right to access care like any other person", despite the criminalization of same-sex sexual behaviour in Kenya. This finding is similar to studies in other settings such as South Africa(47), though in the South African study this affirmation of the rights of MSM was made by HCPs after a sensitivity training, in a setting where same-sex sexual behaviour is not criminalized. Countries such as Kenya can therefore learn lessons from what has been done to improve care for MSM in other African countries such as South Africa where same-sex sexual behaviour is not illegal.

Although majority of HCPs reported positive attitudes towards TSMSM and demonstrated willingness and readiness to serve them, some of the terms used by HCPs in reference to TSMSM

such as “these people” may suggest othering of MSM, and possibly underlying negative attitudes towards MSM. As well, our findings from previous work suggest that TSMSM largely reported experiences of stigma and discrimination when they sought services from the institution-based health facilities(34). It could be that the setting of FGDs may have introduced social desirability bias, where HCPs may have under or over reported their perspectives on care for TSMSM, based on how they gauged the reactions of other HCPs during the discussions. Alternatively, perhaps the discussions offered HCPs a safe space to reflect on their attitudes and previous handling of TSMSM, balance this against their professional duty of care, and hence report positive attitudes. Regardless, the positive attitudes reported by HCPs can be harnessed to improve services for TSMSM, especially if the HCPs are sensitized and trained to identify and respond to the healthcare needs of TSMSM. Though some HCPs demonstrated knowledge and ability to address the healthcare needs (such as anal STIs) of TSMSM, other HCPs indicated they had never “heard of anal STIs in college”. The lack of pre-service training on the health needs of non-heterosexual individuals and how to respond to these needs was reported in the current study, and has also been observed in other studies in Kenya, Uganda and Tanzania(48–50). Evidence from Kenya and South Africa suggests that sensitization and training reduces homo-prejudice and improves knowledge and skills of HCPs (47,51–53), and should hence be considered for adoption and scale-up.

Religious beliefs also influenced the way HCPs handled TSMSM. Rejection of same-sex practices by various religions can negatively impact healthcare for MSM(54), and indeed in the current study, most HCPs acknowledged that their religions do not accept nor condone homosexuality and this was the basis of the HCPs not accepting homosexuality too. However, most HCPs indicated capacity to compartmentalize their religious beliefs and duty to care, and in so doing were able to provide services to TSMSM in a way the HCPs felt was non-prejudicial. Interestingly, some HCPs noted that their agreeability to provide care for TSMSM was based on religious values such as the ‘golden rule’ (treating others the way one would want to be treated) and accepting those shunned by society. Given that religion is deeply set in society(55), we suggest that this positive religious effect can be leveraged to stimulate more accommodating HCP attitudes that can facilitate quality and equitable care for TSMSM.

Cultural factors also emerged as a challenge to provision of care. Participants reported a conflict between their dual roles as HCPs and parents, sometimes resulting in them viewing TSMSM as their children who should not be having sex, and who should be converted to the culturally and

socially accepted heterosexual orientation. The view of young people by HCPs as immature and not old enough to seek sexual and reproductive health services has also been found to be an age-related barrier in a study among students at a tertiary academic institution in South Africa(56). Even in countries where same-sex sexual behaviour is not criminalized such as the USA, one study showed that YMSM are not only told that they are too young to have sex, but are also dissuaded from having sex with men and instead encouraged to get themselves girlfriends(18). Programs are needed to create awareness among HCPs that existing 'therapies' to change sexual orientation lack medical merit, and create an environment in which prejudice, stigma and discrimination thrive, thus threatening the health of sexual minorities(57), including TSMSM. Secondary stigmatization of MSM-friendly HCPs by fellow HCPs calls for more efforts in sensitization and training geared towards achieving a critical mass of MSM-friendly HCPs. As suggested by HCPs in this study, more encounters with MSM clients could be helpful in fostering positive attitudes. Considerations should thus be made to offer HCPs in tertiary institution-based health facilities, the opportunity to work in MSM-friendly clinics so as to acquire hands-on experience with serving MSM clients.

HCPs suggested a range of approaches to address the challenge of non-disclosure of same-sex sexual behaviour. As a first step, HCPs proposed reaching out to TSMSM through the orientation program for new students, and using social media channels for continuing students, in order to improve access and use of services. The World Health Organization (WHO) recommends that proven youth-friendly services are adapted for YMSM, by including components pertinent for reaching and providing services to YMSM(58). Though TSMSM may have unique healthcare needs, having a specialized clinic or clinic day at the health facilities would likely be counterproductive and keep them away from seeking services. Instead, having services for TSMSM integrated with services for the general student population would be ideal, since TSMSM could walk in and receive the services they needed with their privacy and confidentiality maintained. Since disclosure poses the risk of stigma and discrimination (22–27), future research should explore TSMSM perspectives about disclosing same-sex sexual behaviour to HCPs, and how TSMSM would like to be supported if they needed to disclose. As well, adapting youth-friendly services to be TSMSM-friendly services will likely require the involvement of both health facility managers and HCPs, since the HCPs cannot do this on their own without the approval and support of the managers. To address the challenge of non-acceptance of MSM in society, HCPs

recommended increased and sustained awareness creation and advocacy at various levels of the society. HCPs in this study were aware of the criminalization of same-sex sexual practices under the Kenyan law, but this did not seem to affect their willingness and readiness to offer services to TSMSM. Perhaps then this provides an environment that can be leveraged to create awareness about the health needs of TSMSM, and thus hopefully empower TSMSM with this knowledge to facilitate their seeking and access to services when they need to.

Our study had some limitations as well as strengths. In terms of limitations, study participants were drawn from health facilities in public tertiary institutions within the Nairobi metropolis. As a result, the views of these HCPs may not represent the views of HCPs from private tertiary institutions, as well as health facilities outside tertiary institutions, and other geographical settings in the country. However, we note that most participants had previously worked in health facilities outside the tertiary institutions and their experiences from those health facilities may have enriched the discussions. Strength wise, including HCPs of six different cadres enabled us to obtain a wider range of views, compared to other studies which mostly focus on clinicians and nurses only. This is important since all these cadres of HCPs interact with TSMSM, and how TSMSM are handled at various points of services from the time they enter and leave the health facility, determines how well they are able to engage with healthcare services and their likelihood of return. Overall, the study offers valuable lessons on the attitudes and perspectives of HCPs towards care, and what can be done to improve access and use of healthcare services for TSMSM.

6.4 Conclusion

A majority of HCPs were generally cognizant of their duty of care to TSMSM, but encountered challenges in providing services. There is urgent need to sensitize and train HCPs in tertiary academic institution-based health facilities so as to equip them with the cultural competencies, knowledge and skills required to address the unique healthcare needs of TSMSM. This should go along with increasing opportunities for more interactions between HCPs and MSM, and advocacy for improved health access for MSM. Sexual and reproductive health services offered to the student community should also be made friendly and inclusive for TSMSM.

References

1. Arnett JJ. Emerging Adulthood: A Theory of Development From the Late Teens Through the Twenties. Am Psychol. 2000;55(5):469–80.
2. Needham BL, Austin EL. Sexual Orientation, Parental Support, and Health During the Transition to Young Adulthood. J Youth Adolesc. 2010;39(10):1189–98.
3. Toomey RB, Russell ST. The Role of Sexual Orientation in School-Based Victimization: A Meta-Analysis. Youth Soc. 2013;48(2):176–201.
4. Fields EL, Bogart LM, Smith KC, Malebranche DJ, Ellen J, Schuster MA. "I Always Felt I Had to Prove My Manhood ": Homosexuality, Masculinity, Gender Role Strain, and HIV Risk Among Young Black Men Who Have Sex With Men. Am J Public Health. 2015;105(1):122–31.
5. Halkitis PN, Maiolatesi AJ, Krause KD. The Health Challenges of Emerging Adult Gay Men: Effecting Change in Health Care. Pediatr Clin North Am. 2020;67:293–308.
6. Mustanski B, Andrews R, Herrick A, Stall R, Schnarrs PW. A Syndemic of Psychosocial Health Disparities and Associations With Risk for Attempting Suicide Among Young Sexual Minority Men. Am J Public Health. 2014;104(2):287–94.
7. Wilson C, Cariola LA. LGBTQI+ Youth and Mental Health: A Systematic Review of Qualitative Research. Adolesc Res Rev. 2020;5(2):187–211.
8. Koedijk FD, Van Benthem BH, Vrolings EM, Zuilhof W, Van Der Sande MA. Increasing sexually transmitted infection rates in young men having sex with men in the Netherlands, 2006-2012. Emerg Themes Epidemiol. 2014;11(1):12.
9. Fromme K, Corbin WR, Kruse MI. Behavioral Risks During the Transition From High School to College. Dev Psychol. 2008;44(5):1497–504.
10. Renn K. LGBTQ Students on Campus: Issues and Opportunities for Higher Education Leaders [Internet]. Higher Education Today. 2017 [cited 2021 Jun 10]. Available from: https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/.
11. Fan S, Yang Z, Hou F, Yu M, Luo Z, Liao M, et al. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: A systematic review and meta-analysis. Sex Health. 2019;16(6):554–65.
12. Lucas Ramon M, Kellyn B, Rafael Carrano L, Enrique López de la P, Ilia S, Daron T. State-Sponsored Homophobia 2020: Global Legislation Overview Update. Geneva, ILGA; 2020.

13. Santos G, Makofane K, Arreola S, Do T, Ayala G. Reductions in access to HIV prevention and care services are associated with arrest and convictions in a global survey of men who have sex with men. Sex Transm Infect. 2017;93:62–4.
14. Semugoma P, Nemande S, Baral SD. The irony of homophobia in Africa. Lancet. 2012;380(9839):312–4.
15. Bhattacharjee P, Morales GJ, Kilonzo TM, Dayton RL, Musundi RT, Mbole JM, et al. Can a national government implement a violence prevention and response strategy for key populations in a criminalized setting ? A case study from Kenya. J Int AIDS Soc. 2018;21(S5):109–14.
16. Beck J, Santos G-M, Ayala G. Young Men Who Have Sex with Men : Health, Access , and HIV. The Global Forum on MSM and HIV (MSMGF); 2013.
17. Brooks H, Llewellyn CD, Nadarzynski T, Pelloso FC. Sexual orientation disclosure in health care: a systematic review. Br J Gen Pract. 2018;68(668):e187–96.
18. Griffin M, Krause KD, Kapadia F, Halkitis PN. A Qualitative Investigation of Healthcare Engagement Among Young Adult Gay Men in New York City: A P18 Cohort Substudy. LGBT Heal. 2018;5(6):368–74.
19. Logie CH, Lacombe-duncan A, Brien N, Jones N, Lee-foon N, Levermore K, et al. Barriers and facilitators to HIV testing among young men who have sex with men and transgender women in Kingston , Jamaica : a qualitative study. J Int AIDS Soc. 2017;20(1):21385.
20. Metheny N, Stephenson R. Disclosure of Sexual Orientation and Uptake of HIV Testing and Hepatitis Vaccination for Rural Men Who Have Sex With Men. Ann Fam Med. 2016;14(2):155-158.
21. Kokogho A, Amusu S, Baral SD, Charurat ME, Adebajo S, Nowak RG, et al. Disclosure of Same - Sex Sexual Practices to Family and Healthcare Providers by Men Who Have Sex with Men and Transgender Women in Nigeria. Arch Sex Behav. 2021;50(4):1665–76.
22. Risher K, Adams D, Sithole B, Ketende S, Kennedy C, Mnisi Z, et al. Sexual stigma and discrimination as barriers to seeking appropriate healthcare among men who have sex with men in Swaziland. J Int AIDS Soc. 2013;16(Suppl 2):1–9.
23. Wanyenze RK, Musinguzi G, Matovu JKB, Kiguli J, Nuwaha F, Mujisha G, et al. “If You Tell People That You Had Sex with a Fellow Man, It Is Hard to Be Helped and Treated ” : Barriers and Opportunities for Increasing Access to HIV Services among Men Who Have

Sex with Men in Uganda. PLoS One. 2016;11(1):1–19.

24. Kushwaha S, Lalani Y, Maina G, Ogunbajo A, Wilton L, Agyarko-Poku T, et al. “but the moment they find out that you are MSM ⋯”: a qualitative investigation of HIV prevention experiences among men who have sex with men (MSM) in Ghana’s health care system. BMC Public Health. 2017;17(770).
25. Rispel LC, Metcalf CA, Cloete A, Moorman J, Reddy V, Moormand J. You become afraid to tell them that you are gay: Health service utilization by men who have sex with men in South African cities. J Public Health Policy. 2011;32(Supplement 1):137–51.
26. Duby Z, Nkosi B, Scheibe A, Brown B, Bekker L-G. ‘Scared of going to the clinic’: Contextualising healthcare access for men who have sex with men, female sex workers and people who use drugs in two South African cities. South Afr J HIV Med. 2018;19(1):701.
27. Lane T, Mogale T, Struthers H, Mcintyre J, Kegeles SM. “They see you as a different thing”: The Experiences of Men Who Have Sex with Men with Health Care Workers in South African Township Communities. Sex Transm Infect. 2009;84(6):430–3.
28. Beyrer C, Sullivan PS, Sanchez J, Dowdy D, Altman D, Trapence G, et al. A call to action for comprehensive HIV services for men who have sex with men. Lancet. 2012;380(9839):424–8.
29. Elst EM Van Der, Kombo B, Gichuru E, Omar A, Musyoki H, Graham SM, et al. The green shoots of a novel training programme: progress and identified key actions to providing services to MSM at Kenyan health facilities. J Int AIDS Soc. 2015;(18):20226.
30. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol. Front Public Heal. 2021;9:619694.
31. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. “My Friends Would Believe My Word”: Appropriateness and Acceptability of Respondent-Driven Sampling in Recruiting Young Tertiary Student Men Who Have Sex with Men for HIV/STI Research in Nairobi, Kenya. Int J Environ Res Public Health. 2022;19(12):7331.
32. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi, Kenya: a respondent-driven sampling survey. AIDS Res Ther. 2023;20:7.

33. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. Prevalence of five curable sexually transmitted infections and associated risk factors among tertiary student men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey. Sex Health. 2023;20(2):105–17.
34. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. Res Sq [Internet]. 2022; Available from: https://www.researchsquare.com/article/rs-1994768/v1.
35. Frith H. Focusing on Sex: Using Focus Groups in Sex Research. Sexualities. 2000;3(3):275–97.
36. Morgan DL, Krueger RA. When to Use Focus Groups and Why. In: Morgan DL, editor. Successful Focus Groups: Advancing the State of the Art. Thousand Oaks: SAGE Publications, Inc.; 2013. p. 3–19.
37. Study in Kenya. Universities and Colleges in Nairobi County [Internet]. 2021 [cited 2022 Jun 24]. Available from: https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1.
38. University of Nairobi. University of Nairobi Health Services [Internet]. [cited 2022 Apr 29]. Available from: http://healthservices.uonbi.ac.ke/.
39. Kenyatta University. Kenyatta University Health Unit [Internet]. [cited 2022 Apr 29]. Available from: http://www.ku.ac.ke/healthunit/.
40. Jomo Kenyatta University of Agriculture and Technology. Jomo Kenyatta University of Agriculture and Technology Health Services Department [Internet]. [cited 2022 Apr 29]. Available from: http://www.jkuat.ac.ke/departments/hospital/.
41. Guest G, Namey E, McKenna K. How Many Focus Groups Are Enough? Building an Evidence Base for Nonprobability Sample Sizes. Field methods. 2017;29(1):3–22.
42. Liamputtong P. Qualitative Research Methods. 5th ed. Docklands, Victoria, Australia: Oxford University Press; 2020.
43. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Heal Care. 2007;19(6):349–57.
44. Shenton AK. Strategies for ensuring trustworthiness in qualitative research projects. Educ

Inf. 2004;22(2):63–75.

45. Holmes AGD. Researcher positionality: a consideration of its influence and place in qualitative research. Shanlax Int J Educ. 2020;8(4):1–10.
46. Kapanda L, Jumbe V, Izugbara C, Muula AS. Healthcare providers' attitudes towards care for men who have sex with men (MSM) in Malawi. BMC Health Serv Res. 2019;19:316.
47. Duby, Zoe; Fong-Jaen, Francisco; Nkosi, Busisiwe; Brown, Benjamin; Scheibe A. ' We must treat them like all the other people': Evaluating the Integrated Key Populations Sensitivity Training Programme for Healthcare Workers in South Africa. South Afr J HIV Med. 2019;20(1):a909.
48. Taegtmeyer M, Davies A, Mwangome M, Elst EM Van Der, Graham SM, Price MA, et al. Challenges in Providing Counselling to MSM in Highly Stigmatized Contexts : Results of a Qualitative Study from Kenya. PLoS One. 2013;8(6):e64527.
49. Matovu JKB, Musinguzi G, Kiguli J, Nuwaha F, Mujisha G, Musinguzi J, et al. Health providers' experiences, perceptions and readiness to provide HIV services to men who have sex with men and female sex workers in Uganda - A qualitative study. BMC Infect Dis. 2019;19:214.
50. Mgopa LR, Rosser BRS, Ross MW, Lukumay GG, Mohammed I, Massae AF, et al. Cultural and clinical challenges in sexual health care provision to men who have sex with men in Tanzania: a qualitative study of health professionals' experiences and health students' perspectives. BMC Public Health. 2021;21:676.
51. Elst EM Van Der, Gichuru E, Omar A, Kanungi J, Duby Z, Midoun M, et al. Experiences of Kenyan healthcare workers providing services to men who have sex with men : qualitative findings from a sensitivity training programme. J Int AIDS Soc. 2013;16(Suppl 3):18741.
52. Elst EM Van Der, Smith AD, Gichuru E, Wahome E, Musyoki H, Muraguri N, et al. Men who have sex with men sensitivity training reduces homoprejudice and increases knowledge among Kenyan healthcare providers in coastal Kenya. J Int AIDS Soc. 2013;16(Suppl 3):18748.
53. Scheibe AP, Duby Z, Brown B, Sanders EJ, Bekker L-G. Attitude shifts and knowledge gains: Evaluating men who have sex with men sensitisation training for healthcare workers in the Western Cape, South Africa. South Afr J HIV Med. 2017;18(1):a673.

54. Mbote DK, Sandfort TGM, Waweru E, Zapfel A. Kenyan Religious Leaders' Views on Same-Sex Sexuality and Gender Nonconformity: Religious Freedom versus Constitutional Rights. J Sex Res. 2018;55(4–5):630–41.
55. Gichuru E, Kombo B, Mumba N, Sariola S, Sanders EJ, van der Elst EM. Engaging religious leaders to support HIV prevention and care for gays, bisexual men, and other men who have sex with men in coastal Kenya. Crit Public Health. 2018;28(3):294–305.
56. Alli F, Maharaj P, Vawda MY. Interpersonal relations between health care workers and young clients: Barriers to accessing sexual and reproductive health care. J Community Health. 2013;38:150–5.
57. Pan American Health Organization/World Health Organization. "Therapies" to change sexual orientation lack medical justification and threaten health. Washington DC: PAHO/WHO; 2012.
58. World Health Organization (WHO). HIV and young men who have sex with men: Technical brief. Geneva, Switzerland: WHO; 2015.

Chapter 7: Conclusion

This chapter summarizes the key research findings in relation to the research aims. It also discusses the contribution and limitations of the study, outlines implications on policy and practice, and recommends opportunities for future research.

In chapter 1, a literature survey on the existing knowledge on the topic of study was provided, concluding with a statement of the research gaps the current study aimed to fill. In chapter 2, formative research demonstrated that the RDS method was both appropriate and acceptable for recruiting TSMSM into a HIV/STIs bio-behavioural survey. The challenges that would be anticipated from using RDS, as well as possible solutions to these challenges were considered. In chapter 3, HIV prevalence of 3.6 % (95 % CI: 1.3% - 6.0%) among TSMSM was observed, and was independently associated with studying in private institutions, preferring a sex partner of any age, last sex partner being >25 years, meeting the last sex partner online and prevalent gonorrhea infection. In chapter 4, prevalence of at least one of the five STIs at any anatomic site, chlamydia, gonorrhea, *Mycoplasma genitalium* infection, trichomoniasis and latent syphilis were 58.8% (95% CI: 50.4 – 67.3), 51.0% (95% CI: 42.3-59.8), 11.3% (95% CI: 6.1-16.5), 6.0% (95% CI: 2.6-9.4), 1.5% (95% CI: -0.3-3.3) and 0.7% (95% CI: -0.1 – 1.5), respectively. Inconsistent condom use, and the last sex partner being a regular partner were independently associated with testing positive for at least one of the five curable STIs at any anatomic site.

In chapter 5, the experiences of TSMSM with healthcare engagement were explored. Findings showed that TSMSM experienced prejudice, stigma and discrimination in public and institution-based health facilities, but felt they were attended to more equitably in community pharmacies, private and MSM-friendly health facilities. Healthcare needs prioritized by TSMSM centered on issues around sexual and mental health. TSMSM desired to have HCPs who were empathetic, non-judgmental and knowledgeable about the unique healthcare needs of MSM. TSMSM also highlighted the usefulness of digital media in offering telehealth doctor consultations and health education on subjects such as prevention of HIV/STIs. In chapter 6, the attitudes and perspectives of HCPs towards care for TSMSM were assessed. HCPs demonstrated general readiness and willingness to serve TSMSM, though some acknowledged having attitudes, beliefs and values that would hinder care for TSMSM. HCPs identified religious principles such as the golden rule of "treating others as one would want to be treated" as a facilitator of care for TSMSM. Care delivery

challenges reported included inadequate knowledge and skills; HCP versus parental role conflict that tended to divert attention to attempts to 'converting' TSMSM to heterosexual instead of attending to their presenting health needs; secondary stigma from other HCPs; and failure by TSMSM to disclose same-sex sexual behaviour. Suggestions for improving care comprised sensitization and training of HCPs, encouraging more HCP interaction with MSM clients, providing TSMSM-friendly and inclusive services, and advocacy for MSM services.

These findings have implications for policy, practice and future research. The formative research was a practical way of gaining entry into a young marginalized population, ensuring that the views and voices of prospective study participants were incorporated into the design of the subsequent HIV/STIs bio-behavioural survey. It is recommended that researchers should consider the value of formative research in designing studies aiming to reach young marginalized populations, who in most cases are underrepresented in research despite experiencing disproportionate burdens of sexual, physical and mental ill health. The alarmingly high rates of HIV/STIs call for urgent prevention, treatment and control interventions among TSMSM. Such interventions should target increasing HIV testing through strategies such as HIV self-testing, screening for STIs using point-of-care tests, HIV/STIs prevention through condom use, PrEP for HIV prevention, and HIV/STIs treatment. More so, TSMSM should be educated on the risk of age-disparate and stable relationships that put them at increased risk of HIV/STIs, and be offered strategies to mitigate these risks. Further implementation research is required to assess the acceptability, feasibility and effectiveness of delivering interventions online, including on smart phones whose use among TSMSM was ubiquitous. The prejudice, stigma and discrimination experienced by TSMSM during engagement with healthcare requires addressing. There is urgent need to sensitize and train HCPs in tertiary academic institution-based health facilities so as to equip them with the cultural competencies, knowledge and skills required to address the unique healthcare needs of TSMSM. This should go along with increasing opportunities for more interactions between HCPs and MSM, and advocacy for improved health access for MSM. Sexual and reproductive health services offered to the student community should also be made friendly and inclusive for TSMSM.

This study was not without limitations. By nature, formative research is neither definitive nor designed to test hypotheses. However, the finding that RDS was both an appropriate and acceptable method for recruiting TSMSM into a HIV/STIs bio-behavioural survey were validated

by the successful implementation of the survey using this method. Noteworthy, RDS is not a classical probabilistic method and the assumptions on which it based are not always possible to fulfill in practice, and this may lead to an under/overestimation of prevalence of a disease and its associated risk factors. Additionally, cross-sectional studies also experience limitations such as recall bias, inability to determine causal inference, residual confounding, and restricted generalizability. Further, studies about sensitive topics such as individual sexual behaviours for TSMSM, and how HCPs attend to TSMSM may encounter the limitation of social desirability bias, leading to under/over reporting of such behaviours, and practices respectively. As discussed in the respective chapters of this thesis, the researchers took several measures to mitigate these limitations. Despite these limitations, this study contributed valuable lessons in terms of the usefulness of formative research in informing the design and implementation of a HIV/STI bio-behavioural survey among TSMSM, burden of HIV/STIs and associated risk factors among TSMSM, experiences of TSMSM with healthcare engagement, as well as attitudes and perspectives of HCPs towards care for TSMSM.

Efforts have been made to disseminate the findings from this research. Two papers have been published, one paper is in press, and three manuscripts are under review in peer-reviewed journals. Two poster presentations have been done at two separate global and public health conferences within the African continent. In due course, all the findings from the study will be synthesized and developed into a policy brief. The policy brief will be shared with stakeholders at the Ministry of Health through the Key Populations Programme under NASCOP, leaders and managers of tertiary institutions through the heads of their institution-based health facilities, MSM-focused service providers and advocacy groups, and partners who may be interested in exploring and funding potential interventions to improve care for TSMSM. Hopefully, this work will contribute to the prevention and control of HIV/STIs among this population both within the Nairobi metropolis and other parts of the country. Other countries whose demographics are similar to Kenya's can also learn lessons from this work to inform their own responses to HIV/STIs among this population. Overall, it is hoped that these findings will inform future research, policy and practice in the field.

Appendices

Appendix 1: Wits Human Research Ethics Committee Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research & Post Graduate Affairs)

TO: Dr SW Mwaniki
School of Clinical Medicine
Department of Medicine
Division of Internal Medicine
Medical School
University

E-mail: smwaniki@cartafrica.org

CC: Supervisor: Drs T Palanee-Phillips and PM Mugo <tpalanee@wrhi.ac.za> and <HREC-Medical.ResearchOffice@wits.ac.za>

FROM: Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2020/07/31

REF: *R14/49*

PROTOCOL NO: **M200215** *(This is your ethics application study reference number. Please quote this reference number in all correspondence relating to this study)*

PROJECT TITLE: *Integrated biological behavioural assessment of human immunodeficiency virus and sexually transmitted infections amongst tertiary student men who have sex with men in Nairobi, Kenya (Project Bespoke)*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to the Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr SW Mwaniki

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200215

NAME: (Principal Investigator)	Dr SW Mwaniki
DEPARTMENT:	School of Clinical Medicine Department of Medicine Division of Internal Medicine Medical School University
PROJECT TITLE:	Integrated biological behavioural assessment of human immunodeficiency virus and sexually transmitted infections amongst tertiary student men who have sex with men in Nairobi, Kenya (Project Bespoke)
DATE CONSIDERED:	2020/02/28
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Drs T Palanee-Phillips and PM Mugo
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/07/31

This clearance certificate is valid for 5 years from the date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **February** and will therefore reports and re-certification will be due early in the month of **February** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

2020/08/05
Date

Appendix 2: KNH - UoN Ethics Research Committee Approval

UNIVERSITY OF NAIROBI
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Ref: KNH-ERC/A/93

5th March 2020

Samuel Waweru Mwaniki
PhD Candidate
School of Clinical Medicine, Faculty of Health Sciences
University of Witwatersrand, Johannesburg
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KENYATTA NATIONAL HOSPITAL APPROVED 05 MAR 2020 KNH/UoN-ERC P.O. BOX 20723 - 00202 NAIROBI

Dear Samuel

RESEARCH PROPOSAL –INTEGRATED BIOLOGICAL BEHAVIOURAL ASSESSMENT OF HUMAN IMMUNODEFICIENCY VIRUS AND SEXUALLY TRANSMITTED INFECTIONS AMONG TERTIARY STUDENT MEN WHO HAVE SEX WITH MEN IN NAIROBI, KENYA (Project Bespoke) (P990/12/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 5th March 2020 – 4th March 2021.

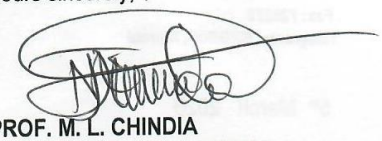
This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website**http://www.erc.uonbi.ac.ke**

Protect to discover

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
Supervisors; Dr. Thesia Palanee-Philips, University of Witwatersrand, South Africa
Dr. Mugo Peter Mwangi, KEMRI- Wellcome Trust Program, Kenya/
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Ref. No.KNH/ERC/R/30

17th February 2021

Samuel Waweru Mwaniki
PhD Candidate
School of Clinical Medicine, Faculty of Health Sciences
University of Witwatersrand,
Johannesburg, South Africa
Email; smwaniki@uonbi.ac.ke

Dear Samuel

Re: Approval of Annual Renewal – Integrated biological behavioural assessment of human immunodeficiency virus and sexually transmitted infections among tertiary student men who have sex with men in Nairobi, Kenya (Project Bespoke) (P990/12/2019)

Refer to your communication dated 12th January , 2021.

This is to acknowledge receipt of the study progress report and hereby grant annual extension of approval for ethical research protocol P990/12/2019.

The approval dates are 5th March 2021 – 4th March 2022.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH- UoN ERC before implementation.
c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH- UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH- UoN-Ethics & Research Committee for each batch of shipment.
g) Submission of an *executive summary* report within 90 days upon completion of the study
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely,

PROF. M.L. CHINDIA
SECRETARY, KNH-UON ERC

c.c. The Principal, College of Health Sciences, UoN
The Senior Director CS, KNH
The Chairperson, KNH-UoN ERC

Appendix 3: Publication – Study Protocol

frontiers in Public Health

STUDY PROTOCOL
published: 11 October 2021
doi: 10.3389/fpubh.2021.619694

Project BESPOKE (Integrated Bio-Behavioral Assessment of HIV and STI Among Young Tertiary Student Men Who Have Sex With Men in Nairobi, Kenya): A Respondent-Driven Sampling Survey Protocol

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Introduction: Globally, men who have sex with men (MSM) are a key population for the human immunodeficiency virus (HIV) epidemic. Among MSM, young men who have sex with men (YMSM) are disproportionately affected by HIV and other sexually transmitted infections (STI). However, there is a dearth of research and interventions targeting HIV/STI prevention among YMSM. In Kenya, there is paucity of knowledge on the burden of HIV/STI and related factors among YMSM, including tertiary student men who have sex with men (TSMSM). The barriers TSMSM experience in accessing and utilizing health services in their learning institutions have seldom been explored. In the context of healthcare providers (HCP) working in tertiary institutions, little is known about their knowledge, attitudes, and practices toward providing services to TSMSM.

Methods: The aims of the study are to: estimate prevalence and correlates of HIV/STI among TSMSM; estimate population size of TSMSM; explore experiences of TSMSM with access and utilization of health services; and assess HCP knowledge of, attitudes toward, and practices in provision of services to TSMSM. A mixed-methods approach will be used in three phases: Phase I—formative qualitative research will be conducted to understand TSMSM social networks, select "seeds", and explore strategies for implementing a respondent-driven sampling (RDS) survey. Interviews will be conducted with at least three staff who work in community based/non-governmental organizations (CBO/NGO) that serve MSM and at least 10 TSMSM. Phase II—an integrated bio-behavioral assessment (IBBA) will be conducted, where 200 TSMSM recruited by RDS will be offered HIV/STI testing, complete a behavioral survey, and provide information for population size estimation (PSE). Phase III—in-depth interviews will be held with 20 TSMSM selected from 200 TSMSM in phase II, to explore their experiences with access and utilization of healthcare services. Focus group discussions (FGD) will be conducted

with HCP working in tertiary institutions to assess their knowledge of, attitudes toward, and practices in providing services to TSMSM. Data collection started in September 2020 and is expected to end by September 2021.

Discussion: Findings from this study will be useful in informing HIV/STI prevention programming for TSMSM, by policy makers such the Kenyan ministries of health and education, tertiary education institutions, service providers, advocacy groups, and other interested stakeholders.

Keywords: healthcare providers, HIV, integrated bio-behavioral assessment, Kenya, men who have sex with men, respondent-driven sampling, sexually transmitted infections, young university students

INTRODUCTION

Despite the global advances made in prevention of human immunodeficiency virus (HIV) infections, men who have sex with men (MSM) continue to experience a disproportionate burden of HIV infections (1). Globally in 2019, close to one quarter (23%) of all new adult HIV infections were among MSM (1). The risk of acquiring HIV is 26 times higher among MSM compared to heterosexual men (2). Data from Sub-Saharan Africa (SSA) countries show high rates of HIV infection among MSM. A recent study in South Africa reported a HIV infection rate of 37.5% (3). High HIV infection rates have also been reported in other Southern African countries such as Namibia—12.4%, Botswana—19.6%, and Malawi—12.5–21.4% (4–6). Similarly, this pattern is observed in West African countries where HIV infection rates are also high in countries such as Nigeria—34.9% (7), Ivory Coast—18% (8), and Ghana—17% (9). In the Eastern Africa region, high rates of HIV infection have also been reported in Tanzania—30.2% (10), Uganda—12.9% (11), and Kenya—26.4% (12). Furthermore, high rates of various sexually transmitted infections (STI) among MSM have been reported in various countries in SSA. These include: *Chlamydia trachomatis* (CT) in Tanzania—7.5% (10) and Kenya—26% (13); *Mycoplasma genitalium* (MG) in Nigeria—36.8% (14); *Neisseria gonorrhoae* (NG) in Tanzania—14.4% (10) and Kenya—26% (13); *Treponema pallidum* (TP) in Malawi—12.3% (6) and Uganda—9% (11); and *Trichomonas vaginalis* (TV) in South Africa—9% (15).

Globally, the HIV epidemic remains poorly defined among young men who have sex with men (YMSM) aged 15–24 years. There is minimal data on population size estimates of YMSM, their HIV rates as well as risk and protective factors. This, in part, is attributed to lack of research and surveillance, and the difficulty of reaching YMSM who may fear disclosing their same-sex behavior due to social stigma (16). Social stigma is common among MSM across SSA, and may further influence risks for HIV and STI via its association with depression (17, 18). In most countries, YMSM are made especially vulnerable to HIV by criminalization of homosexuality, widespread discrimination, stigma, and violence, power imbalances in relationships and, sometimes, alienation from family and friends (19). Overall, YMSM are often at greater risk of acquiring HIV than young heterosexual males or older MSM (20).

Notwithstanding the relative paucity of research targeting YMSM in the global context, estimates of HIV prevalence among MSM have pointed to consistently high rates of infection among YMSM (21). A meta-analysis of studies published between 2006 and 2012 in China estimated the prevalence rates of HIV and TP among high school and college YMSM students to be 4.4 and 5.7%, with separate study prevalence rates ranging from 1.1 to 26.9% and 2.2 to 15.4%, respectively (22). In the USA, between 2008 and 2010, new HIV infections among YMSM aged 13–24 years increased by 22%, compared to 12% among MSM overall (23). Also in the USA, in 2011, 92.8% of all diagnosed HIV infections among young males aged 13–19 years was attributed to YMSM (24). In low and middle income countries, HIV prevalence rates as high as 9.6% in Nigeria, 12.7% in Senegal, 24% in Bahamas, and 28% in Jamaica, have also been reported among YMSM (25).

Among tertiary students in the USA, TSMSM were found to be especially vulnerable to HIV infection (26). Further, a study of TSMSM attending university health services in the USA showed that 3% of participants had either a rectal CT or pharyngeal NG infection (27). Similarly, a study among university students in China demonstrated that TSMSM were more sexually active and at greater risk of STI than their non-TSMSM counterparts (28). Additional studies in China have reported considerable rates of HIV and TP among TSMSM, ranging from 2.5 to 5.5 and 4.4 to 7%, respectively (29–31), with many TSMSM only learning of their HIV-positive serostatus at university (32). In a South African higher education sector HIV survey, 6% of male students reported engaging in same sex practices and HIV

Abbreviations: AIDS, acquired immunodeficiency syndrome; CARTA, consortium for advanced research training in Africa; CBO, community-based organization; CT, *Chlamydia trachomatis*; HCP, healthcare providers; HIV, human immunodeficiency virus; IBBA, integrated bio-behavioral assessment; IQR, inter-quartile range; MG, *Mycoplasma genitalium*; MSM, men who have sex with men; NASCOP, national AIDS and STI control program; NG, *Neisseria gonorrhoeae*; NGO, non-governmental organization; PHDA, partners in health and development in Africa; PI, principal investigator; PSE, population size estimation; RDS, respondent-driven sampling; REDCap, research electronic data capture; SSA, Sub-Saharan Africa; STATA, software for statistics and data science; STI, sexually transmitted infections; TP, *Treponema pallidum*; TSMSM, tertiary student men who have sex with men; TV, *Trichomonas vaginalis*; UAI, unprotected anal intercourse; WHO, World Health Organization; YMSM, young men who have sex with men.

prevalence among TSMSM (4.1%) was greater than twice that of heterosexual male students (1.7%) (33).

Tertiary student men who have sex with men like other YMSM engage in high risk behavior. Upon joining tertiary institutions, they are suddenly exposed to peers with similar sexual orientation, more freedom, and more socializing opportunities. Subsequently, many have sex more frequently, and some might have unprotected anal intercourse (UAI) more frequently (32). A meta-analysis of studies among Chinese high school and university student MSM found high rates of UAI, unsatisfactory condom use during the last homosexual anal intercourse, and having multiple sex partners (34). Additionally, TSMSM in the USA have been shown to have complex and expansive sexual networks within which HIV/STI may circulate widely and amplify epidemics (35). The results of a behavioral survey in 14 higher education institutions in South Africa indicated a high prevalence of various risk factors for HIV/STI transmission among TSMSM, including: high partner turnover, concurrent sexual partners, presence of STI, early sexual debut, having female sex partners, forced sex experiences, inconsistent condom usage, and alcohol and drug use (36). With most tertiary students owning smart phones, TSMSM like other MSM may also use geosocial applications such as Grindr® in seeking high risk casual sex partners online (36, 37).

In Kenya, there is a dearth of knowledge on the burden of HIV among YMSM, including TSMSM. Additionally, the prevalence of STI in TSMSM is also not known, despite the fact that untreated STI biologically potentiate transmission and acquisition of HIV (38–42), as well as cause considerable morbidity on their own (43). Epidemiological data of related indexes such as HIV/STI-related knowledge and risk factors among TSMSM is also sparse. As well, data on population size estimation (PSE) of TSMSM to inform advocacy activities, resource allocation, and scale of requisite prevention/treatment programs (44), is not available. Besides, the barriers TSMSM experience in accessing and utilizing general and sexual health services in their academic institutions have also not been explored. Further, in the context of healthcare providers (HCP) working in tertiary institutions, little is known about their knowledge of, attitudes toward, and practices in provision of services to TSMSM—factors which are critical to access and utilization of health services by the TSMSM. These are the knowledge gaps this study aims to fill.

METHODS AND ANALYSIS

Aim

The primary aim of this study is to estimate the prevalence of HIV and STI (CT, MG, NG, TP, and TV) and their correlates (such as unprotected sexual intercourse, multiple sexual partners, alcohol, and drug use) among TSMSM. The secondary aims are to: estimate the population size of TSMSM; explore the experiences of TSMSM with access and utilization of health services; and assess tertiary institutions HCP's knowledge of, attitudes toward, and practices in provision of services to TSMSM.

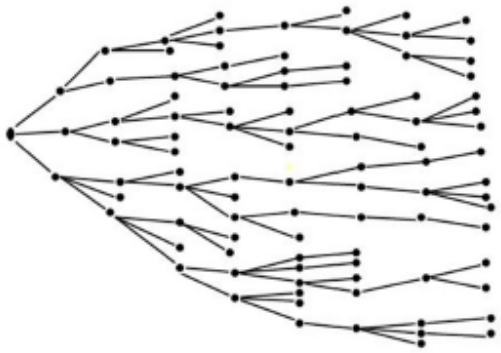


FIGURE 1 | Theoretical RDS recruitment chain [Source—Open Access: Johnston and Sabin, (49)].

Study Design

An integrated bio-behavioral assessment (IBBA) of HIV and STI will be conducted among TSMSM recruited through the respondent-driven sampling (RDS) method. Integrated bio-behavioral assessment is a term that refers to an overarching approach to tracking HIV and STI prevalence—biological component, and linking these data with related factors—behavioral component, among key populations at higher risk for HIV/STI infection, such as MSM (45). Respondent-driven sampling is both a recruitment and statistical method (46). It utilizes "snowball sampling" where individuals recruit those they know, the recruited individuals in turn recruit those they know and so on. This recruitment is combined with a mathematical model that weights the sample to compensate for the non-random (snowball) sampling (46). Using RDS makes it possible to draw statistically valid samples from hidden populations—such as MSM (47), and provide unbiased population estimates (such as disease prevalence) and measures of the precision of those estimates (such as confidence intervals) (48). Recruitment begins with "seeds" purposely selected from the target population and given a limited number of "coupons" to recruit their peers into the study. Participants who are recruited by the "seeds" form the first "wave" of recruitment. Participants in the first "wave" are then issued with "coupons" to recruit the second "wave" of participants. This process goes on until the desired sample size is reached. **Figure 1** shows a theoretical RDS recruitment chain (49).

As per guidelines (50), supplemental studies will be incorporated into the IBBA. Prior to the IBBA, formative research in form of semi-structured interviews will be conducted with service providers who work in community based/non-governmental organizations (CBO/NGO) that serve MSM; and TSMSM referred to the study team by the service providers. The aims of the formative research are to: understand the social networks of TSMSM, assess the appropriateness and

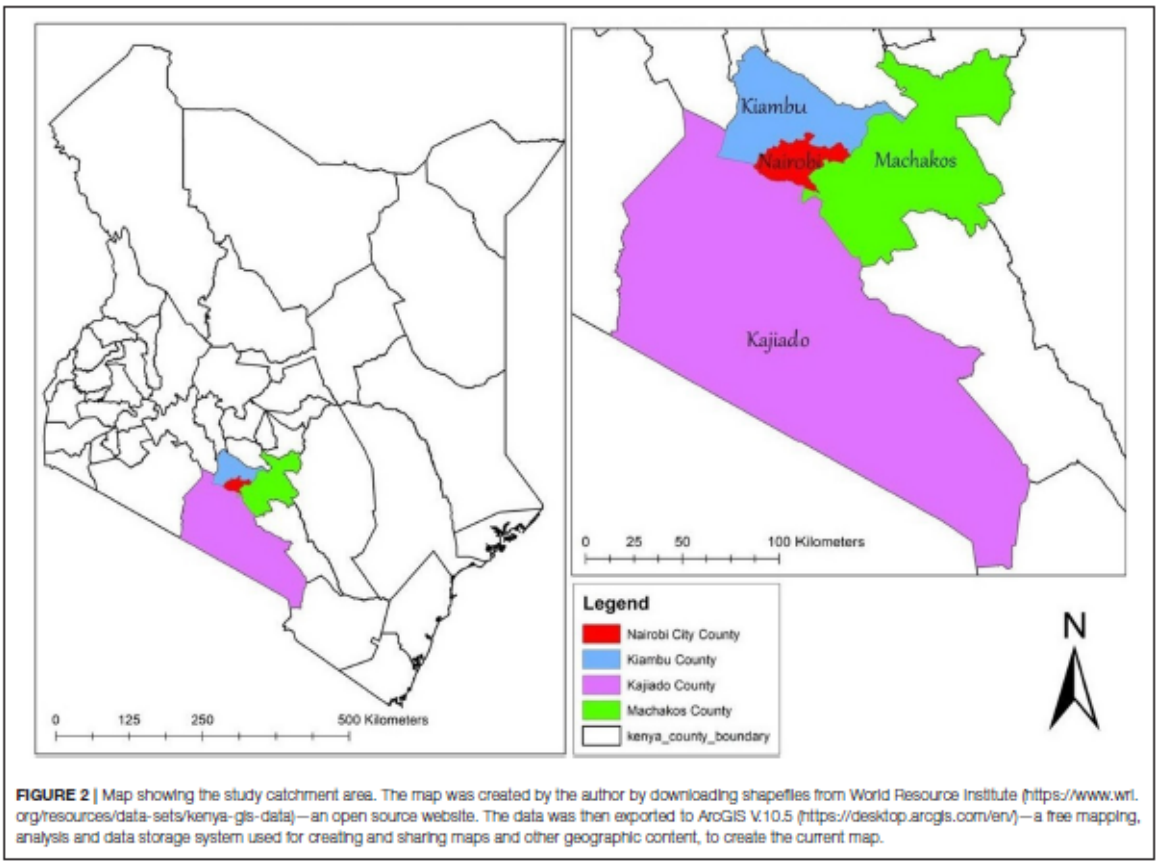


FIGURE 2 | Map showing the study catchment area. The map was created by the author by downloading shapefiles from World Resource Institute (https://www.wri.org/resources/data-sets/kenya-gis-data)—an open source website. The data was then exported to ArcGIS V.10.5 (https://desktop.arcgis.com/en/)—a free mapping, analysis and data storage system used for creating and sharing maps and other geographic content, to create the current map.

acceptability of using RDS, inform survey logistics and help with the recruitment of seeds. During the IBBA, data will also be collected to conduct PSE for TSMSM. In addition, qualitative in-depth interviews will be conducted with selected TSMSM to explore their experiences with access and utilization of health services. Finally, focus group discussions (FGD) will be held with HCP from tertiary institutions to assess their knowledge of, attitudes toward, and practices in provision of services to TSMSM. Standard operating procedures will be developed and used for the various components of the study.

Study Setting

The study will be conducted in Nairobi, Kenya. Apart from being Kenya's capital, Nairobi is one of the 47 administrative regions (counties) of Kenya. Based on what has been observed in other places where data is available (35), it is assumed that the TSMSM community in Nairobi is networked to some extent. As a result, the study will aim to reach TSMSM in tertiary institutions that are in the larger Nairobi metropolitan area, that includes tertiary institutions within a radius of approximately 25 km (16 miles) from the Nairobi central business district. This area extends to the neighboring counties of Kiambu, Kajiado, and Machakos as shown in **Figure 2**.

Research with TSMSM will be conducted in a study office within Nairobi's central business district. The study office had successfully been used to recruit 618 MSM participants for another study among MSM in 2017. It is easily accessible through various public transport routes used by TSMSM from different institutions around the city. In addition, it offers privacy to study participants and has no identifiers that would expose participants as being MSM. It is owned and will be offered to the study team at no cost by Partners in Health and Development in Africa (PHDA)—a non-profit organization affiliated to the University of Nairobi and University of Manitoba—that conducts HIV/STI research among key populations, including MSM. Human immunodeficiency virus testing will be conducted at the study office. Sexually transmitted infections sample storage and testing will be conducted at the Connect Afya Medylinks laboratories. Research with service providers working in CBO/NGO that serve MSM, and HCP from tertiary institutions will be conducted at their work places or the site of the IBBA or any other agreed location, whichever place is most convenient for them.

Characteristics of Participants

The study population will be TSMSM studying and staying within Nairobi; staff working in CBO/NGO that serve MSM in Nairobi; and HCP working in tertiary institutions.

Service Providers Working in CBO/NGO That Serve MSM

Service providers will be eligible to participate if they: directly work with MSM and provide written informed consent to participate in the study. They will be ineligible if they are unable or unwilling to provide written informed consent to participate.

TSMSM

Tertiary student men who have sex with men will be eligible to participate if they: are at least 18 years of age; registered students in a tertiary institution (college/university) in Nairobi; were assigned male sex at birth (transgender women will be eligible if they have had anal sex with a man in the last 12 months); have had consensual receptive or insertive oral or anal sexual intercourse with an adult man (18 years and above) in the last 12 months; provide written informed consent to participate in the study; and have a valid recruitment coupon (except for seeds). Tertiary student men who have sex with men will be ineligible for the study if they: are below 18 years of age; have not had consensual receptive or insertive oral or anal sexual intercourse with an adult man in the last 12 months (only having had vaginal intercourse with a postoperative transgender woman will not constitute eligibility); do not have a valid recruitment coupon; have participated in the study before; are unable or unwilling to provide written informed consent in the language available at the study site; and have any condition that in the opinion of the investigators will interfere with successful completion of study procedures.

Because of cash reimbursements given for participation in the study, participants may want to take part more than once by forging coupons or recruit participants who do not meet the eligibility criteria. To minimize this, the design of the coupon will incorporate a unique feature such as a mark which is not easily visible but can be identified by a trained member of the study team. A biometric system in form of a fingerprint reader—DigitalPersona™ (51) will be used to deter double participation. As well, prior to recruitment into the study, the study team will screen participants using a set criterion. Under this criterion, participants will be requested to show their student identification documents. The screening staff will compare the image on the identification document with the prospective participant's facial appearance and upon verification, return the document to the prospective participant. Copies of the identification documents will not be requested for retention by the study team.

HCP Working in Tertiary Institutions

Healthcare providers will be sampled from the following cadres: health records information officers (usually working as front office staff in most health centers in tertiary institutions and have first contact with the students seeking services), nurses, clinicians, pharmacists, laboratory technologists, and counselors. They will be eligible to participate if they: are professionally trained and licensed to practice in their respective fields; directly provide services to students in tertiary institutions; and provide written informed consent to participate in the study. They will be ineligible to participate in the study if they: do not directly provide services to students (e.g., those who only hold administrative positions) and are unable or unwilling to provide written informed consent to participate.

Sampling Procedures and Sample Size Determination

Phase I: Formative Research

At least one service provider will be purposely selected from each of the two CBO that offer MSM-exclusive health services and one NGO that in addition to MSM, also serves other key populations. After participation, these providers will help with the identification of TSMSM who will also participate in the formative phase. These providers may be or not be HCP. The providers will be given the contacts of the principal investigator (PI) and asked to request TSMSM known to them to contact the PI about possible participation in the formative research. At least 10 TSMSM will be purposely selected to take part in the in-depth interviews. These TSMSM will ideally be peer leaders, each with a social network size of at least nine people, be interested in the study and helping the TSMSM community. The "seeds" for the RDS will be drawn from these interviewees, upon completion of the formative research. Since this phase is formative and is intended to understand the social networks of TSMSM, explore the logistics of conducting the RDS among TSMSM, as well as selecting "seeds" for the RDS, a sample of 10 was deemed adequate to enable selection of five seeds and retain the other five as standby "seeds." A previous systematic review demonstrated that on average, RDS studies used 10 seeds [range, 2–32, median 8.0, intra-quartile range (IQR) 6.0–13.0] and had 1.6 (range 0–19, median 0, IQR 0–2.0) unsuccessful seeds per study (52). It is analytically desirable to have a small number of seeds and longer recruitment chains that ensure recruitment goes deeper into the networks of the target population, and where this is not practical, additional seeds may be used (53). Since the study seeks to recruit participants from a hidden population within the tertiary institutions, no particular tertiary institution will be targeted for the recruitment of the 10 TSMSM. However, the study team will seek to have diversity among the 10 TSMSM in terms of the type of institutions they attend (public/private) and geographical location of their institutions within Nairobi (Central, North, South, East, or West).

Phase II: IBBA and PSE

For the IBBA and PSE, 200 TSMSM will be recruited. The sample size for the IBBA was calculated to estimate the prevalence of HIV among TSMSM, based on World Health Organization's (WHO) 2017 bio-behavioral survey guidelines for populations most at risk for HIV (50). The formula below was used:

$$n = \frac{DEFF * Z^2 * P * (1 - P)}{d^2}$$

where:

n = minimum sample size required,
$DEFF$ = design effect,
Z = z-score for the desired confidence level (usually 1.96 for 95% confidence),
P = expected proportion,
d = precision.

Applying a $DEFF$ of 3 to account for clustering that occurs as a result of recruitment by RDS, P of 4.1% based on HIV prevalence from a previous study among TSMSM in South Africa (33), and a precision of 5%, the minimum sample size required is:

$$n = \frac{(3 * 1.96 * 1.96 * 0.041 * 0.959)}{0.05^2} = 181.3$$

Adding 10% to the sample to account for non-response, the adjusted sample size is:

$$N = 181.3 * \frac{110}{100} = 199.4 \approx \mathbf{200}$$

Phase III: In-depth Interviews With TSMSM and FGD With HCP Working in Tertiary Institutions

TSMSM

For the qualitative in-depth interviews, 20 TSMSM (10% of the total 200 TSMSM in the IBBA) will be selected to participate. To recruit participants in an unbiased manner, every 10th participant in the IBBA will be invited to take part in the in-depth interviews. A similar approach was used in a study in Tanga, Tanzania, and none of the participants in the IBBA who were invited to take part in the qualitative in-depth interviews declined (54). Should an invited participant from the IBBA decline to take part in the interviews, the next participant within the next interval of 10 participants will be invited. We expect to get a consenting participant within that interval before getting to the next scheduled 10th participant, from where recruitment for the qualitative in-depth interviews will continue as initially scheduled.

HCP Working in Tertiary Institutions

Tertiary institutions that have students' health centers will be identified. Healthcare providers from these institutions will be purposively selected to participate in the focus groups. At least one HCP will be selected from each tertiary institution per the various cadres outlined under the eligibility criteria. A focus group will consist 6–8 HCPs from one cadre to ensure homogeneity, minimize the effects of group power dynamics, and encourage more openness during discussions. One focus group will be held for every cadre, which translates to six focus groups in total. Previous research has shown that the most prevalent themes within a dataset can be identified with only three focus groups (55). As such, the six focus groups proposed in this study are deemed adequate to bring out prevalent themes from the topics of discussion. Focus groups were selected for their usefulness in exploratory research in under-researched topics (56), such as provision of services to TSMSM in this case. They are also effective when participants do not have easily accessible ways of constructively talking about a research topic (57), as is the case with debates on same-sex behavior which are usually hostile in SSA countries such as Kenya (58). Focus groups create a setting where different perceptions, judgments, and experiences about a certain topic come up. Participants are then stimulated to air their own views, by what they hear other members of the group say, thus providing deeper and detailed information on the research topic being discussed (59).

Data Collection

Phase I: Formative Research

The data collected from this phase will be used to inform the implementation of the second phase of the study. Formative research will entail interviews with at least three staff who work in CBO/NGO that serve MSM and at least 10 TSMSM from tertiary institutions in Nairobi, Kenya. The interview guides that will be used in this phase were modified for this study from the Integrated HIV Bio-behavioral Surveillance Toolbox by the University of California, San Francisco (60).

Phase II: IBBA and PSE

IBBA

The data collected in this phase will be used to reach the first aim of the study. An IBBA will be conducted to collect data from 200 TSMSM recruited through the RDS method. The recruitment will start with five "seeds" selected from the TSMSM interviewed in phase I. The recruitment will continue in "waves" until the calculated sample size is reached. The behavioral assessment will be conducted by self-interview on tablets using questionnaires set up on REDCap® software (Vanderbilt University). As and when needed, a member of the study team will be at hand to guide participants with navigating the self-interviews. The behavioral assessment will collect data on the following themes: demographic information; use of smart phone apps and social media; sexual behavior history; last sex partner matrix; condom access and use; lubricant access and use; rectal douching and enema use; HIV testing history; HIV self-testing; HIV care and treatment; pre-exposure and post-exposure knowledge and use; STI; healthcare services use; stigma, discrimination, and violence; alcohol, injection, and other drugs' use; and mental health assessment (anxiety, depression, and stress).

After completing the behavioral assessment, participants will be offered tests for HIV, CT, MG, NG, TP, and TV. Venepuncture will be performed by a trained HCP to collect 4–5 ml of blood for HIV and TP screening and confirmatory tests. Participants will be given instructions on how to collect approximately 20 ml of first void urine for CT, MG, NG, and TV testing. Anorectal and pharyngeal swabs for CT, MG, NG, and TV testing will be collected by a different trained HCP. Participants will be free to choose the gender of the HCP who will collect the anorectal swab. Alternatively, participants will be given instructions on how to collect the anorectal swab if they are not comfortable with the HCP doing it.

Human immunodeficiency virus and TP testing will be done using rapid diagnostic tests as provided for by Kenya national and WHO testing algorithms. CT, MG, NG, and TV testing will be done using commercial nucleic acid amplification tests.

Pre- and post-testing counseling will be offered to all participants. Participants who test positive for HIV and are not on care will be referred to facilities of their choice for HIV care and treatment. Participants who test negative for HIV and are at high risk for HIV infection will be referred for pre-exposure prophylaxis (PrEP) if not already on PrEP. The referral will be done by the counselor or a clinician (clinical officer or nurse) who is a member of the study team at the PHDA study office. Participants who test positive for CT, MG, NG, TP, and TV will be offered treatment based on Kenyan treatment guidelines.

For participants who consent to this, leftover blood will be stored for future tests. These tests may include: HIV viral load if the test result for HIV is positive; CD4 cell count if the test result for HIV is positive; Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV). Approximately 2–3 ml of serum will be extracted from the left-over blood. This will be stored for a maximum of five years in the biobank at Kenya AIDS Vaccine Initiative—Institute of Clinical Research, University of Nairobi. No further research will be carried out on these specimens without ethical clearance from the relevant research and ethics committees i.e., University of the Witwatersrand, Human Research Ethics Committee-Medical, and Kenyatta National Hospital—University of Nairobi Ethics and Research Committee.

The questionnaire that will be used in the behavioral assessment was developed for this study, with modifications from various sources, including: Integrated HIV Bio-behavioral Surveillance Toolbox by University of California, San Francisco (60), Rectal Douching and Enema Survey by International Rectal Microbicide Advocates—University of California, Los Angeles (61), MSM Stigma Metrics by Johns Hopkins University (62), and American Men's Internet Survey by Emory University (63). In addition, the Alcohol Use Disorders Identification Test (AUDIT) (64), Perceived Stress Scale-10 (PSS-10) (65), Patient Health Questionnaire-9 (PHQ-9) (66), and Generalized Anxiety Disorder-7 (GAD-7) (67) tools were included in the IBBA questionnaire. The PSE questionnaire was developed for this study.

PSE

Prior to the behavioral self-interview, an interviewer-guided questionnaire will be used to collect data for PSE. A combination of methods embedded within the RDS study will be used to produce multiple estimates of the population sizes of TSMSM. These are: wisdom of the crowds, successive sampling (SS)-RDS and RDS-network based capture recapture.

Wisdom of the Crowds

Under this method, participants will be asked to provide their best estimate of the number of TSMSM within Nairobi. This approach will produce a measure of the of the population size of TSMSM, as perceived by TSMSM participating in the RDS study. This method is based on the assumption that members of the population have specialized knowledge on the population and that personal opinion expressed in private will not be influenced by others' responses (44). The estimate obtained will be examined using the median, mode, and mean responses and compared to the yields of other PSE methods.

Successive Sampling-RDS

This is a novel PSE method proposed by Handcock et al. (68). As such, the method is also referred to as Handcock-RDS or sequential sampling-RDS. It is based on the assumption that during RDS, participants with larger network sizes are more likely to be recruited earlier than those with smaller network sizes. Over the recruitment period, with SS without replacement, the probability of being sampled over time is proportional to the network size of the remaining members of the population. The SS-RDS method uses self-reported individual network size (i.e., the number of other members of the target population an individual participant knows) as the informative measure of the target population. The SS-RDS method uses a prior estimate in combination with the specified distribution and the data (the self-reported network size in RDS) to calculate the posterior PSE, through a Bayesian approach. In this study, the PSE obtained from the "wisdom of the crowds" method will be used as the prior estimate, and then the posterior PSE calculated using the RDS-A/RDSAT software.

RDS—Network Based Capture Recapture

This is a novel method proposed by Dombrowski et al. (69). In this method, study participants will be asked to provide some personal characteristics (approximate height, approximate weight, ethnicity, and handedness) and a "telefunken code. A "telefunken code" will be derived from the last four digits of participants' mobile phone number. The code is created where phone digits are coded as odd or even and low (0–4) or high (5–9)[1]. The participants will then be asked to randomly select three TSMSM contacts from their mobile phone directory. A participant will then be asked about the randomly selected contacts, in order to obtain data on the contacts' personal characteristics and "telefunken code." The "telefunken code" together with the approximate height, approximate weight, ethnicity, and handedness will produce an almost unique anonymous code for each participant. This will facilitate the matching of the participant to contacts described by another participant's interview. For the purpose of PSE, study participants will be treated as the "capture" population, while each of the contacts provided during the interviews ("reports") will be considered a "recapture assay." The number of the original participants discovered via recapture assays (as a proportion of the total number of assays), will be used as a basis for estimating the overall size of the TSMSM population. The following formula and parameters will be used for PSE:

$$N = n * \frac{s}{r}$$

where:

N = TSMSM PSE,
n = Number of MSM captured in the survey with valid "telefunken codes",
s = Number of valid "telefunken codes" reported by TSMSM in the study,

[1]For instance, for a participant whose phone number last four digits are 1234, the "telefunken code" is: odd-even-odd-even-low-low-low-low.

r = Excluding false matches, number of TSMSM' "telefunken codes" mentioned by other MSM.

Phase III: In-depth Interviews With TSMSM and FGD With HCP Working in Tertiary Institutions

The data collected in this phase will be used to reach the second and third aims of the study. In-depth interviews with 20 TSMSM selected from the 200 in the IBBA will be held separately with each of the participants, in a private room at the PHDA study office. The aims of the interviews will be to explore TSMSM's experiences with access and utilization of health services and their self-identified strategies for improving these services. An interview guide with open ended questions will be used for this purpose.

Selected HCP working in tertiary institutions who will have been previously contacted will be invited to a central location such as the boardroom of the study office for the FGD. This will happen after the IBBA so that participating TSMSM do not get to meet HCP from their institutions. Alternatively, the discussions could take place in another central location as preferred by the HCP. The aim of the FGD is to assess the knowledge, attitudes, and practices of HCP toward provision of services to TSMSM. A discussion guide with questions covering the various aspects to be assessed will be used. The interview/discussion guides that will be used in this phase were developed for this study.

Data Management

Qualitative Data Management

Each interview in phases I and III will be conducted by an interviewer who will also take notes. Focus group discussions will be led by a facilitator (the PI) assisted by a note-taker. Both the interviews and FGD will be audio-recorded and thereafter transcribed. In addition to note-taking being part of best practice for qualitative research (70), notes are also a backup to the audio-recordings in case the latter are spoilt or lost before transcription. Transcription and translation where needed, will be done by a member of the study team. The hard copies of the notes taken and printouts of the transcripts will be stored in locked file cabinets, in locked offices and access limited to authorized study staff only. The audio-recordings will be transferred from the recorder to a password protected hard drive and project computer. Thereafter, the recordings will be deleted from the recorders. The soft copies of the transcription will also be stored in a password protected computer. After transcription, a member of the study team will read the transcripts as he/she listens to the audio-recording to ensure that the transcripts and translations if any, are accurate.

Quantitative Data Management

During the IBBA in phase II, participants will electronically complete the behavioral questionnaire and the data will automatically be saved in a database on REDCap hosted at the University of the Witwatersrand, Johannesburg, South Africa. To assure quality of data, built in checks will be programmed into the REDCap control file, to be able to verify completeness and internal consistency of data automatically. Skip patterns or branching logic will be programmed in the questionnaire to ensure each participant is asked appropriate questions during the self-interview. Different scenarios with skip patterns will be thoroughly pre-tested to ensure correctness and consistency before the actual data collection commences. For the PSE questionnaires which will be interviewer-administered, the data will also be entered into a REDCap database developed for the study. To ensure the quality of data, the project coordinator will conduct checks for every 10th interview—both for IBBA and PSE—to verify for completeness and internal consistency. Both databases will be password protected and only accessed by research team members authorized by the PI. Hard copies of completed PSE questionnaires will be filed and kept in a locked cabinet. Only unique study codes, and not identifiable information will be used on the questionnaires. Unique study codes from the survey and HIV/STI testing will be managed by the project coordinator.

Coupon management to check validity, track distribution, and monitor reimbursements will be done using an Excel RDS Coupon Management File, 2010 (NGO Iskorak, Zagreb, Croatia). NetDraw v 2.170 (Analytic Technologies) will be used to monitor weekly reports of participant characteristics and recruitment chain graphs. This will help the study team make adjustments to coupon distribution so as to manage recruitment and maximize representativeness of the study sample. Initially, participants will be issued with three coupons to recruit their peers. This will be tapered off to two, one, and then zero coupons as the calculated sample size is approached and eventually reached. The following information will be displayed on the coupons: name of the study without disclosing same-sex behavior (Project Bespoke: health study for college/university male students), physical address of the study site with a map, telephone contact, hours of operation, coupon number, dates of coupon issue, and expiration, instructions to recipients on how to issue coupons, and brief description of the services that will be offered during the study.

Data Analysis

Qualitative Data Analysis

Transcripts will be entered into NVivo software version 11 (QSR International) for coding and analysis. A thematic framework approach will be adopted. Both deductive (set a priori) and inductive (emerging from the data) themes will be analyzed. Themes will be supported with verbatim excerpts from the transcripts. To enhance trustworthiness of the data, coding will be done independently by two members of the study team, who will then compare codes for agreement and decide whether to merge some codes, get rid of others or come up with new ones.

Quantitative Data Analysis

As per recommendations (71), specialized analyses will be carried out using RDS-Analyst (RDS-A) software (University of California—Los Angeles) or RDS Analysis Tool (RDSAT) software (Cornell University). These analyses will produce population prevalence estimates of HIV/STI, and confidence intervals of variables, adjusting for unequal probabilities of inclusion due to varying social network sizes and homophily (the similarities in characteristics of persons within their

social networks). The resulting data will then be exported to STATA software version 15 (StataCorp LLC) for further analysis. The primary analyses will be the adjusted population estimates of disease prevalence (HIV/STI), key risk behaviors (e.g., unprotected sex, multiple sexual partners, UAI), and access to and use of HIV/STI prevention, care and treatment services. Categorical variables will be described using frequencies. Normally distributed continuous variables will be described using means (with standard deviations) and non-normally distributed continuous variables will be described using medians (with IQR). Bi-variate analysis of variables will be done using Chi-square for categorical variables and Student's *t*-test for continuous variables. Finally, a multivariate analysis of variables associated with HIV/STI infection will be done using logistic (or binomial) regression. Population size estimation will be calculated using wisdom of the crowds, SS-RDS, and RDS-network based capture-recapture methods.

DISCUSSION

To the best of our knowledge, this is the first study in SSA to deploy RDS in conducting an IBBA of HIV/STI among TSMSM. Data from this study will be useful in informing HIV/STI prevention programming for this key and vulnerable population, by the ministries of health and education, tertiary education institutions, CBO/NGO, advocacy groups, and other interested stakeholders. One of the uniqueness of this study is the incorporation of supplemental qualitative components—formative research, in-depth interviews with TSMSM, and FGD with HCP—that seek to lay the ground for, and provide a deeper meaning of the quantitative data obtained from the IBBA, respectively. In this way, it is possible to obtain deeper perspective from both TSMSM and HCP, and thus begin to understand how to best design interventions for HIV/STI prevention as well as other healthcare services for TSMSM. The other strength of this study is the inclusion of the PSE section in the IBBA. Data on PSE of TSMSM will be useful in advocating for appropriate resource allocation toward health interventions for this population. Use of computer-formatted interviews on the REDCap software also constitutes other strengths of the study, including: consistency in the way questions are asked thus maximizing standardization; limiting handling of data forms; protecting participant confidentiality; and direct data capturing thereby decreasing staff effort and enhancing data quality.

Tertiary student men who have sex with men who are the primary participants in the study are a hard-to-reach population without an obvious sampling frame, due to criminalization of same-sex behavior in Kenya (72). This will be mitigated by using RDS, which is both a sampling and recruitment method for hidden populations. In addition, the study may run the risk of not reaching the required sample size due to refusal to participate and dropping out. The formative phase of the study will be used to engage the community of service providers and TSMSM, so as to build support for subsequent phases of the study and help attain the required sample size. Furthermore, as most data in the behavioral survey for TSMSM will be self-reported, this may present various forms of bias in the study. Recall bias may occur since participants will be asked to report things that happened to them in the past. To mitigate this, the time-frame of experiences in the survey has been limited to the last 12 months in most cases, last 6 or 3 months in some cases, and only a few questions ask about life-time experiences. Additionally, since the survey has questions on topics such as sexual behavior, alcohol and drug use, participants may underreport on these topics resulting in social desirability bias. This will be mitigated by using self-interviews as compared to interviewer-administered questionnaires, where the propensity to underreport is increased with the latter.

ETHICS AND DISSEMINATION

Informed Consent

Participants will be provided with information about the study, including: their roles in the study; general nature of interview questions; procedures for specimen collection and testing and duration and frequency of participation. Participants will then be given opportunities to ask questions and/ or seek clarifications about the study. Thereafter, participants will provide written informed consent to participate in the study.

Age of Participants

The study will recruit TSMSM who are at least 18 years old. Tertiary student men who have sex with men below 18 years of age will be ineligible to participate. Staff working in CBO/NGO and HCP will also be at least 18 years old.

Protection of Study Participants

A major ethical concern of this study is that taking part may reveal that participants are engaging in same-sex sexual activity which is both illegal and stigmatized in Kenya. Unintended disclosure of personal information collected from the study may expose participants to discrimination, stigmatization, and potential harm. Several measures will be taken to minimize the risk of information disclosure, including: study staff will check recruitment coupons to ensure their validity and use an interviewer administered questionnaire to screen prospective participants for study eligibility; no identifying information will be written on study documents nor laboratory specimens associated with a participant; all paper-based study materials will be stored in locked file cabinets, in locked offices and access limited to authorized study staff; audio-transcripts will be stored in a password protected computer accessible only to authorized study staff; access to study databases will be limited to authorized study staff only; and same-sex sexual behavior will not be reported to authorities. All staff working with participants will be trained on the importance of confidentiality and be required to sign a confidentiality agreement. In addition, the proposed staff for this project have worked with MSM in previous studies such as TRANSFORM and are already aware of the requirements of protection of participants.

A HIV/STI positive result may also subject a participant to psychological and emotional stress. To lessen these harms, trained, certified, and experienced counselors will provide pre- and post-test counseling to all participants. Moreover, since the

study asks TSMSM questions on their experiences of stigma, discrimination and violence; mental health—depression, anxiety, and stress; and alcohol and drug use, a distress protocol has been developed. The protocol outlines the course of actions to be taken by the study counselor should a participant exhibit acute emotional distress, safety concern or imminent danger to himself or others, at any stage of the study.

Written informed consent forms for TSMSM may pose a risk of exposing their identity. This will be mitigated by: using unique survey codes to link the forms, data, and specimens; storing the informed consent forms securely and separately from data and biological specimens collected during and after the study; and limiting access to the informed consent forms to study staff members authorized by the PI. Furthermore, possession of the consent form might pose a safety threat to TSMSM by revealing their identity and to HCP by revealing that they took part in a study on a subject that is both criminalized and stigmatized in Kenya. For both TSMSM and HCP who feel that this may happen to them, the study team will provide them with minimal information (the contact information of the study team and relevant research ethics committees) and not the whole copy of the consent form. In addition, copies of the information and consent forms will be retained at the study office, where a participant can pick them when and if they are comfortable to do so.

Healthcare providers participating in the FGD where there is neither confidentiality nor anonymity may also face more risks. A participant could express an opinion which other participants do not like. Such a participant could be at risk of social harms such as being reported to the employer, religious leaders, and/or social groups. To minimize this, participants in the FGD will be reminded to respect the privacy of their fellow participants and not to repeat what is said in the FGD to other people outside the group. Though what is said outside the FGD cannot be completely censored, a non-disclosure statement will be included in the consent form and participants required to agree to it.

The study office is located on the fifth floor of a building in the central business district of the city and participants can walk in without raising any suspicion from members of the public. This study area has previously been used for other studies among MSM such as TRANSFORM. Furthermore, the Ministry of Health through National AIDS and STI Control Program (NASCOP), runs a Key Populations Program whose work supports research among key populations and guards against harassment by security agencies. NASCOP has issued a "to whom it may concern" letter to support this study.

Potential Benefits

Study participants will be provided with the following services at the study site free of charge: counseling and testing for HIV/STI; treatment for STI; referral for HIV care and treatment at MSM-friendly health facilities or facilities of their choice; condoms and lubricants; and HIV/STI educational materials.

Participant Compensation

Reimbursements will be offered to compensate participants in the IBBA for the significant level of effort and time required to complete the study activities, and cater for transport costs. Participants will be given a primary incentive of KES 1,000 (USD 10) for participating in the study and a secondary incentive of KES 300 (USD 3) for each participant recruited. Thus, a participant who recruits three other participants would get KES 1,900 (USD 19) in total as compensation. NGO/CBO staff and HCPs will also each be reimbursed KES 1,000 (USD 10) for time spend in the study and to cover transport costs.

Ethical Review and Approval

This study protocol has been reviewed and approved by University of the Witwatersrand Human Research Ethics Committee-Medical (M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (P990/12/2019).

Dissemination

The findings from this study will be disseminated through the Key Population Program which is led by NASCOP under the ministry of health. Community meetings will also be organized to share the findings with TSMSM community members. The findings will be also shared with both participating and other interested CBO/NGO that serve MSM in Kenya, as well as HCP working in tertiary institutions. Additionally, the findings will be disseminated through peer reviewed journals, presentations at conferences, engagements with stakeholders, and with policy makers in Kenya including the Kenyan ministries of health and education. Finally, a study closure report will be submitted to the research ethics committees in Kenya and South Africa.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of the Witwatersrand Human Research Ethics Committee (Medical), Kenyatta National Hospital—University of Nairobi Ethics and Research Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SM, PM and TP-P conceptualized the study, designed the study protocol, and its instruments. SM acquired funding for the study and drafted the manuscript. PM and TP-P reviewed the manuscript. All authors have read and approved the final manuscript.

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REFERENCES

1. Joint United Nations Programme on HIV/AIDS (UNAIDS). *Global AIDS Update - Seizing the Moment - Tackling Entrenched Inequalities to End Epidemics*. UNAIDS (2020). Available online at: https://www.unaids.org/sites/default/files/media_asset/2020_global-aids-report_en.pdf (accessed May 6, 2021).
2. Joint United Nations Programme on HIV/AIDS (UNAIDS). *Fact Sheet - Latest Global and Regional Statistics on the Status of the AIDS Epidemic*. UNAIDS (2020). Available online at: https://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf (accessed May 6, 2021).
3. Fearon E, Tenza S, Mokoena C, Moodley K, Smith AD, Bourne A, et al. HIV testing, care and viral suppression among men who have sex with men and transgender individuals in Johannesburg, South Africa. *PLoS ONE*. (2020) 15:e0234384. doi: 10.1371/journal.pone.0234384
4. Baral S, Trapence G, Motimedi F, Umar E, Iipinge S, Dausab F, et al. HIV Prevalence, risks for HIV infection, and human rights among men who have sex with men (MSM) in Malawi, Namibia, and Botswana. *PLoS ONE*. (2009) 4:e4997. doi: 10.1371/journal.pone.0004997
5. Wirtz AL, Jumbe V, Trapence G, Kamba D, Umar E, Ketende S, et al. HIV among men who have sex with men in Malawi: elucidating HIV prevalence and correlates of infection to inform HIV prevention. *J Int AIDS Soc*. (2013) 16:18742. doi: 10.7448/IAS.16.4.18742
6. Wirtz AL, Trapence G, Kamba D, Gama V, Chalera R, Jumbe V, et al. Geographical disparities in HIV prevalence and care among men who have sex with men in Malawi: results from a multisite cross-sectional survey. *Lancet HIV*. (2017) 3018:30042–5. doi: 10.1016/S2352-3018(17)30042-5
7. Vu L, Adebajo S, Tun W, Sheehy M, Karlyn A, Njab J, Azeez A et al. High HIV prevalence among men who have sex with men in Nigeria: implications for combination prevention. *J Acquir Immune Defic Syndr*. (2013). 63:221–7. doi: 10.1097/QAI.0b013e31828a3e60
8. Hakim AJ, Aho J, Semde G, Diarrassouba M, Ehoussou K, Vuylsteke B, et al. The epidemiology of HIV and prevention needs of men who have sex with men in Abidjan, Cote d'Ivoire. *PLoS ONE*. (2015) 10:e0125218. doi: 10.1371/journal.pone.0125218
9. Nelson LE, Wilton L, Agyarko-Poku T, Zhang N, Aluoch M, Thach CT, et al. The association of HIV stigma and HIV/STD knowledge with sexual risk behaviors among adolescent and adult men who have sex with men in Ghana, West Africa. *Res Nurs Health*. (2015) 38:194–206. doi: 10.1002/nur.21650
10. Ross MW, Nyoni J, Ahaneku HO, Mbwambo J, McClelland RS, McCurdy SA. High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania. *BMJ Open*. (2014) 4:e006175. doi: 10.1136/bmjopen-2014-006175
11. Kim EJ, Hladik W, Barker J, Lubwama G, Sendagala S, Ssenkusu JM, et al. Sexually transmitted infections associated with alcohol use and HIV infection among men who have sex with men in Kampala, Uganda. *Sex Transm Infect*. (2016) 92:240–5. doi: 10.1136/sextrans-2015-052034
12. Evidence for HIV Prevention in Southern Africa (EHPSA). *The TRANSFORM Study*. EHPSA. (2018). Available from: https://www.ehpsa.org/all-documents/research-fund/526-ehpsa-evidence-brief-the-transform-study-v2/file (accessed April 28, 2021).
13. Sanders EJ, Thiong AN, Okuku HS, Mwambi J, Priddy F, Shafi J, et al. High prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections among HIV-1 negative men who have sex with men in coastal Kenya. *Sex Transm Infect*. (2010) 86:440–2. doi: 10.1136/sti.2010.043224
14. Crowell TA, Lawlor J, Lombardi K, Nowak RG, Hardick J, Odeyemi S, et al. Anorectal and urogenital mycoplasma genitalium in nigerian men who have sex with men and transgender women: prevalence, incidence, and association with HIV. *Sex Transm Dis*. (2020) 47:202–6. doi: 10.1097/OLQ.0000000000001105
15. Hoffman CM, Fritz L, Radebe O, Dubbink JH, Mcintyre JA, Kock MM, et al. Rectal *Trichomonas vaginalis* infection in South African men who have sex with men. *Int J STD AIDS*. (2018) 29:1445–7. doi: 10.1177/0956462418788418
16. World Health Organization (WHO). *HIV and Young Men Who Have Sex With Men: Technical Brief*. Geneva: WHO (2015).
17. Shauna S, Grosso A, Ketende S, Sweitzer S, Mothopeng T, Taruberekera N, et al. Depression and social stigma among MSM in lesotho: implications for HIV and sexually transmitted infection prevention. *AIDS Behav*. (2015) 19:1460–9. doi: 10.1007/s10461-015-1094-y
18. Ahaneku H, Ross MW, Nyoni JE, Selwyn B, Troisi C, Mbwambo J, et al. Depression and HIV risk among men who have sex with men in Tanzania. *AIDS Care*. (2016). 28(Suppl. 1):140–7. doi: 10.1080/09540121.2016.1146207
19. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. *J Int AIDS Soc*. (2015). 18(Suppl 1):29–40. doi: 10.7448/IAS.18.2.19833
20. Mustanski BS, Newcomb ME, Bois SN. Du, Garcia SC, Grov C. HIV in young men who have sex with men: a review of epidemiology, risk and protective factors, and interventions. *J Sex Res*. (2011) 48:218–53. doi: 10.1080/00224499.2011.558645
21. Beyrer C, Sullivan P, Sanchez J, Baral SD, Collins C, Wirtz AL, et al. The increase in global HIV epidemics in MSM. *AIDS*. (2013). 27:2665–78. doi: 10.1097/01.aids.0000432449.30239.fe
22. Li Y, Xu J, Reilly KH, Zhang J, Wei H, Jiang Y, et al. Prevalence of HIV and Syphilis infection among high school and college student MSM in China: a systematic review and meta-analysis. *PLoS ONE*. (2013) 8:e69137. doi: 10.1371/journal.pone.0069137
23. Rhodes SD, Wong FY. HIV prevention among diverse young MSM: research needs, priorities and opportunities. *AIDS Educ Prev*. (2016) 28:191–201. doi: 10.1521/aeap.2016.28.3.191
24. Centre for Disease Control and Prevention. *HIV Among Youth in the US: Protecting a Generation [Internet]. CDC Vital Signs*. Available online at: https://www.cdc.gov/vitalsigns/pdf/2012-11-27-vitalsigns.pdf (accessed September 14, 2020).
25. Joint United Nations Programme on HIV/AIDS (UNAIDS). *Securing the Future: Synthesis of Strategic Information on HIV and Young People*. Geneva: UNAIDS (2011).
26. Centre for Disease Control (CDC). *HIV Transmission Among Black College Student and Non-Student Men Who Have Sex With Men - North Carolina* 2003. *Morbidity and Mortality Weekly Report* 2004. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5332a1.htm (accessed September 16, 2020).

27. Pinsky L, Chiarilli DB, Klausner JD, Kull RM, Okeefe R, Heffer C, et al. Rates of asymptomatic nonurethral gonorrhea and chlamydia in a population of university men who have sex with men. *J Am Coll Heal.* (2012) 60:481–4. doi: 10.1080/07448481.2012.690465
28. Cong L, Ono-kihara M, Xu G, Ma Q, Pan X, Zhang D, et al. The characterisation of sexual behaviour in Chinese male university students who have sex with other men: a cross-sectional study. *BMC Public Health.* (2008). 8, 250. doi: 10.1186/1471-2458-8-250
29. Xu J-J, Reilly KH, Lu C-M, Ma N, Zhang M, Chu Z-X, et al. A cross-sectional study of HIV and syphilis infections among male students who have sex with men (MSM) in northeast China: implications for implementing HIV screening and intervention programs. *BMC Public Health.* (2011). 11, 287. doi: 10.1186/1471-2458-11-287
30. Zheng J, Wu Z, Poundstone KE, Pang L, Rou K, HIV. syphilis infection, and risky sexual behaviors among male university students who have sex with men in Beijing, China: a cross-sectional study. *AIDS Educ Prev.* (2012) 24:78–88. doi: 10.1521/aeap.2012.24.1.78
31. Zhang L, Ding X, Lu R, Feng L, Li X, Xiao Y, et al. Predictors of HIV and syphilis among men who have sex with men in a chinese metropolitan city: comparison of risks among students and non-students. *PLoS ONE.* (2012) 7:e37211. doi: 10.1371/journal.pone.0037211
32. Zou H, Tucker JD, Fan S, Xu J, Yu M, Luo Z, et al. Learning about HIV the hard way: HIV among Chinese MSM attending university. *Lancet Infect Dis.* (2018) 18:16–8. doi: 10.1016/S1473-3099(17)30711-9
33. Higher Education HIV/AIDS Programme South Africa (HEAIDS). *HIV Prevalence and Related Factors: Higher Education Sector Study South Africa.* Johannesburg (2009).
34. Yang Z, Huang Z, Dong Z, Zhang S, Han J, Jin M. Prevalence of high-risky behaviors in transmission of HIV among high school and college student MSM in China: a meta-analysis. *BMC Public Health.* (2015) 15:1272. doi: 10.1186/s12889-015-2614-4
35. Hightow LB, MacDonald PDM, Pilcher CD, Kaplan AH, Foust E, Nguyen TQ, et al. The Unexpected Movement of the HIV Epidemic in the Southeastern United States. *JAIDS J Acquir Immune Defic Syndr.* (2005) 38:531–7. doi: 10.1097/01.qai.0000155037.10628.cb
36. Brink JG, Unit E, Africa S. Considerations for South African higher education: a national student men who have sex with men sexual behavior survey. *South African J High Educ.* (2017) 31:184–207. doi: 10.20853/31-4-877
37. Hall WJ, Sun CJ, Tanner AE, Mann L, Stowers J, Rhodes SD, et al. Prevention opportunities with GPS-based social and sexual networking applications for men who have sex with men. *AIDS Educ Prev.* (2017) 29:38–48. doi: 10.1521/aeap.2017.29.1.38
38. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Health.* (1999) 75:3–17. doi: 10.1136/sti.75.1.3
39. Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. *JAIDS J Acquir Immune Defic Syndr.* (2010) 53:537–43. doi: 10.1097/QAI.0b013e3181c3ef29
40. Buchacz K, Patel P, Taylor M, Kerndt PR, Byers RH, Holmberg SD, et al. Syphilis increases HIV viral load and decreases CD4 cell counts in HIV-infected patients with new syphilis infections. *AIDS.* (2004) 18:2075–9. doi: 10.1097/00002030-200410210-00012
41. Salazar JC, Cruz AR, Pope CD, Valderrama L, Trujillo R, Saravia NG, et al. Treponema pallidum elicits innate and adaptive cellular immune responses in skin and blood during secondary syphilis: a flow-cytometric analysis. *J Infect Dis.* (2007) 195:879–87. doi: 10.1086/511822
42. Jones J, Weiss K, Mermin J, Dietz P, Rosenberg ES, Gift TL, et al. Proportion of incident hiv cases among men who have sex with men attributable to gonorrhea and chlamydia: a modeling analysis. *Sex Transm Dis.* (2019) 46:357–63. doi: 10.1097/OLQ.0000000000000980
43. Low N, Broutet N, Adu-Sarkodie Y, Barton P, Hossain M, Hawkes S. Global control of sexually transmitted infections. *Lancet.* (2006) 368:2001–16. doi: 10.1016/S0140-6736(06)69482-8
44. Joint United Nations Programme on HIV/AIDS (UNAIDS). *Guidelines on Estimating the Size of Populations Most at Risk to HIV.* Geneva: UNAIDS (2010).
45. Family Health International. *Integrated Behavioral and Biological Assessment: Guidelines for Surveys of Populations at Risk of HIV Infection.* New Delhi: Indian Council of Medical Research and FHI. (2011). Available online at: https://www.fhi360.org/sites/default/files/media/documents/Integrated Behavioral and Biological Assessment Guidelines for Surveys of Populations at Risk of HIV Infection.pdf (accessed September 14, 2020).
46. *Respondent Driven Sampling.* Available online at: http://www.respondentdrivensampling.org/ (accessed May 28, 2021).
47. Stahlman S, Johnston LG, Yah C, Ketende S, Maziya S, Trapence G, et al. Respondent-driven sampling as a recruitment method for men who have sex with men in southern sub-Saharan Africa: a cross-sectional analysis by wave. *Sex Transm Infect.* (2016) 92:292–8. doi: 10.1136/sextrans-2015-052184
48. Okal J, Raymond HF, Tun W, Musyoki H, Dadabhai S, Broz D, et al. Lessons learned from respondent-driven sampling recruitment in Nairobi: experiences from the field. *BMC Res Notes.* (2016) 9, 158. doi: 10.1186/s13104-016-1965-y
49. Johnston LG, Sabin K. Sampling hard-to-reach populations with respondent driven sampling. *Methodol Innov Online.* (2010) 5:38–48. doi: 10.4256/mio.2010.0017
50. WHO CDC, UNAIDS F. 360. *Biobehavioural Survey Guidelines for Populations at Risk for HIV.* Geneva: World Health Organization (2017).
51. SimbaPOS. *DigitaPersona Biometric Fingerprint Reader.* (2021). Available from: https://www.simbapos.co.ke/product/digitalpersona-biometric-fingerprinter-reader-in-kenya/ (accessed June 30, 2021).
52. Malekinejad M, Johnston LG, Kendall C, Kerr LR, Rutherford GW. Using respondent-driven sampling methodology for hiv biological and behavioral surveillance in international settings: a systematic review. *AIDS Behav.* (2008) 12:105–30. doi: 10.1007/s10461-008-9421-1
53. Lachowsky NJ, Sorge JT, Raymond HF, Cui Z, Sereda P, Rich A, et al. Does size really matter? A sensitivity analysis of number of seeds in a respondent-driven sampling study of gay, bisexual and other men who have sex with men in Vancouver, Canada. *BMC Med Res Methodol.* (2016). 16, 157. doi: 10.1186/s12874-016-0258-4
54. Larsson M, Shio JM, Ross MW, Agardh A. Acting within an increasingly confined space: a qualitative study of sexual behaviours and healthcare needs among men who have sex with men in a provincial Tanzanian city. *PLoS ONE.* (2017) 12:e0183265. doi: 10.1371/journal.pone.0183265
55. Guest G, Namey E, McKenna K. How many focus groups are enough? Building an evidence base for nonprobability sample sizes. *Field Methods.* (2017) 29:3–22. doi: 10.1177/1525822X16639015
56. Frith H. Focusing on sex: using focus groups in sex research. *Sexualities.* (2000) 3:275–97. doi: 10.1177/136346000003003001
57. Morgan DL, Krueger RA. When to use focus groups and why. In: Morgan DL, editor. *Successful Focus Groups: Advancing the State of the Art.* Thousand Oaks, MA: SAGE Publications, Inc. (2013). p. 3–19. Available online at: https://methods.sagepub.com/base/download/BookChapter/successful-focus-groups/n1.xml (accessed September 16, 2020).
58. Elst EM. Van Der, Kombo B, Gichuru E, Omar A, Musyoki H, Graham SM, et al. The green shoots of a novel training programme: progress and identified key actions to providing services to MSM at Kenyan health facilities. *J Int AIDS Soc.* (2015) 18:20226. doi: 10.7448/IAS.18.1.20226
59. Lindlof T. *Qualitative Communication Research Methods.* London; Thousand Oaks: SAGE Publications, Inc. (1995). p. 174.
60. University of California San Francisco (UCSF). *Integrated HIV Bio-behavioural Surveillance Toolbox.* Available online at: https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox (accessed October 8, 2020).
61. Javanbakht M, Stahlman S, Pickett J, LeBlanc MA, Gorbach PM. Prevalence and types of rectal douches used for anal intercourse: results from an international survey. *BMC Infect Dis.* (2014). 14, 95. doi: 10.1186/1471-2334-14-95
62. Augustinavicius JL, Baral SD, Murray SM, Jackman K, Xue QL, Sanchez TH, et al. Characterizing cross-culturally relevant metrics of stigma among men who have sex with men across 8 Sub-Saharan African countries and the United States. *Am J Epidemiol.* (2020) 189:690–7. doi: 10.1093/aje/kwz270
63. Rollins School of Public Health Emory University. *American Men's Internet Survey (AMIS) 2018: Online HIV Behavioral Survey of Men Who Have Sex*

with Men. Available from: http://emoryamis.org/wp-content/uploads/2019/07/AMIS-2018-Survey.pdf (accessed October 8, 2020).
64. Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG. The alcohol use disorders identification test (AUDIT), 2nd ed. *Geneva: World Health Organization*. (2001).
65. Cohen S, Kamarck T, Mermelstein R. *Perceived Stress Scale. Vol. 10, Measuring Stress: A Guide for Health and Social Scientists*. Menlo Park, CA: Mind Garden, Inc. (1994).
66. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. (2001) 16:606–13. doi: 10.1046/j.1525-1497.2001.016009606.x
67. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. (2006) 166:1092–7. doi: 10.1001/archinte.166.10.1092
68. Handcock MS, Gile KJ, Mar CM. Estimating hidden population size using Respondent-Driven Sampling data. *Electron J Stat*. (2014) 8:1491–521. doi: 10.1214/14-EJS923
69. Dombrowski K, Khan B, Wendel T, McLean K, Misshula E, Curtis R. Estimating the size of the methamphetamine-using population in New York City using network sampling techniques. *Adv Appl Sociol*. (2012) 02:245–52. doi: 10.4236/aasoci.2012.24032
70. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Heal Care*. (2007). 19:349–57. doi: 10.1093/intqhc/mzm042
71. Gile KJ, Beaudry IS, Handcock MS, Ott MQ. Methods for inference from respondent-driven sampling data. *Annu Rev Stat Its Appl*. (2018) 5:65–93. doi: 10.1146/annurev-statistics-031017-100704
72. Laws of Kenya Cap 63: *The Penal Code*. Available onlline at: http://www.kenyalaw.org/lex/actview.xql?actid=CAP.63 (accessed May 28, 2021).

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Appendix 4: Publication – Formative Research

International Journal of Environmental Research and Public Health

MDPI

Article

"My Friends Would Believe My Word": Appropriateness and Acceptability of Respondent-Driven Sampling in Recruiting Young Tertiary Student Men Who Have Sex with Men for HIV/STI Research in Nairobi, Kenya

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Abstract: (1) Background: We conducted formative research to assess the appropriateness and acceptability of respondent-driven sampling (RDS) in recruiting tertiary student men who have sex with men (TSMSM) into a prospective human immunodeficiency virus/sexually transmitted infection (HIV/STI) biobehavioral survey in Nairobi, Kenya. (2) Methods: Between September and October 2020, semi-structured qualitative interviews were held with service providers from organizations that serve MSM (n = 3), and TSMSM (n = 13). Interviews were conducted in English, audio-recorded and transcribed, then thematically analyzed using NVivo version 11. (3) Results: Service providers reflected that RDS was appropriate due to the large though concealed networks of TSMSM. TSMSM perceived RDS to be acceptable based on their large social network sizes and the trust that existed amongst themselves. TSMSM were concerned about participating due to the risk of being outed as MSM and hence emphasized that researchers needed to assure them of their confidentiality and include MSM as part of the study team to encourage participation. (4) Conclusions: RDS was perceived as both an appropriate and acceptable sampling method. Use of RDS should be considered as a strategy for recruiting young, marginalized populations for HIV/STI research.

Keywords: human immune deficiency virus; sexually transmitted infections; men who have sex with men; respondent-driven sampling; sub-Saharan Africa; Kenya

1. Introduction

Globally, the HIV epidemic remains poorly defined among young MSM (YMSM) aged 15–24 years. There is minimal data on population size estimates of YMSM and their HIV rates, as well as risk and protective factors. This is partially attributed to a lack of research and surveillance, as well as the difficulty of reaching YMSM with services [1], especially in countries such as Kenya, where same-sex behavior continues to be criminalized [2]. Additionally, YMSM are vulnerable to HIV due to widespread discrimination and stigmatization, homophobia and violence, power imbalances in relationships and alienation from family and friends [3]. Largely due to these factors, YMSM are invariably at disproportionate risk of acquiring HIV/STI compared to young heterosexual males or older MSM [4].

During the transition period from adolescence to adulthood and a parallel shift from secondary to tertiary educational institutions, a majority of students find themselves in an environment with limited direct supervision of their behavior and increased freedom and opportunities to engage in risky behavior, such as alcohol use and casual sex [5]. For tertiary student MSM (TSMSM), this involves a sudden exposure to peers with similar sexual orientation, increased freedom and autonomy in young adulthood and more socializing opportunities [6]. Subsequently, they may engage in sex more frequently [7], and some might have unprotected anal intercourse more regularly [8], increasing their risk of HIV/STI infection. With most tertiary students in Kenya owning smart phones [9], TSMSM, like other MSM, may also use geosocial applications, such as Grindr®, to seek more sex partners for immediate sexual gratification without paying attention to the accompanying risk of HIV/STI infection [10].

Even in countries where same-sex behavior is legal and data are available, TSMSM have been found to engage in high-risk behavior that increases their susceptibility to HIV/STI. A systematic review and meta-analysis of studies published between 2003 and 2016 in China found out that TSMSM engaged in sex work, group sex, sex with female partners, drug use and seeking casual sex partners online [11]. In the USA, TSMSM have been shown to have complex and expansive sexual networks within which HIV/STI may circulate widely and magnify epidemics [12]. In South Africa, a behavioral survey among TSMSM showed a high prevalence of various risk factors for HIV transmission among TSMSM, including high partner turnover, concurrent sexual partners, presence of STI, early sexual debut, having female sex partners, forced sex experiences, inconsistent condom usage, and alcohol and drug use [13].

In Kenya, same-sex behavior is criminalized [2]. This may further amplify the impact of behavioral risk taking on HIV/STI transmission over and above what has been observed among TSMSM in countries where same-sex behavior is legal [11–13]. A literature review of TSMSM in Kenya yielded no information on the prevalence of HIV/STI or risk behaviors in this potentially at-risk sub-group of MSM. There is a need to conduct research to better understand the epidemic in this neglected sub-population, informing the form and design of interventions to combat the HIV/STI syndemic in this population.

Respondent-driven sampling (RDS) has become a popular method to assess HIV/STI and risk behaviors in hidden or hard-to-reach populations, such as MSM. RDS is both a recruitment and statistical method that utilizes "snowball sampling", where individuals recruit those they know; the recruited individuals in turn recruit those they know and so on until an adequate sample is reached. This recruitment is combined with a mathematical model that weights the sample to compensate for the non-random sampling [14]. Using RDS makes it possible to draw statistically valid samples from populations for whom there is no sampling frame and provide unbiased population estimates and confidence intervals of disease prevalence and risk behaviors, such as unprotected anal intercourse, among MSM [15]. Recruitment begins with 'seeds' purposely selected from the target population and given, at most, three 'coupons' to recruit their peers into the study. Participants who are recruited by the 'seeds' form the first 'wave' of recruitment. Participants in the first 'wave' are then issued with 'coupons' to recruit the second 'wave' of participants. This process goes on until the calculated sample size is reached. To encourage recruitment, participants are given an incentive to complete the survey (primary incentive) and to recruit their peers (secondary incentive) [16].

Previous studies that investigated HIV/STI in TSMSM recruited participants through either convenience sampling [17–19] or conducted studies among the general MSM population, then drew a subset of TSMSM from this sample [20] or conducted studies among the general tertiary student population and drew a subset of TSMSM from this sample [7,13,21].

Formative research helps researchers and public health practitioners reach their target population and define that population's characteristics that are pertinent to a particular public health issue of interest [22]. Assessing appropriateness and acceptability is important so as to gauge the suitability of a particular method for a given population and the

agreeability of that method to a range of stakeholders, respectively [23]. We conducted formative research to investigate these two outcomes for RDS as a recruitment strategy for TSMSM in a proposed HIV/STI biobehavioral survey [24], as well as to identify potential challenges that would be faced with the use of such a method and proposed strategies to mitigate these challenges. The study was conducted in Nairobi, the capital of Kenya. Our study showed that RDS is both appropriate and acceptable and should be considered as a strategy for recruiting young and marginalized populations for HIV/STI research.

2. Materials and Methods

2.1. Aim

The primary aim of the study was to assess the appropriateness and acceptability of using the RDS method to recruit TSMSM into a prospective HIV/STI biobehavioral survey. The secondary aim of our study was to identify potential challenges that would likely be encountered with the use of the RDS method, as well as proposed mitigation strategies to address these challenges.

2.2. Theoretical Framework and Reporting

The study was underpinned by the content analysis theoretical framework, where data is systematically organized into a structured format [25]. Reporting of the study was done following the consolidated criteria for reporting qualitative studies (COREQ) [26]. (See Supplementary Materials File S1).

2.3. Site

The study was conducted in Nairobi, the capital city of Kenya and home to more than 50 campuses of various universities and technical and vocational education training (TVET) institutions.

2.4. Participants

Service providers were purposely selected from community-based organizations (CBOs) that provide MSM-exclusive health services (n = 2) and from a non-governmental organization (NGO) that provides MSM-friendly health services (n = 1). The three organizations were selected purposely, first, because they are the main providers that offer MSM-exclusive/friendly health services in Nairobi and are popular with both YMSM and TSMSM. Secondly, we sought to obtain information on how to best reach different typologies of TSMSM, with the 'more out' TSMSM assumed to be more likely to use the MSM-exclusive services and those 'less out' to use the non-exclusive but MSM-friendly services. Thirdly, the three organizations are conveniently located, with the NGO within and the CBOs located about 5 km from the central business district, hence easily accessible by TSMSM.

TSMSM were purposely recruited with the help of the service providers at the three facilities. After completing the interviews, the service providers were given the telephone contact of one member of the study team and asked to request TSMSM known to them to contact the member of the study team regarding possible participation in the formative research. The service providers were given the ideal qualities of the TSMSM the study team was interested in speaking to, which included peer leaders with a social network size of at least nine TSMSM interested in research and working with the TSMSM community. Consequently, contact was established with 16 TSMSM, out of which 13 were interviewed. Of the three who were not interviewed, one had already completed university education, one was not studying in Nairobi and the third was unable to create time for the interview.

2.5. Data Collection

Semi-structured interview guides were obtained from the Integrated HIV Bio-behavioral Surveillance Toolbox of the University of California, San Francisco [27] and modified to fit the purpose of the current study (see Supplementary Materials Files S2 and S3).

All the interviews were conducted by the first author, who introduced himself to the participants and provided them with detailed information about the study, including the key components of the RDS method. Interviews with service providers consisted of five major domains, namely service providers' roles in their respective organization, type of services offered by the organizations, description of the TSMSM community and their networks, appropriateness and acceptability of using RDS to recruit participants for the HIV/STI biobehavioral survey, challenges expected with the use of RDS and proposed strategies to mitigate these challenges. Interviews with TSMSM consisted of three major domains, namely their social networks, appropriateness and acceptability of using RDS to recruit participants for the planned HIV/STI biobehavioral survey, challenges expected with the use of RDS and proposed strategies to mitigate these challenges. The network size was estimated by asking the question: 'How many TSMSM do you know by name, and they know you by name, and they live in and around the city of Nairobi?'. Demographic information was also collected using a brief self-administered questionnaire on REDCap (Vanderbilt University, Nashville, TN, USA).

Interviews with the service providers were held at their respective workplaces. Interviews with the TSMSM were held in a private room at the integrated counselling and education center of the University of Nairobi health services department. Only the interviewer and one participant were present at the time of each interview. Interviews with the service providers lasted an average of 40 min, whereas those with TSMSM took an average of 35 min. For the interviews with TSMSM, saturation was reached by the 10th participant. All interviews were held between September and October 2020.

The interviewer took notes during all the interviews. All interviews were audio-recorded, transcribed and translated to English in the few instances where Swahili was used. The interviewer then read the transcripts as he listened to the audio recordings to ensure that the transcripts and translations, if any, were accurate.

2.6. Data Analysis

Data in the form of the transcripts was managed using NVivo software version 11 (QSR International). A thematic framework approach was adopted. Analysis was conducted both deductively and inductively, using themes set a priori and coding emerging themes, respectively. Themes were supported with verbatim excerpts from the transcripts. Coding was performed independently by two members of the study team, who then compared codes for agreement and decided whether to merge some codes, get rid of others or come up with new ones.

2.7. Trustworthiness of the Data

The trustworthiness of the data was premised on the following criteria: credibility, transferability, dependability and confirmability [28,29]. To ensure credibility, the study used well-established methods for qualitative investigation. Prior to data collection, the first author familiarized himself with the setup and roles of the participating CBOs/NGO by reading content posted on the organizations' respective websites. During data collection, iterative questioning was deployed by rephrasing previously asked questions to gain deeper understanding of and confirm the information provided by participants at the first instance of questioning. Member checking was performed "on the spot" by paraphrasing and summarizing what the participants said at intervals and at the end of the interviews, respectively. For transferability, details about the study participants, study design, data collection procedures and analysis have been made available to aid in comprehension of the findings and comparison/contrasting of these findings with those of similar studies. To address dependability, the study processes are reported in sufficient detail to enable future researchers reproduce the study, even if not necessarily to obtain similar results. For confirmability, individual interviews were used due to the sensitivity of the study topic occasioned by criminalization and marginalization of same-sex behavior in Kenya.

Confirmability was also established by supporting the findings with verbatim quotes from the participants.

2.8. Ethics Statement

The study protocol was reviewed and approved by the University of the Witwatersrand Human Research Ethics Committee-Medical (reference number: M200215) and the University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (reference number: P990/12/2019). The study also received a letter of support from the Key Populations Program of the National AIDS and STI Control Program (NASCOP), Ministry of Health, Government of Kenya. Participants provided written informed consent before taking part in the study.

3. Results

3.1. Participant Characteristics

The service providers who participated from the CBOs were both male, in their 30s and identified as gay. The service provider from the NGO was female, in her 40s and identified as heterosexual. All the providers had college degrees. All the service providers had dual roles at their respective organizations. The service provider at the first CBO worked as a pre-exposure prophylaxis (PrEP) program officer/research coordinator, the one at the second CBO as a community mapping officer/peer educator supervisor and the one at the NGO as a clinician/head of the clinic. These service providers were selected on the basis of their day-to-day interaction with members of the MSM population and the assumption that they would have rich information on the TSMSM sub-population who were part of their clientele. All three organizations offered HIV/STI prevention, treatment and care services. Additionally, the two CBOs offered other services, including community outreach, as well as economic empowerment of and provision of legal aid to the MSM communities they served. On the other hand, the NGO offered care to victims of gender-based violence and sexual and reproductive health services to other key populations, such as female sex workers. The service providers referred 16 TSMSM to the research team, out of which 13 participated in the formative research (n = 13).

Demographic characteristics of the TSMSM participants are presented in Table 1. More than three-quarters (76.9%) were 21–24 years of age. All participants were undergraduate students in their first (23.1%), second (38.5%) or third (38.5%) year of study. A majority (69.2%) identified as homosexual or gay and the rest as bisexual.

Table 1. Demographic characteristics of TSMSM participants (n = 13).

Variable	n (%)
Age	
18–20	3 (23.1)
21–24	10 (76.9)
Level of education	
Undergraduate	13 (100)
Year 1	3 (23.1)
Year 2	5 (38.5)
Year 3	5 (38.5)
Type of institution	
University	11 (84.6)
* TVET/College	2 (15.4)
Ownership of institution	
Public	9 (69.2)
Private	4 (30.8)
Field of study	
Arts and humanities	3 (23.1)
Business and management	3 (23.1)

Table 1. *Cont.*

Variable	n (%)
Engineering and technology	3 (23.1)
Health sciences	2 (15.4)
Social sciences	2 (15.4)
Residence	
Rented (apartment/flat/hostel outside college/university)	8 (61.5)
At home with family	5 (38.5)
Main source of income	
Part time employment	8 (61.5)
Parents/guardians	5 (38.5)
Network size	
10–24	6 (46.2)
25–40	7 (53.8)
Sexual orientation	
Homosexual or gay	9 (69.2)
Bisexual	4 (30.8)

* TVET: technical and vocational education training institution.

The following sections explore the main themes from the analysis of the interviews with both the service providers and TSMSM. The themes include (a) social networks of TSMSM as a measure of the appropriateness of using the RDS method for recruiting TSMSM into the prospective HIV/STI biobehavioral survey; (b) appropriateness and acceptability of using the RDS method as perceived by participants; and (c) likely challenges anticipated with the use of the RDS method, as well as proposed strategies to mitigate these challenges. Themes are described and supported with illustrative quotes from the interviews. Quotes are attributed to participants using pseudonyms and role (service provider or student).

3.2. Social Networks of TSMSM

A key theme that emerged from the interviews is that TSMSM constituted a large and well-networked sub-group of the MSM community. TSMSM formed networks among themselves, as well as with other sub-groups of MSM. TSMSM had regular face-to-face interactions with their peers from the same institution and those from different institutions. However, since the outbreak of COVID-19, these interactions had been hampered by government-imposed restrictions to reduce risk of disease transmission. Consequently, TSMSM mainly interacted through social media applications, such as Facebook, WhatsApp, Twitter and Instagram.

> "In the student MSM community, what happens is that there is some sort of invisible network that is hidden but it is very large and well connected." Justin, service provider.

> "I know about 30 to 40 people (other TSMSM in Nairobi). I have seen about 10 (in the last 30 days) . . . due to the COVID situation, so most people travelled (out of Nairobi) . . . most of them are the people we study with, like in the same institution . . . but I also know others from other universities." Kyle, student.

> "Twenty-five to thirty (number of TSMSM known). Due to the corona (COVID-19), I have seen about 12 . . . we are used to each other . . . we always chat through WhatsApp, Facebook and Twitter sometimes . . . even through Instagram." Caleb, student.

TSMSM exhibited strong ties with their peers (intragroup ties), through which they found safe spaces to socialize, such as night clubs and house parties. The house parties offered opportunities to engage in risky behaviors, such as use of alcohol and casual sex. In spaces where there were other MSM, such as night clubs, TSMSM tended to interact and socialize with each other, staying away from other MSM perceived to have lower educational attainments.

"They (TSMSM) love parties … like on Fridays, they have house parties among themselves … so they really interact among themselves so much, then they get drunk and have sex." Nicole, service provider.

"Most of them (MSM) group themselves into clusters, whereby even if you get into a club, you will find them like the tertiary ones (students) are seated at one corner, and the lower end ones (with lower education levels) at the other corner." Mike, service provider.

TSMSM also interacted with other sub-groups of MSM. TSMSM were a bridging sub-population between well-off, older MSM and less well-off MSM within their age group and engaged in transactional sex, receiving money from the former and in turn giving money to the later.

"MSM students have sponsors (older and well-off MSM) … because they want to have a flashy lifestyle, they want to have money, so they will have sponsors to sponsor their lifestyles." Nicole, service provider.

"Tertiary MSMs, they have sex with those guys with money so that they can cater for their needs. Once (after) they are from that upper end, they will come into the clubs … they try to mingle and buy sex from the lower end partners." Mike, service provider.

3.3. Appropriateness and Acceptability of Using RDS to Recruit TSMSM in a Prospective HIV/STI Survey

Participants felt that RDS would be an appropriate and acceptable method of recruiting TSMSM for the prospective HIV/STI survey. TSMSM regarded RDS as an appropriate recruitment strategy due to the hidden but networked nature and the trust that existed among members of the TSMSM community. The perceived trust among peers would enable them to reach each other better, as compared to the research team trying to reach TSMSM directly.

"It (RDS) would work best and I think it is one of the recommended methods especially MSM being hidden … of course they will tend to trust information coming from their peers and this group of MSM is actually very highly networked" Jay, student.

"I think it (RDS) would work very well because it's easier for me to refer someone than you going out there to look for a guy to participate … they (my friends) would believe my word of mouth so it's convincing enough." Trevor, student.

Service providers noted that they were already known and trusted by TSMSM, and this existing relationship would make TSMSM referred by the service providers more likely to agree to participate in the prospective survey.

"If you are given something by a friend of yours, it is easy to accept it … but if you are given by a stranger, that is when challenges come in … because you (researchers) are already embedding yourselves in the existing networks, then it is okay because of the already existing trust between us (service providers) and the students." Justin, service provider.

The proposed double reimbursement for first participating and then getting a friend to participate in the prospective survey also made RDS popular. The first reimbursement would be used to cater for expenses, such as fare to get to the survey site, and the second would motivate peers to bring in their friends to take part in the prospective survey.

"It (RDS) will be good because of the reimbursement … you are using your transport from where you live to the place where you are going to get the service or the research so it will be a good thing. Once you've told someone that the moment you bring someone there is something for you it's not that hard (for a friend to agree to participate)." Danny, student.

"I think since there is a small reimbursement, I think that would motivate people to really recruit their friends to come for the study." Kyle, student.

3.4. Anticipated RDS Implementation Challenges and Proposed Mitigation Strategies

Participants anticipated that RDS implementation would face some challenges and offered probable ways of mitigating these challenges. Key among the anticipated challenges was that if the survey was associated with CBOs that serve sex workers, then TSMSM would not be willing to take part in the survey because they would not want to be associated with sex work. It was proposed that the researchers present themselves to possible participants as independent from these CBOs so as to encourage participation.

"The only challenge will be if this (the survey) is associated with some organizations it might discourage some people from participating. You find this group (TSMSM) sometimes doesn't want to be associated with some community clinics because they have a reputation of serving sex workers … I guess I like that you presented yourself as an independent researcher from an academic institution, that is straightforward … people will feel free to participate." Jay, student.

Another foreseen challenge was the possible loss of recruitment coupons. Participants suggested various ways of handling this, including indicating the incentives on the coupons so that TSMSM would be motivated to keep the coupons safe, using coupons of small size that would easily fit in a pocket and placing coupons in an envelope.

"They (coupons) get lost a lot, someone just presents himself without it. If they are communicating the incentive directly, then it works … someone will be able to store it properly." Jay, student.

"The challenge I was thinking of is when it (the coupon) gets lost … but if it will be in a smaller size, a pocketable size it is not easy to lose it." Frank, student.

"The person can lose the coupon. If it can be sealed in an envelope well, then it will be easy for them to handle." Caleb, student.

It was also noted that some TSMSM would be unwilling to participate if they were not assured about confidentiality with regard to their same-sex behavior. To encourage TSMSM recruitment, it was suggested that during consenting, TSMSM be provided with adequate information on how their privacy and confidentiality would be guaranteed, as well as assurance that it was safe to participate in the survey.

"I believe with detailed information, if one got the information correctly, maybe the willingness (to participate) would be much better." Kyle, student.

"Most of them (MSM), I think you need to assure them of the confidentiality in the interview. That is the thing that most MSM fear. Maybe they will be mentioned out there, or if they are students like at the university, they will be discriminated." Pitts, student.

To further encourage recruitment, it was suggested that part of the survey team be MSM because TSMSM would be more comfortable opening up to other MSM.

"Due to the sensitivity of what you're dealing with, only some of my friends would agree to come for the study … most of them are ok opening up to fellow members (MSM) but when it comes to somebody else they don't open up. So it is good to have other MSM working with you." Perry, student.

Participants also predicted that TSMSM would encounter a twofold challenge in getting to the survey site: knowing the location of the survey site and having the means to get to the survey site. To allay this challenge, participants proposed that the survey team should consider giving directions to the survey site by sharing a location pin on smart phones, providing a telephone number TSMSM could call if they needed clarifications about the location of the survey site and reimbursing participants with money to cover transport costs.

"In terms of direction, if someone has a smartphone you can send them the location pin [GPS coordinates] of the study office. It could work … instead of walking around asking from people … and include phone details just for inquiries." Andy, student.

"You might find someone does not have the transport to get to town. If there could be a way they could be sorted out when they come, they get reimbursed the amount … I think it would work. It would give someone motivation to come and participate." Andy, student.

From the service providers' point of view, it was noted that due to the proposed incentives in the prospective survey, there was a likelihood of recruiting MSM who were not TSMSM and/or men who were not MSM. To mitigate this to some extent, it was recommended that the research team could ask to see a student identification card and compare the student's facial appearance with the image on the identification card.

"When someone wants to get the incentive and does not have friends who are students, you are likely to be brought people who are coached … you are also likely to be brought people who are not MSM who are also coached." Nicole, service provider.

"To participate, one comes with his school ID … but now, one can borrow an ID … it is still not 100% viable (foolproof) but it tries to limit number of non-students participating." Nicole, service provider.

Finally, carrying out the prospective survey when tertiary learning institutions were closed due to COVID-19 restrictions or when students were having examinations would interfere with recruitment of participants. It was proposed that the prospective survey be conducted at a time when COVID-19 restrictions would have eased and students were not sitting examinations.

"For a student it depends on whether he is currently in college or at home because of corona (COVID-19) … and also, are you giving these coupons during exams time? Of course no one would come if they have exams. And you know students at university, they only read during exams time and therefore they would not bring back the coupons during that time." Justin, service provider.

"It is better if you do the study when universities re-open (after COVID-19 restrictions have eased) and also when the students are not having exams." Mike, service provider.

4. Discussion

We assessed whether RDS was an appropriate and acceptable strategy for recruiting young TSMSM in an HIV/STI biobehavioral survey. We also assessed the challenges anticipated with the use of this method and strategies to mitigate these challenges as proposed by the participants. RDS relies on certain assumptions that need to be met for it to be considered an appropriate sampling method for a particular population. These assumptions are that (1) the target population is sufficiently networked to sustain recruitment through the waves and eventually reach the desired sample size, (2) peer relationships are reciprocal (a knows and can recruit b; b knows and can recruit a), (3) recruitment within an individual's network is random and (4) sampling occurs with replacement so that the set of available recruits is not depleted [30]. Our findings demonstrate that the first two assumptions were met for the TSMSM population. To begin with, the TSMSM population was well networked, with members exhibiting close social ties and having large network sizes. Secondly, members of the TSMSM population formed reciprocal relationships characterized by trust between each other. Based on the fulfillment of these two assumptions, RDS would thus be an appropriate recruitment strategy for TSMSM. Besides the trust that exists between peers, RDS was also acceptable to TSMSM due to the proposed double incentives and the discrete approach the method uses.

Our target population of TSMSM is young and socially marginalized. Other studies have shown that, to varying degrees, RDS is an appropriate and acceptable strategy for recruiting university students [31]; sexual and gender minority youth, including young MSM [32]; and young adult non-medical users of pharmaceutical opioids [33] for research. However, other studies have found that RDS may be an inappropriate strategy for recruiting socially marginalized populations, such as urban young MSM [34] and young illicit drug users [35], mainly due to members of the target populations having small network sizes and insufficient ties within their networks, resulting in the inability to sustain recruitment. Notably, the studies highlighted here used data that were collected after the RDS surveys had been completed. To the best of our knowledge, this is the first study to use formative research to assess the appropriateness and acceptability of using RDS to recruit young TSMSM for HIV/STI research in sub-Saharan Africa. As in other studies [36–38], this formative research provided us with useful information on the challenges that could be expected with the use of RDS, as well as probable mitigation strategies in response to these challenges. Being aware of these challenges is important to research teams because the teams are then able to put in place measures to address these challenges prior to implementing RDS surveys.

Our study had some limitations. By the nature of its design, formative research aims to describe the attributes of a community that are relevant to a specific public health issue. It is not designed to test hypotheses. Rather, in this instance, formative research helped inform whether RDS could be considered an appropriate and acceptable strategy for the target population and contributed to the RDS survey planning process by identifying anticipated implementation challenges and proposed mitigation strategies for these challenges. Therefore, we cannot say for sure that based on these findings, an RDS survey among TSMSM would be successful. We would have to conduct the RDS survey itself and then evaluate its outcomes and consider the value of the formative research to the RDS survey. Another limitation of this study is that we interviewed a small, convenient sample of service providers. However, we felt that with this sample, given the dual roles each of the providers had at their respective organizations and the day-to-day interactions they had with MSM, we would be able to obtain sufficient information to meet the objectives of our study. Additionally, the three organizations from which the participants were sampled are the primary providers of MSM-exclusive/friendly services and are highly rated by MSM. Furthermore, the study was conducted at a time when there were government-imposed COVID-19 restrictions, with most staff in these organizations working from home, thus limiting their availability and accessibility to participate in the study. In addition, our study only utilized interviews for data collection. Other methods of qualitative data collection, such as focus group discussions and community mapping, may yield more information for assessing the appropriateness and acceptability of the RDS method, as well as anticipated RDS implementation challenges and possible strategies to mitigate these challenges [22,38]. Future studies should consider larger sample sizes, as well as a combination of qualitative methods so as to yield more data. Finally, the study was conducted in the capital city, which is expected to be more liberal than other smaller cities or rural settings in the country, thus limiting the generalizability of our findings. Nonetheless, these findings demonstrate the appropriateness and acceptability of RDS among TSMSM, in addition to bringing to light the anticipated challenges of using RDS and offering recommendations on how these challenges could be addressed prior to implementing the RDS survey.

5. Conclusions

TSMSM had large network sizes and strong ties within the networks, properties considered to be appropriate to sustain recruitment through RDS waves. The RDS method was acceptable to TSMSM due to the trust that existed amongst them, making it easier for them to reach each other as compared to the researchers themselves attempting to reach TSMSM directly. The study also offered valuable lessons on the challenges that would be expected with the use of RDS in the TSMSM population and proposed strategies to mitigate

these challenges. Pre-assessing the suitability and agreeability of methods to reach young marginalized populations appears to be a practical way to gain entry into these populations, ensuring that the views and voices of possible future participants are incorporated into the design of prospective studies.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19127331/s1, File S1: COREQ checklist; File S2: Guide for interviews with service providers; File S3: Guide for interviews with TSMSM.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Reference number: P990/12/2019, 5 March 2020) and the University of the Witwatersrand Human Research Ethics Committee-Medical (Reference number: M200215, 31 July 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available because they are qualitative interviews that contain personal and potentially identifiable information from members of a marginalized population.

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References

1. World Health Organization (WHO). *HIV and Young Men Who Have Sex with Men: Technical Brief*; WHO: Geneva, Switzerland, 2015.
2. Laws of Kenya Cap 63: The Penal Code. Available online: http://www.kenyalaw.org/lex/actview.xql?actid=CAP.63 (accessed on 18 August 2021).
3. Delany-morethwe, S.; Cowan, F.M.; Busza, J.; Bolton-moore, C.; Kelley, K.; Fairlie, L. Providing comprehensive health services for young key populations: Needs, barriers and gaps. *J. Int. AIDS Soc.* **2015**, *18*, 29–40. [CrossRef] [PubMed]
4. Mustanski, B.S.; Newcomb, M.E.; Bois, S.N.D.; Garcia, S.C.; Grov, C. HIV in young men who have sex with men: A review of epidemiology, risk and protective factors, and interventions. *J. Sex Res.* **2011**, *48*, 218–253. [CrossRef] [PubMed]
5. Fromme, K.; Corbin, W.R.; Kruse, M.I. Behavioral risks during the transition from high school to college. *Dev. Psychol.* **2008**, *44*, 1497–1504. [CrossRef]
6. Renn, K. LGBTQ Students on Campus: Issues and Opportunities for Higher Education Leaders. Higher Education Today. 2017. Available online: https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/ (accessed on 10 June 2021).

7. Cong, L.; Ono-Kihara, M.; Xu, G.; Ma, Q.; Pan, X.; Zhang, D.; Kihara, M. The characterisation of sexual behaviour in Chinese male university students who have sex with other men: A cross-sectional study. *BMC Public Health* **2008**, *8*, 250. [CrossRef] [PubMed]
8. Zou, H.; Tucker, J.D.; Fan, S.; Xu, J.; Yu, M.; Luo, Z.; Grulich, A.E. Learning about HIV the hard way: HIV among Chinese MSM attending university. *Lancet Infect. Dis.* **2018**, *18*, 16–18. [CrossRef]
9. Ojino, R.; Mich, L. Mobile applications in university education: The case of Kenya. *J. E-Learn. Knowl. Soc.* **2018**, *14*, 111–125.
10. Hall, W.J.; Sun, C.J.; Tanner, A.E.; Mann, L.; Stowers, J.; Rhodes, S.D. HIV prevention opportunities with GPS-based social and sexual networking applications for men who have sex with men. *AIDS Educ. Prev.* **2017**, *29*, 38–48. [CrossRef]
11. Fan, S.; Yang, Z.; Hou, F.; Yu, M.; Luo, Z.; Liao, M.; Zou, H. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: A systematic review and meta-analysis. *Sex Health* **2019**, *16*, 554–565. [CrossRef]
12. Hightow, L.B.; MacDonald, P.D.; Pilcher, C.D.; Kaplan, A.H.; Foust, E.; Nguyen, T.Q.; Leone, P.A. The unexpected movement of the HIV epidemic in the Southeastern United States. *JAIDS J. Acquir. Immune Defic. Syndr.* **2005**, *38*, 531–537. [CrossRef]
13. Brink, J.G.; Unit, E.; Africa, S. Considerations for South African higher education: A national student men who have sex with men sexual behavior survey. *S. Afr. J. High. Educ.* **2017**, *31*, 184–207. [CrossRef]
14. Respondent Driven Sampling. Available online: http://www.respondentdrivensampling.org/ (accessed on 24 September 2021).
15. Okal, J.; Raymond, H.F.; Tun, W.; Musyoki, H.; Dadabhai, S.; Broz, D.; Geibel, S. Lessons learned from respondent-driven sampling recruitment in Nairobi: Experiences from the field. *BMC Res. Notes* **2016**, *9*, 158. [CrossRef] [PubMed]
16. Johnston, L.G.; Sabin, K. Sampling hard-to-reach populations with respondent driven sampling. *Methodol. Innov. Online* **2010**, *5*, 38–48. [CrossRef]
17. Xu, J.J.; Reilly, K.H.; Lu, C.M.; Ma, N.; Zhang, M.; Chu, Z.X.; Shang, H. A cross-sectional study of HIV and syphilis infections among male students who have sex with men (MSM) in northeast China: Implications for implementing HIV screening and intervention programs. *BMC Public Health* **2011**, *11*, 287. [CrossRef] [PubMed]
18. Zheng, J.; Wu, Z.; Poundstone, K.E.; Pang, L.; Rou, K. HIV, syphilis infection, and risky sexual behaviors among male university students who have sex with men in Beijing, China: A cross-sectional study. *AIDS Educ. Prev.* **2012**, *24*, 78–88. [CrossRef] [PubMed]
19. Pinsky, I.; Chiarilli, D.B.; Klausner, J.D.; Kull, R.M.; O'Keefe, R.; Heffer, C.; Seward, S.L., Jr. Rates of asymptomatic nonurethral gonorrhea and chlamydia in a population of university men who have sex with men. *J. Am. Coll. Heal.* **2012**, *60*, 481–484. [CrossRef] [PubMed]
20. Zhang, L.; Ding, X.; Lu, R.; Feng, L.; Li, X.; Xiao, Y.; Qian, H.Z. Predictors of HIV and syphilis among men who have sex with men in a chinese metropolitan city: Comparison of risks among students and non-students. *PLoS ONE* **2012**, *7*, e37211. [CrossRef]
21. Higher Education HIV/AIDS Programme South Africa (HEAIDS). *HIV Prevalence and Related Factors: Higher Education Sector Study South Africa*; Higher Education South Africa: Pretoria, South Africa, 2009.
22. Forrest, J.I.; Stevenson, B.; Rich, A.; Michelow, W.; Pai, J.; Jollimore, J.; Roth, E.A. Community mapping and respondent-driven sampling of gay and bisexual men's communities in Vancouver, Canada. *Cult. Heal. Sex* **2014**, *16*, 288–301. [CrossRef]
23. Proctor, E.; Silmere, H.; Raghavan, R.; Hovmand, P.; Aarons, G.; Bunger, A.; Hensley, M. Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. *Adm. Policy Ment. Health Ment. Health Serv. Res.* **2011**, *38*, 65–76. [CrossRef]
24. Mwaniki, S.W.; Mugo, P.M.; Palanee-Phillips, T. Project BESPOKE (integrated bio-behavioral assessment of HIV and STI among young tertiary student men who have sex with men in Nairobi, Kenya): A respondent-driven sampling survey protocol. *Front. Public Health* **2021**, *9*, 1452. [CrossRef]
25. Liamputtong, P. *Qualitative Research Methods*, 5th ed.; Oxford University Press: Docklands, VIC, Australia, 2020.
26. Tong, A.; Sainsbury, P.; Craig, J. Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *Int. J. Qual. Health Care* **2007**, *19*, 349–357. [CrossRef]
27. University of California San Francisco (UCSF). Integrated HIV Bio-Behavioural Surveillance Toolbox. Available online: https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox (accessed on 24 September 2021).
28. Guba, E.G. Criteria for assessing the trustworthiness of naturalistic inquiries. *ECTJ* **1981**, *29*, 75. [CrossRef]
29. Shenton, A.K. Strategies for ensuring trustworthiness in qualitative research projects. *Educ. Inf.* **2004**, *22*, 63–75. [CrossRef]
30. Volz, E.; Heckathorn, D. Probability based estimation theory for respondent driven sampling. *J. Off. Stat.* **2008**, *24*, 79–97.
31. Wejnert, C.; Heckathorn, D.D. Web-based network sampling: Efficiency and efficacy of respondent-driven sampling for online research. *Sociol. Methods Res.* **2008**, *37*, 105–134. [CrossRef]
32. Wirtz, A.L.; Iyer, J.R.; Brooks, D.; Hailey-Fair, K.; Galai, N.; Beyrer, C.; PUSH Study Group. An evaluation of assumptions underlying respondent-driven sampling and the social contexts of sexual and gender minority youth participating in HIV clinical trials in the United States. *J. Int. AIDS Soc.* **2021**, *24*, e25694. [CrossRef]
33. Daniulaityte, R.; Falck, R.; Li, L.; Nahhas, R.W.; Carlson, R.G. Respondent-driven sampling to recruit young adult non-medical users of pharmaceutical opioids: Problems and solutions. *Drug Alcohol Depend.* **2012**, *121*, 23–29. [CrossRef]
34. Kuhns, L.M.; Kwon, S.; Ryan, D.T.; Garofalo, R.; Phillips, G.; Mustanski, B.S. Evaluation of respondent-driven sampling in a study of urban young men who have sex with men. *J. Urban Health* **2015**, *92*, 151–167. [CrossRef]
35. Bryant, J. Using respondent-driven sampling with "hard to reach" marginalised young people: Problems with slow recruitment and small network size. *Int. J. Soc. Res. Methodol.* **2014**, *17*, 599–611. [CrossRef]

36. Higgins, D.L.; O'Reilly, K.; Tashima, N.; Crain, C.; Beeker, C.; Goldbaum, G.; Guenther-Grey, C. Using formative research to lay the foundation for community level HIV prevention efforts: An example from the AIDS community demonstration projects. *Public Health Rep.* **1996**, *111*, 28–35.
37. Allen, D.R.; Finlayson, T.; Abdul-Quader, A.; Lansky, A. The role of formative research in the National HIV Behavioral Surveillance System. *Public Health Rep.* **2009**, *124*, 26–33. [CrossRef]
38. Johnston, L.G.; Whitehead, S.; Simic-Lawson, M.; Kendall, C. Formative research to optimize respondent-driven sampling surveys among hard-to-reach populations in HIV behavioral and biological surveillance: Lessons learned from four case studies. *AIDS Care Psychol. Socio Med. Asp. AIDS/HIV* **2010**, *22*, 784–792. [CrossRef] [PubMed]

Appendix 5: Publication – HIV Prevalence and Associated Risk Factors

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AIDS Research and Therapy

RESEARCH Open Access

HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi, Kenya: a respondent-driven sampling survey

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Abstract

Background Young men who have sex with men (MSM), are a key population at higher risk of HIV infection yet they are underrepresented in research. We conducted a bio-behavioral survey to estimate HIV prevalence and associated risk factors among tertiary student MSM (TSMSM) in Nairobi, Kenya.

Methods Between February and March 2021, 248 TSMSM aged ≥ 18 years who reported sex with another man in the past year participated in a respondent-driven sampling (RDS) based cross-sectional survey. Participants completed an electronically self-administered behavioral survey and provided a blood sample for HIV antibody testing, alongside urine, anorectal and oropharyngeal swabs for pooled testing of sexually transmitted infections using a multiplex nucleic acid amplification test. RDS-Analyst v.0.72 and Stata v.15 software were used for data analysis. Differences in proportions were examined using chi-square (χ^2) test, and unweighted multivariate logistic regression was used to assess factors associated with HIV infection.

Results HIV prevalence among study participants was 8.3%, whereas the weighted prevalence was 3.6% (95% CI: 1.3–6.0%). Median ages of participants, and at self-reported first anal sex with a man were 21(interquartile range [IQR] 20-22) and 18 (IQR 17-19) years, respectively. A majority (89.3%) of TSMSM owned a smart phone, 46.5% had ever used a geosocial networking app for MSM such as Grindr ® to find a sex partner, and a third (33.6%) met their last sex partner online. Almost three-quarters (71.3%) had > 1 male sex partner in the year before the survey. A third (34.3%) did not use condoms with their last sex partner, 21.2% received money from their last sex partner and 40.9% had taken alcohol/another drug during their last sexual encounter. HIV infection was associated with studying in private institutions (adjusted odds ratio[AOR] = 6.0; 95% confidence intervals [CI] : 1.2–30.0, p = 0.027), preferring a sex partner of any age—younger, same or older (AOR = 5.2; 95 CI: 1.1–25.2, p = 0.041), last sex partner being > 25 years (AOR = 6.4; 95% CI: 1.2–34.6, p = 0.030), meeting the last sex partner online (AOR = 4.2; 95% CI; 1.1–17.0, p = 0.043) and testing positive for *Neisseria gonorrhea* (AOR = 7.8; 95% CI: 2.0–29.9, p = 0.003).

Conclusions HIV prevalence among TSMSM in Nairobi is alarmingly high, demonstrating a need for tailored prevention and control interventions for this young key population.

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Keywords College/university students, HIV prevalence, Respondent-driven sampling (RDS), Risk factors, Young men who have sex with men (YMSM)

Introduction

The incidence of human immunodeficiency virus (HIV) has continued to fall globally [1]. Kenya has made laudable progress in the HIV response as shown by the sustained decline in HIV prevalence among adults (15–49 years) in the general population, from a high of ~ 10% in the mid-1990s to 4.5% in 2020 [2]. Whilst overall incidence has been declining, key populations such as men who have sex with men (MSM) still bear a disproportionate burden of the disease. Globally, despite MSM consisting only 1–3% of the adult male population, almost a quarter (23%) of all new HIV infections in 2020 were among MSM, with MSM having 25-fold greater odds of acquiring HIV than men in the general population [3]. In sub-Saharan Africa, the overall HIV prevalence is approximately 5 times higher among MSM than among men in the general population [4]. In Nairobi—Kenya's capital, the prevalence of HIV among MSM is 25% [5] compared to 3.1% in the general male population (15–49 years old) [6], with 15.2% of all new HIV infections in the country occurring among MSM [7].

Kenya has a dedicated national program that leads the HIV response among key populations in the country [8]. Despite tremendous progress made in scaling up HIV prevention strategies among key populations, the program still grapples with challenges such as lack of updated bio-behavioral survey data and gaps in reaching adolescent and young key populations [9], including tertiary student MSM (TSMSM). In countries such as China where data is available, HIV prevalence among TSMSM is 4.1%, and despite TSMSM constituting only an estimated 8.5% of the total tertiary student population, they account for over 80% of all HIV infections in the tertiary institutions [10]. In South Africa, TSMSM comprise 6% of male tertiary students and have a HIV prevalence of 4.1%, which is greater than twice that of the general male tertiary student population—1.7% [11].

TSMSM like other young MSM (YMSM) may be involved in practices that heighten their risk of acquiring HIV. Upon joining tertiary institutions, they interact with peers who have similar same-sex behavior, experience more freedom from parental supervision, and have increased opportunities for socialization [12]. As a result, studies have shown that TSMSM seek casual sex partners online, have sex more often, and engage in condomless sex, group sex and sex work [10]. Additionally, TSMSM have been shown to have early sexual debuts, forced sex experiences, high sex partner turnover, concurrent sex partners, inconsistent condom use, and alcohol and drug use [13]. Taken together, these behaviors increase the risk of HIV infection for TSMSM. In many African countries, including Kenya, these behavioral risks are further amplified by structural factors such as criminalization of same-sex behavior [14], as well as societal stigma and discrimination towards individuals with same sex behavior [15].

Given the potential risk of HIV infection faced by TSMSM, it is important to understand what the HIV prevalence and associated risk factors are for this population. This information would be useful to stakeholders, including: policy makers, service providers, advocacy groups and TSMSM themselves, in informing tailored prevention and control responses for this population, and thereby contribute towards the ambitious goal of ending AIDS as a public health threat by 2030[16]. This study therefore estimated HIV prevalence and associated factors among TSMSM in Nairobi, Kenya.

Methods

Study methods are detailed in the published study protocol [17], and summarized below:

Study design and setting

This was a cross-sectional survey conducted between February and March 2021, just after COVID-19 restrictions were eased in Kenya and tertiary institutions allowed to re-open for in-person learning. Nairobi, the capital city of Kenya, was selected as the study area because of its large population of tertiary students spread across approximately 150 campuses of various universities and colleges [18], including University of Nairobi which is the largest university in the country [19].

Study population

TSMSM were eligible to participate in the survey if they were: aged ≥ 18 years, provided proof of being a registered student in a university or college in Nairobi; were assigned male gender at birth, reported having had consensual receptive or insertive oral or anal sexual intercourse with another man in the last 12 months and provided written informed consent to participate in the study.

Sample size calculation

The sample size for the survey was calculated to estimate the prevalence of HIV among TSMSM, based on World Health Organization's (WHO) 2017 bio-behavioral survey guidelines for populations at higher risk of HIV infection [20]. A minimum sample size of 200 TSMSM was planned using the Cochran formula [21], with a design

effect of 3 to account for clustering, estimated HIV prevalence of 4.1% based on a previous study among TSMSM in South Africa [11], a level of precision of 0.05 and 10% non-response.

Sampling and recruitment process

Respondent-driven sampling (RDS) was used following findings from formative research that demonstrated the appropriateness and acceptability of the method for recruiting TSMSM into the survey [22]. In summary, RDS is a chain referral sampling method that integrates a mathematical model that weights the sample to compensate for the non-random sampling and minimizes old-style snowballing bias [23]. Six seeds were selected from the TSMSM who took part in the formative research. So as to reach varying networks of TSMSM, various characteristics were taken into consideration when selecting seeds, including: age, residence, sexual orientation identity, and preferred sexual role. Each seed and subsequent participants were issued with 3 coupons until the survey had recruited 120 participants (inclusive of seeds), then 2 coupons until the 150th participant, after which no more coupons were issued. Each participant was reimbursed 1000 Kenyan shillings (equivalent to US$ 10) for their time and expenses related to transport to and from the study site, and 300 Kenyan shillings (equivalent to US$ 3) for every peer they recruited into the study.

Data collection tools and procedures

The behavioral survey was conducted by self- administered interview on tablets using a questionnaire set up on REDCap® software (Vanderbilt University). The questionnaire was adapted for this study from a validated questionnaire available from the integrated HIV biobehavioral surveillance toolbox [24]. The questionnaire contained questions on sociodemographic characteristics and sexual behavior, and was administered in English, the language of instruction in Kenyan tertiary institutions. The survey was conducted at a discreet study site located within the Nairobi central business district. The recruitment coupons had a map showing where the study site was located, and a telephone number which prospective participants could call for directions if they needed to.

Biological specimen collection and testing

After completing the behavioral survey, participants were offered HIV testing based on the Kenyan national testing algorithm [25]. The testing algorithm is serial and recommends use of a screening test, followed by a confirmatory test if the screening test is positive. In cases where results of the confirmatory test disagree with those of the screening test, clients are referred to a laboratory where their samples are tested using an assay which is distinct from both the screening and confirmatory tests. Capillary blood from a finger prick was drawn by a trained HIV testing counselor. All samples were tested using the Determine® rapid test kit. Non-reactive tests were considered negative for HIV. Samples from those with reactive tests were subsequently tested with HIV-1/2 First Response® kit for confirmation of HIV seropositive status, except for participants who self-reported HIV seropositive status. There were no discordant results. Participants were offered pre and post HIV testing counselling. Participants who tested positive for HIV and were not on treatment were referred to facilities of their choice for HIV care and treatment. Participants who tested negative for HIV and were at high risk for HIV infection were referred for PrEP if not already initiated. Participants also provided urine, anorectal and oropharyngeal swabs for pooled *Chlamydia trachomatis* (CT), *Mycoplasma genitalium* (MG), *Neisseria gonorrhea* (NG) and *Trichomonas vaginalis* (TV) testing using a multiplex nucleic acid amplification test (Sacace Biotechnologies®, Italy). HIV testing was done at the study site whereas testing for the other sexually transmitted infections (STIs) was done in a licensed and accredited commercial laboratory within the Nairobi metropolis. All participants were offered condoms and water-based lubricants.

Ethical considerations

The study was approved by University of the Witwatersrand Human Research Ethics Committee-Medical and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee. All participants provided written informed consent. The following measures were taken to protect study participants: no identifying information was written on study documents nor laboratory specimens associated with a participant; all paper-based study materials were stored in locked file cabinets, in locked offices and access granted to only authorized study staff; electronic data was stored in a password-protected computer accessible only to authorized study staff; and same-sex sexual behavior was not reported to the authorities. All staff working with participants were trained on the importance of maintaining confidentiality, and signed confidentiality agreements prior to involvement in the study. The study also received a letter of support from the Kenyan Ministry of Health through the National AIDS and STI Control Program (NASCOP).

Data analysis

Data analysis excluded 6 seeds who were purposely selected to begin the RDS recruitment. The weighted HIV prevalence rate with 95% confidence intervals (CI) was calculated using RDS Analyst (RDS-A) software version 0.72 [26], where Gile's successive sampler (SS) estimator was used for weighting. Gile's SS estimator takes into consideration the self-reported network sizes of participants, recruitment patterns and estimated size of the study population [27]. As per recommendation [28], an estimated population size of 8406 for TSMSM (1.45% of male tertiary students in the Nairobi metropolis) was used, with 0.95 CI and 1000 bootstraps.

Stata version 15 (College Station, TX: StataCorp LLC) was used for further analysis of the unweighted data. Some continuous variables such as age and self-reported number of sex partners were converted into binary categories. Categorical variables were summarized using proportions, and differences in proportions examined using chi-square (χ^2) test. Bivariate analysis and multivariate logistic regression models were used to measure associations between various factors and HIV infection. All exposure variables with a $p \leq 0.2$ in bivariate analysis were included in the final multivariate model. Other variables with $p > 0.2$ but considered to be confounders were included in the multivariate model. Unweighted regression models were used since they have been shown to perform better than weighted regression models for RDS data [29].

Results

Sociodemographic characteristics of TSMSM

A total of 248 TSMSM were recruited including 6 seeds. The final sample had a minimum of one and maximum of eight recruitment waves, as depicted by the recruitment networks in Fig. 1. The median age of participants was 21 years (IQR 20–22), with 96.3% ≤ 24 years, and the oldest being 30 years old (Table 1). A majority (58.3%) were university students, almost three-quarters (71.9%) were in public institutions and four-fifths (79.3%) resided in college or rented hostels outside their campuses. A majority (89.3%) owned a smart phone at the time of the study.

Recruitment was initiated by six seeds who were issued with 418 coupons, 244 coupons were returned and out of these, 242 met the eligibility criteria for study participation and were subsequently enrolled into the study. The waves of recruitment per seed ranged from 1 to 8. Diamonds and circles indicate seed and non-seed participants, respectively.

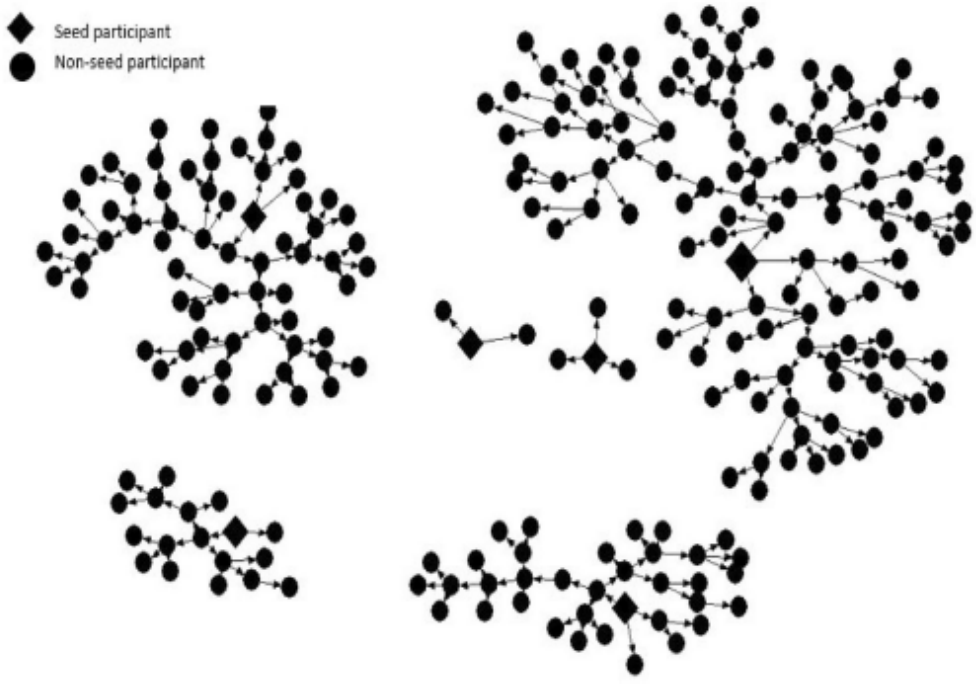


Fig. 1 Recruitment of tertiary student men who have sex with men in Nairobi ($n = 248$)

Table 1 Characteristics of TSMSM (total and by HIV status) in Nairobi, Kenya ($n = 242$)

Variable	Category	n (%)	HIV negative n (%)	HIV positive n (%)	*p* value
Sociodemographic characteristics					
Age (years)	18–20	89 (36.8)	83 (93.3)	6 (6.7)	0.512
	21–30	153 (63.2)	139 (90.8)	14 (9.2)	
Level of institution	University	141 (58.3)	131 (93.0)	10 (7.0)	0.434
	College	101 (41.7)	91 (90.1)	10 (9.9)	
Type of institution	Public	174 (71.9)	165 (94.8)	9 (5.2)	0.005*
	Private	68 (28.1)	57 (83.8)	11 (16.2)	
Type of course	Engineering and technology	103 (42.6)	97 (94.2)	6 (5.8)	0.551
	Health, natural and social sciences	53 (21.9)	48 (90.6)	5 (9.4)	
	Business management	48 (19.8)	44 (91.7)	4 (8.3)	
	Arts and humanities	38 (15.7)	33 (86.8)	5 (13.2)	
Year of study[a]	1st and 2nd year	153 (66.0)	140 (91.5)	13 (8.5)	0.812
	3rd and 4th year	79 (34)	73 (92.4)	6 (7.6)	
Residence	College/rented hostel	192 (79.3)	180 (93.8)	12 (6.2)	0.026*
	With family	50 (20.7)	42 (84.0)	8 (16.0)	
Ever attended boarding school	Yes	203 (16.1)	188 (92.6)	15 (7.4)	0.259
	No	39 (83.9)	34 (87.2)	5 (12.8)	
Main source of finances	Parents/guardians	137 (56.6)	127 (92.7)	10 (7.3)	0.692
	Employment	65 (26.9)	58 (89.2)	7 (10.8)	
	Bursary/scholarship	40 (16.5)	37 (92.5)	3 (7.5)	
Had smartphone at time of the study	Yes	216 (89.3)	196 (90.7)	20 (9.3)	0.105
	No	26 (10.7)	26 (100.0)	0 (0.0)	
Sexual orientation	Gay	153 (63.2)	140 (91.5)	13 (8.5)	0.655
	Bisexual	80 (33.1)	73 (91.3)	7 (8.7)	
	Heterosexual	9 (3.7)	9 (100.0)	0 (0.0)	
Gender identity	Cisgender male	219 (90.5)	201 (91.8)	18 (8.2)	0.937
	Transgender female	23 (9.5)	21 (91.3)	2 (8.7)	
Sexual behavior characteristics					
Ever had vaginal sex with a woman	Yes	130 (53.7)	123 (94.6)	7 (5.4)	0.080
	No	112 (46.3)	99 (88.4)	13 (11.6)	
Age at first anal sex with a man	≤ 18 years	137 (57.0)	124 (90.5)	13 (9.5)	0.455
	> 18 years	103 (43.0)	96 (93.2)	7 (6.8)	
Preferred age of sex partner	Same/younger age	187 (77.6)	178 (95.2)	9 (4.8)	0.001*
	Any age	36 (15.0)	29 (80.6)	7 (19.4)	
	Older	18 (7.4)	14 (77.8)	4 (22.2)	
Age of last sexual partner (years)	15–24	204 (84.7)	193 (94.6)	11 (5.4)	< 0.001*
	≥ 25	37 (15.3)	28 (75.7)	9 (24.3)	
Sexual role at first anal sex with a man	Insertive	103 (42.8)	95 (92.2)	8 (7.8)	0.514
	Receptive	83 (34.4)	74 (89.2)	9 (10.8)	
	Versatile	55 (22.8)	52 (94.6)	3 (5.4)	
Preferred sexual role	Insertive	117 (48.6)	109 (93.2)	8 (6.8)	0.512
	Versatile	75 (31.1)	69 (92.0)	6 (8.0)	
	Receptive	49 (20.3)	43 (87.8)	6 (12.2)	
Nature of first anal sex with a man	Consensual	201 (83.4)	182 (90.6)	19 (9.4)	0.145
	Coerced/forced	40 (16.6)	39(97.5)	1 (2.5)	
Number of men had anal sex within last 12 months	One (1)	69 (28.7)	68 (98.6)	1 (1.4)	0.015*
	More than one (1)	172 (71.3)	153 (89)	19 (11.0)	
Participated in group sex within last 12 months	No	202 (83.8)	186 (92.0)	16 (8.0)	0.628
	Yes	39 (16.2)	35 (89.7)	4 (10.3)	

Table 1 (continued)

Variable	Category	n (%)	HIV negative n (%)	HIV positive n (%)	*p* value
Ever used a geosocial networking app for MSM to find a sex partner	Yes	112 (46.5)	95 (84.8)	17 (15.2)	< 0.001*
	No	129 (53.6)	126 (97.7)	3 (2.3)	
Where last sex partner was met	Offline	160 (66.4)	153 (95.6)	7 (4.4)	0.002*
	Online	81 (33.6)	68 (84.0)	13 (16.0)	
Used condom with last sexual partner	Yes	159 (65.7)	145 (91.2)	14 (8.8)	0.673
	No	83 (34.3)	77 (92.8)	6 (7.2)	
Received money from last sex partner	Yes	51 (21.2)	47 (92.2)	4 (7.8)	0.894
	No	190 (78.8)	174 (91.6)	16 (8.4)	
Taken alcohol/other drug during last sexual encounter	Yes	99 (40.9)	89 (89.9)	10 (10.1)	0.388
	No	143 (59.1)	133 (93.0)	10 (7.0)	
Sexually transmitted infections test results					
Chlamydia trachomatis	Negative	100 (41.3)	94 (94.0)	6 (6.0)	0.283
	Positive	142 (58.7)	128 (90.1)	14 (9.9)	
Mycoplasma genitalium	Negative	217 (89.7)	202 (93.1)	15 (6.9)	0.024*
	Positive	25 (10.3)	20 (80.0)	5 (20.0)	
Neisseria gonorrhea	Negative	206 (85.1)	194 (94.2)	12 (5.8)	0.001*
	Positive	36 (14.9)	28 (77.8)	8 (22.2)	
Trichomonas vaginalis	Negative	239 (98.8)	219 (91.6)	20 (8.4)	0.601
	Positive	3 (1.2)	3 (100.0)	0 (0.0)	

TSMSM tertiary student men who have sex with men

* Significant difference in proportions

[a] Ten (10) missing values not included in the analysis

Sexual behavior characteristics of TSMSM

The median age at reported anal sexual debut with a man was 18 years (IQR 17–19) and most of the sexual debuts (83.4%) were consensual, as shown in Table 1. Almost three-quarters (71.3%) had more than one sex partner, with 16.2% having participated in group sex within the last year. Approximately half (46.5%) had ever used a geosocial networking app for MSM such as Grindr ® to find a sex partner, with one-third (33.6%) having met their last sex partner online. Approximately two-thirds (65.7%) and more than three-quarters (78.1%) had used condoms and lubricants, respectively, with their last sex partner. One-fifth (21.2%) received money from their last sex partner and less than half (40.9%) had taken alcohol or another drug during their last sexual encounter.

HIV prevalence, differences in proportions, and associated factors

The HIV prevalence among the study participants was 8.3%. The weighted HIV prevalence for the study population (TSMSM in Nairobi) was 3.6% (95% CI: 1.3%—6.0%). Three-quarters (77.3%) of those who tested positive for HIV knew of their HIV serostatus prior to testing in the study and all of these participants reported being on antiretroviral therapy. As illustrated in Table 1, HIV prevalence was significantly higher among TSMSM studying in private institutions (16.2% vs 5.2%, $p=0.005$), residing at home with their families (16.0% vs 6.2%, $p=0.026$), who preferred older sex partners (22.2% vs 4.8%, $p=0.001$), whose last sex partner was > 25 years old (24.3% vs 5.4%, $p<0.001$), who had more than one sex partner in the last year (11.0% vs 1.4%, $p=0.015$), who had ever used a geosocial networking app for MSM (15.2% vs 2.3%, $p<0.001$), who met their last sex partner online (16.0% vs 4.4%, $p=0.002$) and those who tested positive for MG (20.0% vs 6.9%, $p=0.024$) and NG (22.2% vs 5.8%, $p=0.001$).

The results of bivariate and multivariate logistic regression are presented in Table 2. In multivariate analysis, independent risk factors for HIV infection were: studying in private institutions (Adjusted Odds Ratio [AOR] = 6.0; 95% CI: 1.2–29.9, $p=0.027$), preferring a sex partner of any age (AOR = 5.1, 95% CI: 1.1–25.2, $p=0.041$), having a last sex partner > 25 years old (AOR = 6.4; 95% CI: 1.2–34.6, $p=0.030$), meeting the last sex partner online (AOR = 4.2; 95% CI; 1.1–17.0, $p=0.043$) and testing positive for NG (AOR = 7.8, 95% CI: 2.0–29.9, $p=0.003$).

Table 2 Unweighted logistic regression of HIV infection and various factors among TSMSM in Nairobi, Kenya (n= 239)

Variable	Category	Unadjusted Odds Ratio (95% CI)	p value	Adjusted Odds Ratio (95% CI)	p value
Sociodemographic characteristics					
Type of institution	Public	1			Ref
	Private	3.5 (1.4–9.0)	0.008	6.0 (1.2–30.0)	0.027*
Residence	College/rented hostel	1			Ref
	With family	2.9 (1.1–7.4)	0.031	3.0 (0.7–13.2)	0.572
Sexual behavior characteristics					
Age at first anal sex with a man	≤ 18 years	1			Ref
	> 18 years	0.7 (0.3–1.8)	0.457	0.6 (0.2–2.4)	0.516
Preferred age of sex partner	Same/younger age	1			Ref
	Any age	4.8 (1.6–13.8)	0.004	5.2 (1.1–25.2)	0.041*
	Older	5.7 (1.5–20.7)	0.009	1.1 (0.1–9.2)	0.948
Age of last sexual partner	15–24	1			Ref
	≥ 25	5.6 (2.1–14.8)	< 0.001	6.4 (1.2–34.6)	0.030*
Sexual role at first anal sex with a man	Versatile	1			Ref
	Insertive	1.4 (0.4–5.7)	0.588	4.9 (0.7–32.7)	0.097
	Receptive	2.1 (0.5–8.2)	0.280	2.0 (0.3–12.7)	0.476
Preferred sexual role	Insertive	1			
	Versatile	1.2 (0.4–3.6)	0.763	0.5 (0.1–2.4)	0.380
	Receptive	1.9 (0.6–5.8)	0.259	1.6 (0.3–8.6)	0.572
Nature of first anal sex with a man	Coerced/forced	1			Ref
	Consensual	4.1 (0.5–31.3)	0.177	0.1 (0.1–1.5)	0.090
Number of men had anal sex with in last 12 months	One	1			Ref
	More than one	8.4 (1.1–64.4)	0.040	8.3 (0.7–94.6)	0.088
Participated in group sex within last 12 months	No	1			Ref
	Yes	1.3 (0.4–4.2)	0.629	0.9 (0.2–4.3)	0.877
Where last sex partner was met	Offline	1			Ref
	Online	4.2 (1.6–11.0)	0.004	4.2 (1.1–17.0)	0.043*
Used condom with last sex partner	No	1			Ref
	Yes	1.2 (0.5–3.4)	0.673	4.3 (0.9–20.3)	0.065
Received money from last sex partner	Yes	1			Ref
	No	1.1 (0.3–3.4)	0.894	3.5 (0.7–18.7)	0.139
Taken alcohol/other drug during last sexual encounter	No	1			Ref
	Yes	1.5 (0.6–3.7)	0.390	2.3 (0.6–8.7)	0.214
Sexually transmitted infections test results					
Mycoplasma genitalium test	Negative	1			Ref
	Positive	3.3 (1.1–10.2)	< 0.001	2.1 (0.5–9.1)	0.293
Neisseria gonorrhea test	Negative	1			
	Positive	4.6 (1.7–12.3)	< 0.001	7.8 (2.0–29.9)	0.003*

TSMSM: tertiary student men who have sex with men

Three records had missing values and were excluded from the logistic regression

*Independent risk factor for HIV infection

Discussion

Our study found an estimated HIV prevalence of 8.3% among study participants and a RDS-weighted HIV prevalence of 3.6% (95% CI: 1.3–6.0%) among TSMSM in Nairobi. The weighted HIV prevalence observed among TSMSM in our study (96% aged 18–24 years) was six times higher than that of young Kenyan men in the general population aged 18–24 years, which is 0.6%[6]. Accordingly, the recent call to have programming that caters for the HIV prevention needs of YMSM

in Africa [30], is quite relevant for TSMSM in Nairobi. The weighted HIV prevalence observed is comparable to the 4.1% HIV prevalence found among TSMSM in both China [10] and South Africa [11]. Notably, with only 77.3% of study participants knowing their HIV status to be seropositive before the study, there is need to scale up HIV testing in this population so as to reach the first 95 of the UNAIDS fast-track 95-95-95 [31]. HIV self-testing is readily available and acceptable in Kenya [32], and should thus be harnessed to increase testing rates in this key population.

Higher HIV prevalence was observed among TSMSM studying in private institutions and staying at home with their families. We hypothesize that most TSMSM who study in private institutions and stay with their families have predominantly lived most of their lives in the city, which is more liberal than the rural areas of the country. Therefore, it is likely that these TSMSM could have started experimenting with anal sex at an earlier age than their rural counterparts who due to costs, mostly tend to join the public institutions and stay either in campus or rented accommodation outside their campuses. For these reasons, there could be an increased exposure period for the former, leading to the elevated risk of HIV infection. Indeed, even higher HIV prevalence (30.3%) than we found, has been observed among YMSM in urban Indonesia [33], a country where it is not illegal to be homosexual.

Meeting sex partners online was significantly associated with HIV infection. This finding is consistent with that of a previous study in Kenya which showed that MSM who sought sex partners online had four-fold greater odds of having HIV infection compared to those who sought sex partners from physical sites [34]. Additional research in sub-Saharan Africa has demonstrated that MSM who seek sex partners online have higher prevalent HIV infection and are more likely to be younger [35], like our study participants. Young MSM, including TSMSM who use the internet to find sex partners are a critical population to target for HIV interventions, since they are inclined to have increased levels of sexual risk behavior, and the internet itself may be a promising mechanism to deliver interventions [36]. Like in our study where 89.6% owned a smart phone, another study showed that 95.6% of tertiary students in Kenya own smart phones [37], and use the phones to access the internet. Future YMSM-focused risk reduction interventions should leverage the internet to host campaigns and safe sex messaging efforts to directly and discretely reach TSMSM who predominantly seek sex partners online. This is necessary since TSMSM—as a result of criminalization of homosexuality, societal stigma and discrimination, may be afraid to seek services from programs that largely depend on physical outreach, thus resulting in missed opportunities for HIV prevention.

Another significant risk factor identified for HIV infection was having reported the last sex partner being > 25 years. This is consistent with the findings of a study in the USA which showed that among YMSM, the odds of HIV infection were significantly elevated as the age of sexual partners increased [38]. This could be explained by the fact that risk of HIV infection generally increases with age, thus increasing the risk of HIV infection among YMSM who have sex with older male partners. In addition, practices that increase the risk of HIV infection such as condomless anal sex have been shown to be common in age-disparate sexual relationships among MSM, and are significantly associated with unrecognized HIV infection [39]. Previous research has shown that YMSM are motivated to seek older MSM partners for economic and social support [40]. Subsequently, the economic power imbalance between YMSM and older MSM may diminish the former's ability to negotiate for safer sex [41], with YMSM previously reporting sexual coercion by older MSM [42]. Since the YMSM—older MSM partnerships are more likely to persist than wane, HIV prevention programs for YMSM should include information about the HIV risk associated with older MSM partners and skills for negotiating for safer sex, particularly the correct and consistent use of condoms. Additionally, TSMSM should be provided with more tools for HIV prevention, including oral pre-exposure prophylaxis (PrEP) which is available in Kenya [43], and offers YMSM more control on usage as compared to condoms which need negotiation between sex partners. As well, since YMSM may choose more pleasurable (condomless sex) over safer sex, PrEP would offer them the opportunity to enjoy sex without fear of HIV infection, the risk of acquiring other STIs notwithstanding [44].

A notable independent risk factor for HIV infection that was observed in our study was testing positive for NG. This coupled with the high prevalence of CT observed (58.7%) has implications for HIV control and prevention. The causal relationship between prevalent CT/NG and incident HIV has previously been established, with CT/NG shown to increase both the risk of HIV acquisition and transmission [45]. Among MSM, rectal CT/NG re-infection has been associated with increased risk of HIV seroconversion [46], with modelling studies demonstrating that 10.4% of incident HIV infections are attributable to CT/NG infection [47]. TSMSM should therefore be encouraged to have diagnostic STI screening often, depending on sexual activity and risk-taking, and thereafter receive appropriate care. This would help mitigate the deleterious synergy between

STI and HIV, as well as forestall morbidities such as infertility that occur secondary to some STI.

Although not independently associated with HIV infection in our study, other behaviors that increase the risk of HIV infection were common. These include engaging in condomless sex, group sex, transactional sex, alcohol and drug use during sex, as well as having multiple sex partners. These findings are consistent with what has been observed among TSMSM in China [10] and South Africa [13]. Behavioral change is therefore urgently needed in this population to augment the biomedical tools available for HIV prevention.

To our knowledge, this study was the first one to assess the prevalence and associated factors of HIV among TSMSM in Kenya, and possibly in sub-Saharan Africa using the RDS method. These findings should be viewed in light of some limitations. Firstly, RDS is not a classical probabilistic sampling method. To offset this limitation, when calculating our sample size, we applied a design effect of 3 to account for the clustering that occurs due to homophily and minimize the traditional bias associated with snowball sampling. We also excluded from analysis the 6 seeds who were purposely selected to start off recruitment. Secondly, since we asked about what happened in the past year, there was a possibility of recall bias. To mitigate this, we aimed to include in our questionnaire either single or multiple choice questions and have very few instances where participants needed to type out answers. We also limited the number of questions about events that happened more than 12 months before the study. Thirdly, we asked questions about sexual behavior which may be affected by social desirability bias. To minimize this, participants self-administered the survey on an online platform accessed through tablet computers, since this has been shown to be more effective in offsetting this kind of bias, as compared to face-to-face interviews [48]. Fourthly, the cross-sectional nature of the study limits causal inference of the independent risk factors identified for HIV infection. Finally, though we used a comprehensive set of variables in the logistic regression analysis, we cannot rule out the possibility of residual confounding from other variables such as experiences of stigma, discrimination and violence. Despite these limitations, this survey offers valuable lessons on the burden of HIV and associated factors among TSMSM, and hopefully portends the development of tailored interventions for the HIV response in this key yet understudied population.

Conclusions

In summary, HIV prevalence among TSMSM in Nairobi is 6 times higher than that of Kenyan young men of comparable age. As a result, urgent efforts to develop bespoke HIV prevention and control interventions for this population are called for. Such interventions should seek to enhance HIV testing (including through HIV self-testing), as well as promote STI screening and treatment. TSMSM should be provided with education messages on the attendant risk of HIV infection in age-disparate relationships, and empowered to practice safer sex through use of both condoms and PrEP. Further, there is need for collaboration between tertiary institutions and relevant agencies of the ministry of health such as National AIDS and STI Control Program (NASCOP), in providing HIV prevention and control services to TSMSM so as to avert new HIV infections in this population. Given its widespread availability and use in Kenya, the internet is an innovative tool that should be harnessed for delivery of these interventions.

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Author contributions

SWM, PMM, TPP conceptualized the study, designed the study protocol and its instruments. SWM and PMK acquired and analyzed the data. PMK prepared Fig. 1. PMM and TPP reviewed the manuscript. SWM acquired funding for the study, drafted the manuscript and incorporated authors' contributions. All authors have read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during this study is not publicly available, but may be available from the corresponding author upon reasonable request, and with permission from University of the Witwatersrand Human Research Ethics Committee-Medical and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee.

Declarations

Ethics approval and consent to participate

This study was approved by University of the Witwatersrand Human Research Ethics Committee-Medical (Ref. No. M200215) and University of Nairobi-Kenyata National Hospital Ethics and Research Committee (Ref. No. P990/12/2019). All participants provided written informed consent to participate.

Competing Interests

The authors have no competing interests or other interests that might be perceived to influence the results and/or discussion reported in this paper.

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References

1. GBD 2019 HIV Collaborators. Global, regional, and national sex-specific burden and control of the HIV epidemic, 1990–2019, for 204 countries and territories: the Global Burden of Diseases Study 2019". Lancet HIV. 2021;8(10):e633–51.
2. National AIDS Control Council (NACC). The second Kenya AIDS strategic framework II, 2020/21, 2024/25—sustain gains, bridge gaps and accelerate progress," Nairobi: Government of Kenya, 2020. [Online]. https://nacc.or.ke/wp-content/uploads/2021/01/KASFII_Web22.pdf. Accessed 11 Nov 2021.
3. Joint United Nations Programme on HIV/AIDS (UNAIDS). 2021 global AIDS update—confronting inequalities. Geneva, Switzerland; 2021.
4. Hessou PHS, et al. Comparison of the prevalence rates of HIV infection between men who have sex with men (MSM) and men in the general population in sub-Saharan Africa: a systematic review and meta-analysis. BMC Public Health. 2019;19(1):1634.
5. Smith AD, Kimani J, Kabuti R, Weatherburn P, Fearon E, Bourne A. HIV burden and correlates of infection among transfeminine people and cisgender men who have sex with men in Nairobi, Kenya: an observational study. Lancet HIV. 2021;8(5):e274–83.
6. National AIDS and STI Control Programme (NASCOP) Kenya. "Preliminary Kenya population-based HIV impact assessment (KENPHIA) Report, Nairobi, Kenya: NASCOP. 2020.
7. Kenya National AIDS Control Council. Kenya HIV prevention response and modes of transmission analysis report_March 2009. 2009.
8. National AIDS and STI Control Programme (NASCOP) Kenya. National AIDS and STI Control Programme Organogram. [Online]. https://www.nascop.or.ke/organogram/. Accessed 11 Jan 2022.
9. Musyoki H, Bhattacharjee P, Sabin K, Ngoksin E, Wheeler T, Dallabetta G. A decade and beyond: learnings from HIV programming with underserved and marginalized key populations in Kenya. J Int AIDS Soc. 2021;24(Suppl 3):e25729–e25729.
10. Fan S, et al. HIV and syphilis and sexual risk behaviours among men who have sex with men attending university in China: a systematic review and meta-analysis. Sex Health. 2019;16(6):554–65.
11. Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV Prevalence and Related Factors: Higher Education Sector Study South Africa. Johannesburg, South Africa; 2009.
12. Renn K. LGBTQ students on campus: issues and opportunities for higher education leaders. Higher Education Today, 2017. [Online]. https://www.highereдtoday.org/2017/04/10/lgbtq-students-higher-education/. Accessed 10 Jun 2021.
13. Brink JG, Unit E, Africa S. Considerations for South African higher education: a national student men who have sex with men sexual behavior survey. S Afr J High Educ. 2017;31(4):184–207.
14. "Laws of Kenya Cap 63: The Penal Code." [Online]. http://www.kenyalaw.org/lex/actview.xql?actid=CAP.63. Accessed 18 Aug 2021.
15. Delany-moretlwe S, Cowan FM, Busza J, Bolton-moore C, Kelley K, Fairlie L. Providing comprehensive health services for young key populations: needs, barriers and gaps. J Int AIDS Soc. 2015;18(Suppl 1):29–40.
16. Joint United Nations Programme on HIV/AIDS (UNAIDS). AIDS and the sustainable development goals, UNAIDS. [Online]. https://www.unaids.org/en/AIDS_SDGs. Accessed 06 May 2021.
17. Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (Integrated bio-behavioral assessment of HIV and STI among young tertiary student men who have sex with men in Nairobi, Kenya): a respondent-driven sampling survey protocol. Front Public Health. 2021;9:1452.
18. Study in Kenya. Universities and Colleges in Nairobi County. 2021. [Online]. https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1. Accessed 24 Sep 2021.
19. University of Nairobi. About us: students. 2021. [Online]. https://www.uonbi.ac.ke/students. Accessed 16 Oct 2021.
20. F. 360 WHO, CDC, UNAIDS. Biobehavioural survey guidelines for populations at risk for HIV. Geneva: World Health Organization; 2017.
21. Cochran WG. Sampling techniques. 3rd ed. New York: Wiley; 1977.
22. Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "My friends would believe my word": appropriateness and acceptability of respondent-driven sampling in recruiting young tertiary student men who have sex with men for HIV/STI research in Nairobi, Kenya. *medRxiv* 2021. 10.21.21265250
23. Respondent Driven Sampling. [Online]. http://www.respondentdrivensampling.org/. Accessed 24 Sep 2021.
24. University of California San Francisco (UCSF). Integrated HIV Bio-behavioural Surveillance Toolbox. [Online]. https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox. Accessed 24 Sep 2021.
25. National AIDS and STI Control Programme (NASCOP) Kenya. Kenya HIV testing services guidelines. 2016. [Online]. https://www.nascop.or.ke/hiv-testing-services/. Accessed 11 Jan 2022.
26. Handcock M, Fellows I, Gile K. RDS analyst: software for the analysis of respondent-driven sampling data, version 0.72." [Online]. http://wiki.stat.ucla.edu/hpmrg/index.php/RDS_Analyst_Install. Accessed 07 Oct 2021.
27. Gile KJ. Improved inference for respondent-driven sampling data with application to HIV prevalence estimation. J Am Stat Assoc. 2011;106(493):135–46.
28. UNAIDS (Joint United Nations Programme on HIV/AIDS). Recommended population size estimates of men who have sex with men. 2020. [Online]. https://www.unaids.org/sites/default/files/media_asset/2020-recommended-population-size-estimates-of-men-who-have-sex-with-men_en.pdf. Accessed 07 Oct 2021.
29. Avery L, Rotondi N, McKnight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: results from a simulation study. BMC Med Res Methodol. 2019;19(1):1–13.
30. Bekker L-G. HIV control in young key populations in Africa. Lancet Child Adolesc Heal. 2019;3(7):442–4.
31. UNAIDS Joint United Nations Programme on HIV/AIDS. Fast-track: accelerating action to end the AIDS epidemic by 2030. Geneva: UNAIDS; 2014.
32. Mugo PM, et al. Uptake and acceptability of oral HIV self-testing among community pharmacy clients in Kenya: a feasibility study. PLoS ONE. 2017;12(1): e0170868.
33. Johnston LG, et al. Alarmingly high HIV prevalence among adolescent and young men who have sex with men (MSM) in Urban Indonesia. AIDS Behav. 2021;25(11):3687–94.
34. Bhattacharjee P, et al. HIV prevalence, testing and treatment among men who have sex with men through engagement in virtual sexual networks in Kenya: a cross-sectional bio-behavioural study. J Int AIDS Soc. 2020;23(S2): e25516.
35. Stahlman S, et al. Characteristics of men who have sex with men in southern Africa who seek sex Online: a cross-sectional study. J Med Internet Res. 2015;17(5):1–12.
36. Zou H, Fan S. 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. Arch Sex Behav. 2017;46(4):885–94.
37. Ojino R, Mich L. Mobile applications in university education: the case of Kenya. J E-Learn Knowl Soc. 2018; 14(1).
38. Hurt CB, et al. Sex with older partners is associated with primary HIV infection among men who have sex with men in North Carolina. JAIDS J Acquir Immune Defic Syndr. 2010;54(2):185–90.
39. Ding Y, Zhou Y, Liu C, Liu X, He N. Sex with older partners, condomless anal sex and unrecognized HIV infection among Chinese men who have sex with men. AIDS Care. 2018;30(3):305–11.
40. Arrington-Sanders R, Leonard L, Brooks D, Celentano D, Ellen J. Older partner selection in young African–American men who have sex with men. J Adolesc Heal. 2013;52(6):682–8.
41. Anema A, et al. Intergenerational sex as a risk factor for HIV among young men who have sex with men: a scoping review. Curr HIV/AIDS Rep. 2013;10(4):398–407.
42. Braun V, Schmidt J, Gavey N, Fenaughty J. Sexual coercion among gay and bisexual men in Aotearoa/New Zealand. J Homosex. 2009;56(3):336–60.
43. AVAC (AIDS Vaccine Advocacy Coalition). PrEP watch Kenya. [Online]. https://www.prepwatch.org/country/kenya/. Accessed 18 Jan 2022.
44. Traeger MW, et al. Association of HIV preexposure prophylaxis with incidence of sexually transmitted infections among individuals at high risk of HIV infection. JAMA. 2019;321(14):1380–90.
45. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Health. 1999;75:3–17.
46. Bernstein KT, Marcus JL, Nieri G, Philip SS, Klausner JD. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. JAIDS J Acquir Immune Defic Syndr. 2010;53(4):537–43.
47. Jones J, et al. Proportion of incident HIV cases among men who have sex with men attributable to gonorrhea and chlamydia: a modeling analysis. Sex Transm Dis. 2019;46(6):357–63.
48. Adebajo S, et al. Comparison of audio computer assisted self-interview and face-to-face interview methods in eliciting HIV-related risks among men who have sex with men and men who inject drugs in Nigeria. PLoS ONE. 2014;9(1):1–6.

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Appendix 6: Publication – Prevalence of Five Curable STIs and Associated Risk Factors

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RESEARCH PAPER
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SEXUAL HEALTH

Prevalence of five curable sexually transmitted infections and associated risk factors among tertiary student men who have sex with men in Nairobi, Kenya: a respondent-driven sampling survey†

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ABSTRACT

Background. Young men who have sex with men (MSM) are a key population at high risk of sexually transmitted infections (STIs). We conducted a respondent-driven sampling (RDS) bio-behavioural survey to estimate the prevalence of five curable STIs: chlamydia, gonorrhoea, syphilis, trichomoniasis and *Mycoplasma genitalium* infection, and associated risk factors among tertiary student MSM (TSMSM) in Nairobi, Kenya. **Methods.** Between February and March 2021, we recruited 248 TSMSM aged ≥18 years who self-reported engaging in anal and/or oral sex with another man in the past year. Samples collected included urine, anorectal and oropharyngeal swabs for pooled *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhoeae* and *Trichomonas vaginalis* testing using multiplex nucleic acid amplification tests, and venous blood for serological *Treponema pallidum* screening and confirmation of current infection. Participants self-completed a behavioural survey on a REDCap digital platform. Data analysis was done using RDS-Analyst (v0.72) and Stata (v15). Differences in proportions were examined using the chi-squared (χ^2) test, and unweighted multivariate logistic regression was used to assess factors associated with STI prevalence. **Results.** RDS-adjusted prevalence rates of at least one of the five STIs, chlamydia, gonorrhoea, *Mycoplasma genitalium* infection, trichomoniasis and latent syphilis were 58.8%, 51.0%, 11.3%, 6.0%, 1.5% and 0.7%, respectively. Factors independently associated with STI prevalence were inconsistent condom use (adjusted odds ratio (AOR) = 1.89, 95% confidence interval (CI): 1.03–3.47, $P = 0.038$) and the last sex partner being a regular partner (AOR = 2.35, 95% CI: 1.12–4.92, $P = 0.023$). **Conclusion.** STI prevalence among TSMSM in Nairobi, Kenya, is disturbingly high, demonstrating urgent need for tailored testing, treatment and prevention interventions for this population.

Keywords: condom use, digital health, nucleic acid amplification tests (NAATs), risk reduction counselling, sex partner, sexual behaviour, sexual minorities, Sub-Saharan Africa, young key populations, young men who have sex with men (YMSM).

Introduction

Globally, compared to the general population, gay, bisexual and other men who have sex with men (collectively referred to as MSM) experience higher rates of sexually transmitted infections (STIs) such as chlamydia, gonorrhoea and syphilis.[1] Data from sub-Saharan African (SSA) countries have shown high rates of these and other STIs among MSM, including chlamydia in Tanzania – 7.5%[2] and Kenya – 26%[3]; gonorrhoea in Tanzania – 14.4%[2] and Kenya – 26%[3]; syphilis in Malawi – 12.3%[4] and Uganda – 9%[5]; *Mycoplasma genitalium* infection in Nigeria – 36.8%[6]; and trichomoniasis in South Africa – 9%.[7]

†A version of this manuscript was submitted and posted as a pre-print on the Research Square platform, and is available from the link below: https://www.researchsquare.com/article/rs-1828548/v1.

In terms of sexual behaviour, MSM may engage in both receptive and insertive anal and oral sex, making them susceptible to anorectal and oropharyngeal STIs besides the usual genital STIs. Unlike the genital STIs, extra-genital STIs are often asymptomatic and thus remain largely undiagnosed and untreated.[8] The World Health Organization (WHO) recommends offering MSM periodic testing for asymptomatic STIs using serological tests for syphilis and nucleic acid amplification tests (NAATs) for chlamydia and gonorrhoea.[9] Whereas serological tests are affordable and easy to use, NAATs require expensive technology and personnel with technical training, and are thus not routinely used in SSA countries. As a result, management of STIs in most SSA countries including Kenya is largely syndromic,[10] leading to missed cases and inadequate management (because many STIs are asymptomatic in early infection), elevated risk of acquisition and transmission of human immunodeficiency virus (HIV),[11] and future complications such as infertility.[12] Simulation studies have shown that this sub-optimal treatment of STIs plays a significant role in HIV infection among young MSM (YMSM) aged 18–24 years.[13] Besides, MSM infected with asymptomatic STIs may unknowingly infect sex partners, thus spreading the infections. Further, commensal oropharyngeal *Neisseria spp*. may transfer genetic material to untreated oropharyngeal *Neisseria gonorrhoeae*, leading to the development of resistance to extended spectrum cephalosporins.[14] Taken together, these factors make surveillance of STIs critical, especially among key populations at heightened risk of infection.

Although more expensive than culturing of bacterial microorganisms, NAATs are currently the gold standard for detecting asymptomatic extra-genital bacterial STIs, given their high sensitivity and specificity.[15] Pooling samples from different anatomical sites from an individual and testing them together can be used to lower the cost of NAATs,[16] and has been shown to perform as well as single-anatomic site testing for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* among MSM in various settings.[17–22]

At the onset of the developmental stage of emerging adulthood (18–25 years), in-school individuals transition from secondary to tertiary institutions.[23] In tertiary institutions, most students find themselves in an environment with limited direct supervision of their behaviour, and increased freedom and opportunities to engage in behavioural risks such as casual sex.[24] For tertiary student MSM (TSMSM), exposure to peers with similar sexual orientation and behaviour provides an environment with more socialising opportunities compared to their secondary school days.[25] There is evidence to suggest that TSMSM may seek casual sex partners online, have sex more often, and engage in condomless sex, group sex and sex work.[26] Moreover, TSMSM have been shown to have early sexual debuts, forced sex experiences, high sex partner turnover, concurrent sex partners, inconsistent condom use, and alcohol and drug use.[27] As well, structural factors, such as criminalisation of homosexuality in Kenya, and societal stigma and discrimination towards individuals with same-sex behaviour, may further limit healthcare engagement for TSMSM,[28] making it difficult to access services for prevention, screening and treatment of STIs. In sum, these behavioural and structural factors increase the risk of STIs among TSMSM, making them an important population to focus on for STIs research. In Kenya, little is known about the prevalence of STIs and associated risk factors among YMSM, including TSMSM. As part of the effort to bridge this knowledge gap, the current study examined the prevalence of five curable STIs (chlamydia, gonorrhoea, syphilis, trichomoniasis and *Mycoplasma genitalium* infection), and associated demographic, behavioural and contextual risk factors among TSMSM in Nairobi, Kenya.

Methods

The study methods are detailed in the published study protocol,[29] and summarised below.

Study design and setting

A cross-sectional bio-behavioural survey was conducted between February and March 2021, just after stringent coronavirus disease 2019 (COVID-19) prevention and control restrictions were eased in Kenya, and tertiary institutions resumed in-person teaching. Nairobi, Kenya's capital, was selected due to its large population of tertiary students, with approximately 150 campuses of various universities and colleges located in the city and within its metropolis.[30]

Participants, sampling, and recruitment

TSMSM were eligible to participate in the study if they were willing and able to provide written informed consent for study participation, were aged ≥18 years, provided proof of registration as a student in a university or college in Nairobi, were assigned male sex at birth, and reported consensual receptive or insertive anal and/or oral sexual intercourse with another man in the last 12 months. The sample size was primarily calculated to estimate the prevalence of HIV among TSMSM, based on WHO 2017 guidelines for bio-behavioural surveys among populations at higher risk of HIV infection.[31] Using the Cochran formula,[32] a design effect of three to account for clustering, estimated a HIV prevalence of 4.1% based on a previous study among TSMSM in South Africa,[33] a level of precision of 0.05 and 10% non-response; we used this to determine that a minimum sample size of 200 TSMSM would be required. The results of the primary objective of the study are reported elsewhere.[34] Respondent-driven sampling (RDS) was used following findings from formative qualitative research, which showed that this sampling method was appropriate and acceptable for recruiting TSMSM into HIV/STI research.[35] From the

TSMSM who took part in the formative research, six seeds were purposively selected based mainly on their self-reported personal network sizes and ability to recruit their peers. The seeds completed half a day training during which they were briefed on the purpose of the study, study procedures, eligibility criteria for prospective participants and types of incentives that would be offered. In addition, the seeds were offered a recruitment script, which if needed, would be used to inform their peers about the study. Upon completing the study procedures, each seed was issued three coupons to recruit their peers. A member of the study team used a prescribed form to screen prospective participants recruited by the seeds and subsequent participants. The screening involved checking the validity of the coupons (based on a unique code for each coupon linked to the seed starting off each recruitment chain), and fulfilment of the other set eligibility criteria. Upon completing the study procedures, each participant was briefed on how to recruit their peers into the study, issued three coupons and a recruitment script similar to the one issued to the seeds. Coupons were valid for a period of 2 weeks. Each seed and subsequent participant could recruit only a maximum of three peers into the study. Issuing of three coupons went on until the survey had recruited 120 participants (inclusive of seeds). Subsequently, two coupons were issued until the 150th participant, after which no more coupons were issued. The study remained open for recruitment for 2 weeks after the last coupons were issued, and closed with 248 TSMSM having participated. Each participant was reimbursed 1000 Kenyan shillings (equivalent to USD10 at that time) for their time and expenses related to transport to and from the study site, and 300 Kenyan shillings (equivalent to USD3) for every peer they recruited into the study. In addition, participants were offered condoms and water-based lubricants.

Data collection tools and procedures

The behavioural survey was conducted by self-administered interviews on tablets using a questionnaire set up on REDCap software (Vanderbilt University, TN, USA). The questionnaire was adapted from a validated questionnaire available from the integrated HIV bio-behavioural surveillance toolbox.[36] The questionnaire contained questions on sociodemographic characteristics, sexual behaviour and other contextual characteristics (symptoms of STIs, use of geosocial networking applications and condom affordability and accessibility), and was administered in English, the language of instruction in Kenyan tertiary institutions.

Biological specimen collection and testing

After completing the behavioural survey, participants were offered testing for HIV[34] and other STIs. Each participant provided approximately 3–4 mL of venous blood for serological syphilis testing using a rapid plasma reagin (RPR) test for screening and a *Treponema pallidum* haemagglutination assay (TPHA) test for confirmation of current syphilis infection. Additionally, each participant provided approximately 20–30 mL of first void urine, one pharyngeal, and one anorectal swab for testing of *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhoeae* and *Trichomonas vaginalis*. Participants self-collected the urine sample in a sterile jar after receiving instructions from the clinician. All pharyngeal swabs were collected by a clinician. A majority (approximately three-quarters) of the anorectal swabs were collected by a clinician, whereas one-quarter were self-collected by participants after receiving instructions from the clinician. Pharyngeal swabs were collected by swabbing the tonsils and the posterior pharynx using flocked swabs. Anorectal swabs were collected by inserting a flocked swab 3 cm into the anus and gently rotating for 5–10 s. Each swab was placed in a separate tube containing universal transport medium. All samples were transported to the laboratory within 24 h. Urine, pharyngeal and anorectal samples from each individual were pooled within 24 h. As per literature,[21,37] the tubes containing the pharyngeal and anorectal swabs were robustly shaken for 15 s, the swabs pressed firmly on the sides of the tube to get rid of fluid, and then discarded. Subsequently, 1 mL of fluid from each of these tubes was mixed with 1 mL of urine in a sterile tube to make a volume of 3 mL. Samples were stored at 2–8°C as per the NAAT manufacturer's instructions and tested within 72 h from collection. Deoxyribonucleic acid (DNA) extraction was done using the QIAamp® kit (Qiagen®, Germany) and DNA detection was done using a multiplex real-time polymerase chain reaction (PCR) test kit for *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhoeae* and *Trichomonas vaginalis* (Sacace Biotechnologies®, Italy) on a Rotor-Gene Q (Qiagen®, Germany) thermocycler.

Ethics approval

This study was approved by the University of the Witwatersrand Human Research Ethics Committee-Medical (Ref. No. M200215) and University of Nairobi-Kenyatta National Hospital Ethics and Research Committee (Ref. No. P990/12/2019). All participants provided written informed consent.

Data analysis

Data analysis excluded six seeds who were purposely selected to begin the RDS recruitment. Weighted STI prevalence with 95% confidence intervals (CI) were calculated using RDS Analyst (RDS-A) software (ver. 0.72).[38] Weighting was done using Gile's successive sampler estimator, which takes to account the self-reported participant network size, recruitment patterns, and estimated size of the study population.[39] We asked the following question to estimate a participant's network size: 'How many TSMSM who study and live in

Nairobi, who know you by name, and you know them by name, have you spoken to in the last 4 weeks/1 month?'. Due to the COVID-19 restrictions in place just before the survey, we added the following clarification: 'By speaking, we mean either talking face-to-face or communicating on the phone whether through calling, texting or voice notes'. As per the Joint United Nations Programme on HIV/AIDS recommendations,[40] an estimated population size of 8406 for TSMSM (1.45% of male tertiary students in the Nairobi metropolis) was used, with 95% CI and 1000 bootstraps.

Stata (ver. 15; StataCorp LLC, College Station, TX, USA) was used for further analysis of the unweighted data. Some continuous variables such as age and self-reported number of sex partners were converted into binary categories and analysed as such. Categorical variables were summarised using proportions, and differences in proportions examined using the chi-squared (χ^2) test. Multivariate logistic regression models were used to measure associations between various factors and STI prevalence. Testing positive for at least one of the five STIs was used as the primary outcome variable. All exposure variables with a $P < 0.1$ in bivariate analysis and without missing values were included in the multivariate model. Unweighted regression models were used because they have been shown to perform better than weighted regression models for RDS data.[41] Both adjusted odds ratio (AOR) and 95% confidence interval (CI) were calculated for each exposure variable in the final model. All statistical tests were two-sided. Variables with a P-value <0.05 were considered statistically significant.

Results

Characteristics of TSMSM

Six seeds recruited 242 participants in eight waves, resulting in a total of 248 TSMSM. The details of the recruitment networks are depicted in Fig. 1. The characteristics of participants in total and by STI status (proportion that tested positive for at least one of the five STIs) are shown in Table 1. Median age was 21 years (interquartile range, IQR, 20–22), with 96.3% of participants aged ≤24 years. More than half (58.3%) attended university, close to three-quarters (71.9%) were in public institutions, and four-fifths (79.3%) resided in hostels inside or outside their institutions, away from their families. A majority (89.3%) owned a smart phone at the time of the study, almost half (46.5%) had ever used a mobile phone geosocial networking application (app) for MSM to meet a sex partner, and one-third (33.6%) had met their last sex partner online. Sexual behaviours that may increase the risk of STIs at the genital, anorectal and oropharyngeal anatomic sites were also common among participants in the 12 months preceding the survey. Almost three-quarters (70.2%) had engaged in both receptive and insertive anal–penile intercourse, more than three-quarters (78.1%) had engaged in both receptive and insertive oral–penile intercourse and more than half (58.7%) had had engaged in both receptive and insertive oral–anal intercourse.

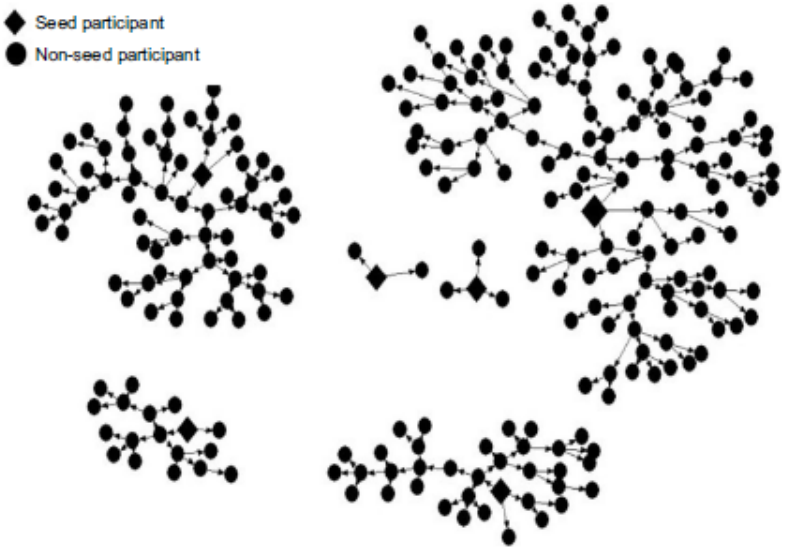


Fig. 1. Recruitment chains of tertiary student men who have sex with men in Nairobi, Kenya ($N = 248$).

Table 1. Characteristics of TSMSM in total and by STI status in Nairobi, Kenya ($N = 242$).

Variable	Category	Total number (%)	Number STI positive (%)	χ^2	P-value
Sociodemographic characteristics					
Age (years)	18–20	89 (36.8)	57 (64.0)	0.01	0.917
	21–30	153 (63.2)	99 (64.7)		
Gender identity	Cisgender male	219 (90.5)	139 (63.5)	0.99	0.320
	Transgender female	23 (9.5)	17 (74.0)		
Sexual orientation identity	Gay	153 (63.2)	102 (66.7)	2.16	0.339
	Bisexual	80 (33.1)	47 (58.8)		
	Heterosexual	9 (3.7)	7 (77.8)		
Institution attended	University	141 (58.3)	92 (65.2)	0.09	0.763
	College	101 (41.7)	64 (63.4)		
Ownership of institution attended	Public	174 (71.9)	111 (63.8)	0.12	0.728
	Private	68 (28.1)	45 (66.2)		
Type of course studied	Science, technology, engineering and mathematics	156 (64.5)	94 (60.3)	3.40	0.066
	Arts, business and humanities	86 (35.5)	62 (72.1)		
Year of study at university/college[A]	1st and 2nd year	153 (66.0)	102 (66.7)	0.80	0.372
	3rd and 4th year	79 (34)	48 (60.8)		
Residence	College/rented hostel	192 (79.3)	120 (62.5)	1.56	0.211
	With family	50 (20.7)	36 (72.0)		
Ever attended boarding school	Yes	203 (16.1)	131 (64.5)	<0.01	0.959
	No	39 (83.9)	25 (64.1)		
Main source of financial support	Parents/guardians	137 (56.6)	87 (63.5)	0.64	0.724
	Employment	65 (26.9)	41 (63.0)		
	Bursary/scholarship	40 (16.5)	28 (70.0)		
Had smartphone at time of the study	Yes	216 (89.3)	137 (63.4)	0.94	0.331
	No	26 (10.7)	19 (73.1)		
General sexual behaviour characteristics					
Ever had vaginal sex with a woman	Yes	130 (53.7)	77 (59.2)	3.36	0.067
	No	112 (46.3)	79 (70.5)		
Age at first anal sex with a man	<18 years	79 (32.9)	50 (63.3)	0.04	0.843
	≥18 years	161 (67.1)	104 (64.6)		
Sexual role at first anal sex with a man	Insertive	103 (42.8)	62 (60.2)	1.82	0.402
	Receptive	83 (34.4)	54 (65.1)		
	Versatile	55 (22.8)	39 (70.9)		
Nature of first anal sex with a man	Consensual	201 (83.4)	131 (65.2)	0.39	0.533
	Coerced/forced	40 (16.6)	24 (60.0)		
Preferred age of sex partner	Same/younger age	187 (77.6)	116 (62.0)	2.26	0.323
	Any age	36 (15.0)	27 (75.0)		
	Older	18 (7.4)	12 (66.7)		
Preferred sexual role	Insertive	117 (48.6)	68 (58.1)	4.08	0.130
	Versatile	75 (31.1)	54 (72.0)		
	Receptive	49 (20.3)	33 (67.4)		

(Continued on next page)

Table 1. (Continued).

Variable	Category	Total number (%)	Number STI positive (%)	χ^2	P-value
Sexual behaviour characteristics with men during last 12 months					
Number of men participant had anal sex with	One (1)	69 (28.7)	40 (58.0)	1.70	0.193
	More than one (1)	172 (71.3)	115 (66.9)		
Participated in group sex	No	202 (83.8)	129 (63.9)	0.11	0.783
	Yes	39 (16.2)	26 (66.7)		
Had insertive anal intercourse	Yes	222 (92.1)	140 (63.1)	1.92	0.165
	No	19 (7.9)	15 (79.0)		
Had receptive anal intercourse	Yes	187 (77.6)	125 (66.8)	2.33	0.127
	No	54 (22.4)	30 (55.6)		
Had both insertive and receptive anal intercourse	Yes	170 (70.2)	44 (61.1)	0.50	0.478
	No	72 (29.8)	112 (65.9)		
Had insertive oral intercourse	Yes	220 (91.3)	142 (64.6)	0.06	0.809
	No	21 (8.7)	13 (61.9)		
Had receptive oral intercourse	Yes	197 (81.7)	131 (66.5)	2.24	0.135
	No	44 (18.3)	24 (54.6)		
Had both insertive and receptive oral intercourse	Yes	189 (78.1)	125 (66.1)	1.06	0.304
	No	53 (21.9)	31 (58.5)		
Had insertive oral–anal intercourse	Yes	158 (65.6)	102 (64.6)	0.01	0.914
	No	83 (34.4)	53 (63.9)		
Had receptive oral–anal intercourse	Yes	175 (72.6)	116 (66.3)	1.08	0.298
	No	66 (27.4)	39 (59.1)		
Had both insertive and receptive oral–anal intercourse	Yes	142 (58.7)	92 (64.8)	0.02	0.900
	No	100 (41.3)	64 (64.0)		
Always used a condom	Yes	74 (30.7)	39 (52.7)	6.30	0.012*
	No	167 (69.3)	116 (69.5)		
Gave money/goods/services to a sex partner	Yes	116 (51.9)	75 (64.7)	0.01	0.916
	No	125 (48.1)	80 (64.0)		
Received money/goods/services from a sex partner	Yes	141 (58.5)	93 (66.0)	0.40	0.527
	No	100 (41.5)	62 (62.0)		
Both gave and received money/goods/services to and from a male sex partner, respectively	Yes	109 (44.8)	73 (67.0)	0.55	0.460
	No	133 (55.2)	83 (62.4)		
Sexual behaviour characteristics with last sex partner					
Age of partner (years)	15–24	204 (84.7)	126 (61.8)	3.77	0.052
	≥25	37 (15.3)	29 (78.4)		
Where partner was met	Offline	160 (66.4)	96 (60.0)	3.86	0.049*
	Online	81 (33.6)	59 (72.8)		
Used condom	Yes	159 (65.7)	100 (62.9)	0.50	0.480
	No	83 (34.3)	56 (67.5)		
Gave money/goods/services to partner	Yes	25 (10.4)	16 (64.0)	<0.01	0.936
	No	216 (89.6)	140 (64.8)		
Received money/goods/services from partner	Yes	51 (21.2)	31 (60.8)	0.44	0.507
	No	190 (78.8)	125 (65.8)		

(Continued on next page)

Table 1. (*Continued*).

Variable	Category	Total number (%)	Number STI positive (%)	χ^2	*P*-value
Had taken alcohol/other drug before sex	Yes	99 (40.9)	63 (63.6)	0.05	0.823
	No	143 (59.1)	93 (65.0)		
Type of partner	Regular	200 (83.0)	136 (68.0)	6.95	0.008*
	One time	41 (17.0)	19 (46.3)		
Contextual characteristics					
HIV serostatus					
HIV serostatus at time of study	HIV negative	222 (91.7)	139 (62.6)	4.01	0.045*
	HIV positive	20 (8.3)	17 (85.0)		
STI symptoms experienced during last 12 months					
Urethritis	Yes	39 (16.2)	25 (64.1)	<0.01	0.959
	No	203 (83.8)	131 (64.5)		
Anal discharge	Yes	20 (8.3)	15 (75.0)	1.06	0.304
	No	222 (91.7)	141 (63.5)		
Ulcer on or near penis or anus	Yes	29 (12.0)	19 (65.5)	0.02	0.885
	No	212 (88.0)	136 (64.2)		
Pre-exposure prophylaxis use					
Ever taken	Yes	27 (11.2)	20 (74.1)	1.23	0.268
	No	215 (88.8)	136 (63.3)		
Currently taking	Yes	14 (5.8)	11 (78.6)	1.30	0.256
	No	228 (94.2)	145 (63.6)		
Use of geosocial networking applications (apps) for MSM					
Ever used apps to find a sex partner	Yes	112 (46.5)	84 (75.0)	9.70	0.002*
	No	129 (53.5)	72 (55.8)		
Condoms					
Perceived affordability	Affordable	141 (58.3)	97 (68.8)	2.77	0.096
	Not affordable	101 (41.7)	59 (58.4)		
Perceived ease of getting condoms in campus	Easy	104 (43.0)	71 (68.3)	1.15	0.283
	Not easy	138 (57.0)	85 (61.6)		

*Significant difference in proportions.
[A] 10 missing values.
STIs, sexually transmitted infections; TSMSM, tertiary student men who have sex with men.

STIs prevalence, differences in proportions and associated factors

The unadjusted and RDS-adjusted prevalence of various STIs among study participants is shown in Table 2. In RDS-adjusted estimates, more than half (58.8%, 95% CI: 50.4–67.3%) of study participants tested positive for at least one of the five STIs, with chlamydia (51.0%, 95% CI: 42.3–59.8%) followed by gonorrhoea (11.3%, 95% CI: 6.1–16.5%), then *Mycoplasma genitalium* infection (6.0%, 95% CI: 2.6–9.4%) being the three most prevalent STIs. Co-infection with more than one STI was also observed with chlamydia/gonorrheoa (5.7%, 95% CI: 2.7–8.7%) being the most common type of co-infection, followed by chlamydia/*Mycoplasma genitalium* infection (4.5%, 95% CI: 2.3–6.7%), then gonorrhoea/*Mycoplasma genitalium* infection and chlamydia/gonorrhoea/*Mycoplasma genitalium* (both at 1.7%, 95% CI: 0.1–3.3%).

Table 1 also shows the results of bivariate analysis. These results revealed that STI prevalence (testing positive for at least one of the five STIs) was statistically significantly higher among participants who used condoms inconsistently when having sex with a man during the 12 months preceding the survey ($\chi^2 = 6.30$, $P = 0.012$), who met their last sex partner online ($\chi^2 = 3.86$, $P = 0.049$), whose last sex partner was a regular partner ($\chi^2 = 6.95$, $P = 0.008$), who tested positive for HIV at the time of the study ($\chi^2 = 4.01$, $P = 0.045$), and who had ever used a geosocial networking app for MSM to find a sex partner ($\chi^2 = 9.70$, $P = 0.002$).

Table 2. Prevalence of STIs among TSMSM in Nairobi, Kenya ($N = 242$).

STIs	Unadjusted prevalence *n* (%)	RDS-adjusted prevalence % (95% CI)
At least one STI	156 (64.5)	58.8 (50.4–67.3)
Chlamydia	142 (58.7)	51.0 (42.3–59.8)
Gonorrhoea	36 (14.9)	11.3 (6.1–16.5)
Mycoplasma genitalium infection	25 (10.3)	6.0 (2.6–9.4)
Latent syphilis (RPR+ve and TPHA –ve)	5 (2.0)	0.7 (–0.1–1.5)
Trichomoniasis	3 (1.2)	1.5 (–0.3–3.3)
HIV	20 (8.3)	3.6 (1.3–6.0)
Co-infections		
At least one STI and HIV	17 (7.0)	2.9 (0.8–4.9)
Chlamydia and gonorrhoea	26 (10.7)	5.7 (2.7–8.7)
Chlamydia and *Mycoplasma genitalium* infection	22 (9.1)	4.5 (2.3–6.7)
Mycoplasma genitalium infection and gonorrhoea	8 (3.3)	1.7 (0.1–3.3)
Chlamydia, *Mycoplasma genitalium* infection and gonorrhoea	8 (3.3)	1.7 (0.1–3.3)
Chlamydia, *Mycoplasma genitalium* infection, gonorrhoea and trichomoniasis	0 (0.0)	0
Chlamydia, *Mycoplasma genitalium* infection, gonorrhoea, trichomoniasis and latent syphilis	0 (0.0)	0

STI, sexually transmitted infection; TSMSM, tertiary student men who have sex with men; RPR, rapid plasma reagin test for screening for syphilis antibodies; TPHA, *Treponema pallidum* haemagglutination assay for confirmation of current syphilis infection.

The results of multivariate logistic regression analysis are shown in Table 3. As shown by the AOR, independent factors associated with testing positive for at least one of the five STIs were: inconsistent condom use when having sex with a man within the 12 months preceding the survey (AOR 1.89, 95% CI: 1.03–3.47, $P = 0.038$) and the last sex partner being a regular partner (AOR = 2.35, 95% CI: 1.12–4.92, $P = 0.023$).

Discussion

Our study aimed to estimate the prevalence of five curable STIs and associated risk factors among TSMSM in Nairobi, Kenya. We found that more than half (58.8%) of study participants had at least one of the five STIs, with the descending order of prevalence being chlamydia, gonorrhoea, *Mycoplasma genitalium* infection, trichomoniasis and syphilis. In terms of co-infection, chlamydia/gonorrhoea was the most common followed by chlamydia/*Mycoplasma genitalium* infection, and gonorrhoea/*Mycoplasma genitalium* infection at the same rate as chlamydia/gonorrhoea/*Mycoplasma genitalium* infection. Co-infection with at least one of the five STIs and HIV was at the rate of 2.9% (95% CI: 0.8–4.9%).

The prevalence of chlamydia was almost double that observed among MSM in Coastal Kenya – 26%,[3] and more than double that observed among YMSM in Vietnam – 22%.[42] We found a prevalence of gonorrhoea (11%) less than half that observed among MSM in Coastal Kenya – 26%[3] and similar to that seen among YMSM in Vietnam – 12%.[42] Overall, the higher prevalence of chlamydia compared to gonorrhea in our study is consistent with evidence from systematic reviews that has shown that despite chlamydia and gonorrhoea being the most prevalent STIs among MSM, chlamydia is more prevalent than gonorrhoea,[43] possibly due to chlamydia's longer duration of infection and higher transmissibility as compared to gonorrhoea.[44] For *Mycoplasma genitalium* infection and trichomoniasis, the observed prevalence was a sixth of that seen among MSM in Nigeria – 37%[6] and in South Africa – 9%,[7] respectively. The observed prevalence of latent syphilis was seven-fold less than that found among TSMSM in China – 4.7%, where evidence suggests that the syphilis epidemic among TSMSM has been growing, and is fuelled by a high prevalence of risky sexual behaviours.[26]

The overall prevalence of STIs among TSMSM in our study was higher than that in the general population in Kenya, as shown by a study that found the prevalence of chlamydia, *Mycoplasma genitalium* infection, gonorrhoea, trichomoniasis and at least one of the four aforementioned STIs was 16.8%, 28.6%, 7.1%, 7.1% and 49.5%, respectively.[45] Therefore, while not neglecting the general population, there is need to focus more attention on the prevention and control of STIs among key populations such as MSM, including TSMSM. This approach may further foster benefits for the prevention and control of STIs in the general population, given that MSM who also have sex with women (36.8% in our study) form a bridge population that may transmit STIs to women, and these women in turn transmit to men in the general population, thus amplifying the STI epidemics.

Table 3. Multivariate logistic regression of factors associated with prevalent STIs among TSMSM in Nairobi, Kenya ($N = 240$).

Variable	Category	Unadjusted odds ratios (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Type of course	Science, technology, engineering and mathematics	Ref	0.067	Ref	0.125
	Arts, business and humanities	1.70 (0.96–3.01)		1.60 (0.87–3.03)	
Ever had vaginal sex with a woman	Yes	Ref	0.068	Ref	0.448
	No	1.64 (0.96–2.81)		1.26 (0.70–2.26)	
Consistently used a condom when having sex with a man within last 12 months	Yes	Ref	0.013	Ref	0.038*
	No	2.04 (1.16–3.58)		1.89 (1.03–3.47)	
Age of last sex partner (years)	15–24	Ref	0.057	Ref	0.313
	≥25	2.24 (0.97–5.16)		1.60 (0.65–3.92)	
Where last sex partner was met	Offline	Ref	0.051	Ref	0.434
	Online	1.78 (0.99–3.20)		1.31 (0.67–2.58)	
Type of last sex partner	One time	Ref	0.010	Ref	0.023*
	Regular	2.46 (1.24–4.86)		2.35 (1.12–4.93)	
HIV serostatus at time of study	HIV negative	Ref	0.057	Ref	0.434
	HIV positive	3.38 (0.96–11.89)		1.71 (0.44–6.58)	
Ever used a geosocial networking app for MSM to seek sex partner	No	Ref	0.002	Ref	0.184
	Yes	2.38 (1.37–4.12)		1.55 (0.81–2.94)	
Perception of affordability of condoms	Not affordable	Ref	0.097	Ref	0.146
	Affordable	1.56 (0.92–2.67)		1.54 (0.86–2.76)	

*Factors independently associated with STI prevalence ($P < 0.05$).
N, number of observations without missing values; STI, sexually transmitted infection; TSMSM, tertiary student men who have sex with men.

In the present study, inconsistent condom use and having a regular sex partner were independently associated with STI prevalence. The inconsistent condom use observed in our study could have been due to problems with affordability and accessibility of condoms, with 41.7% and 57.0% of study participants finding condoms 'not affordable' and 'not easy' to access in campus, respectively. Inconsistent condom use has also been seen among TSMSM in China and YMSM in Sweden and New Zealand, and is attributed to having a regular sex partner and believing that condoms reduce sexual pleasure.[46–48] Another study of YMSM in Hong Kong revealed that despite knowledge of the risk of condomless anal sex (CAS), socio-cultural norms and expectations relating to sexual positioning (insertive partner/top or receptive partner/bottom) contribute to inconsistent condom use, with CAS and condomless internal ejaculation considered a demonstration of intimacy and commitment.[49] Interestingly, in our study, the last sex partner being a regular partner was a risk factor for STIs, and this could be linked to reduced condom use with regular partners, as revealed in the foregoing studies.[46–48]

This study has several implications for future research and development of interventions in the response to STIs among YMSM, including TSMSM. Since condoms remain the leading STI prevention tool, public health practitioners should ensure affordability, availability and accessibility of condoms for YMSM, including for those in tertiary learning institutions. Additionally, practitioners should aim to provide more compelling condom awareness, education and training so as to promote condom use among YMSM. Most importantly, to ensure condom use and effectiveness, interventions need to speak to perceptions of pleasure, relationships and sexual positioning issues that have been shown to have a negative impact on consistent condom use, despite YMSM being aware of the risk of CAS. In the case of Kenya, further research is needed to ascertain whether the studded/dotted condoms routinely distributed by the government and popularised under the tag 'prevention with pleasure',[50] appeal to and meet the needs of YMSM, including TSMSM. Behaviours (such as CAS) that put MSM at risk of infection with STIs also put them at risk of HIV infection. Indeed, a 2019 modelling study among MSM in the USA showed that 10.4% of incident HIV infections were attributable to prevalent chlamydia and gonorrhoea infections.[51] Given the observed high prevalence of STIs in our sample, it is important to reinforce the need for interventions such as pre-exposure prophylaxis (PrEP) to prevent new HIV infections among TSMSM. From our study sample, only a paltry 11.2% and 5.8% had ever taken and were currently taking PrEP, respectively. Further research is required to understand the low use of PrEP in this population, despite

PrEP being freely available in Kenya. However, we note that although the use of PrEP decreases the risk of HIV infection, there is evidence to suggest that it may also lead to a high incidence of STIs among MSM, as a result of additional risk compensation – reduced sexual inhibition leading to increased risky sexual behaviour such as condomless sex.[52] Accordingly, because PrEP does not prevent other STIs, we thus recommend its use as part of a comprehensive sexual health package, which should also include STI screening and treatment, condom use promotion and risk-reduction counselling.

Our findings revealed that 89.3% of our study participants owned a smart phone at the time of the survey. This finding is consistent with previous work that demonstrated that 95% of Kenyan tertiary students own a smart phone, and are regular and savvy users of the internet.[53] In addition, almost half (46.5%) of our study participants had used a geosocial networking mobile phone application for MSM (such as Grindr) to find a sex partner, and one-third (33.6%) had met their last sex partner online. As such, online platforms could potentially be used for reaching TSMSM with interventions that promote and provide STI testing, treatment and prevention services. A systematic review conducted in 2017 showed that online interventions have the potential to address STIs among YMSM,[54] and such interventions have also been recommended by others following a study that found that most MSM in Kenya and South Africa regularly socialise online.[55] Online interventions are particularly recommended due to their private and discrete nature, which may enable TSMSM to bypass some of the barriers they encounter while seeking services in physical health facilities, especially the experiences of stigma and discrimination by healthcare providers.[28,56] Indeed, a consortium of universities within the Nairobi metropolis has developed, and deployed for use is a mobile phone app called RADA (slang for 'be alert').[57] Among other things, the app provides information on sexual and reproductive health matters to tertiary students, but its design and content is largely heteronormative. Considerations should therefore be made for the development of an app that suits and meets the needs of TSMSM. This could be achieved through collaboration with, and support from various stakeholders, including: researchers, policymakers, practitioners, funders, and TSMSM as the eventual app users.

To our knowledge, our study is the first one to investigate the prevalence and associated risk factors of five curable STIs among TSMSM in Kenya, and possibly in SSA countries, using the RDS method. Besides the traditional STIs (chlamydia, gonorrhoea and syphilis), we also investigated two emerging STIs (*Mycoplasma genitalium* infection and trichomoniasis) that are also prevalent among MSM. Pooling of samples from the three anatomical sites offered us a cost-effective way to detect extra-genital agents of STIs that would otherwise be undetected due to their usually asymptomatic nature.[8] Nevertheless, even with the pooling of samples, detection of agents of STIs using NAATs is still costly and not routinely available in resource-limited settings such as Kenya. In the absence of NAATs, treatment of STIs in SSA countries is likely to continue being syndromic. For MSM, quarterly screening that includes physical examination for genital, anorectal and oropharyngeal STIs, and assessment of risky sexual behaviours, can complement the syndromic management of STIs. To further support early diagnosis and hence appropriate treatment of STIs, we suggest that policymakers and providers consider the use of accurate, affordable and timely point-of-care tests for STIs among MSM.[58]

Our findings should be viewed in light of some limitations. RDS is a peer-referral, probability-based sampling method that is susceptible to underestimation or overestimation of study outcomes. To offset this limitation, when calculating our sample size, we applied a design effect of three to account for the clustering that occurs due to homophily and minimise the traditional bias associated with snowball sampling, and used RDS-adjusted analysis to estimate the prevalence of various STIs. To minimise the effect of seed selection bias, we excluded from analysis the six seeds who were purposely selected to start off recruitment. Because we asked about past life events and experiences, there was a possibility of recall bias. To mitigate this, most of our questions focused on events and experiences that occurred within 12 months before the study, with only a few questions focusing on periods longer than 12 months. In addition, we asked questions about sexual behaviour, which may be affected by social desirability bias. To minimise this, participants self-administered the behavioural survey questionnaire on a tablet computer, as this has been shown to be more effective in offsetting this kind of bias, compared to face-to-face interviews.[59] Approximately three-quarters of anorectal samples were collected by the clinician and the other quarter by participants after they received instructions from the clinician. This could potentially lead to variability in the test results of the various STIs. However, evidence suggests that when participants are given and are able to follow clear instructions on self-collection of anorectal samples, clinician-collected and self-collected samples yield concordant results.[60] The cross-sectional nature of the study limits inferences about the direction of causality though the factors we identified to be associated with STIs prevalence, and are plausibly causal based on findings from previous studies.[46–48] Finally, although we used a comprehensive set of variables in the logistic regression analysis, we cannot rule out the possibility of residual confounding from other variables that were not assessed, such as experiences of stigma, discrimination and violence. Despite these limitations, this survey offers valuable lessons on the burden of five curable STIs and associated risk factors among TSMSM, and hopefully will be useful in informing further research, and development of interventions for the prevention and

control of STIs in this key but understudied population, both in Kenya and other similar settings.

Conclusion

We found a high prevalence of STIs among TSMSM that was associated with inconsistent condom use and regular sex partners. Accordingly, tailored interventions for testing, treatment and prevention of STIs are urgently called for in this population. Particularly, accurate, affordable and timely point-of-care tests for agents of STIs are required to optimise treatment and control. Given the high prevalence of STIs observed and their plausible association with incident HIV infection, there is need to implement modern HIV prevention interventions such as PrEP in this population. Further, interventions that increase condom use efficacy and offer risk-reduction counselling are requisite, with online platforms being a potential avenue for the delivery of such interventions.

References

1 World Health Organization (WHO). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Geneva, Switzerland: WHO; 2021. Available at https://www.who.int/publications/i/item/9789240027077

2 Ross MW, Nyoni J, Ahaneku HO, Mbwambo J, McClelland RS, McCurdy SA. High HIV seroprevalence, rectal STIs and risky sexual behaviour in men who have sex with men in Dar es Salaam and Tanga, Tanzania. *BMJ Open* 2014; 4(8): e006175. doi:10.1136/bmjopen-2014-006175

3 Sanders EJ, Thiong'o AN, Okuku HS, Mwambi J, Priddy F, Shafi J, *et al.* High prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections among HIV-1 negative men who have sex with men in coastal Kenya. *Sex Transm Infect* 2010; 86: 440–1. doi:10.1136/sti.2010.043224

4 Wirtz AL, Trapence G, Kamba D, Gama V, Chalera R, Jumbe V, *et al.* Geographical disparities in HIV prevalence and care among men who have sex with men in Malawi: results from a multisite cross-sectional survey. *Lancet HIV* 2017; 4(6): e260–9. doi:10.1016/S2352-3018(17)30042-5

5 Kim EJ, Hladik W, Barker J, Lubwama G, Sendagala S, Ssenkusu JM, *et al.* Sexually transmitted infections associated with alcohol use and HIV infection among men who have sex with men in Kampala, Uganda. *Sex Transm Infect* 2016; 92(3): 240–5. doi:10.1136/sextrans-2015-052034

6 Crowell TA, Lawlor J, Lombardi K, Nowak RG, Hardick J, Odeyemi S, *et al.* Anorectal and urogenital *Mycoplasma genitalium* in Nigerian men who have sex with men and transgender women: prevalence, incidence, and association with HIV. *Sex Transm Dis* 2020; 47(3): 202–6. doi:10.1097/OLQ.0000000000001105

7 Hoffman CM, Fritz L, Radebe O, Dubbink JH, McIntyre JA, Kock MM, *et al.* Rectal *Trichomonas vaginalis* infection in South African men who have sex with men. *Int J STD AIDS* 2018; 29(14): 1444–7. doi:10.1177/0956462418788418

8 Dudareva-Vizule S, Haar K, Sailer A, Wisplinghoff H, Wisplinghoff F, Marcus U, *et al.* Prevalence of pharyngeal and rectal *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections among men who have sex with men in Germany. *Sex Transm Infect* 2014; 90(1): 46–51. doi:10.1136/sextrans-2012-050929

9 World Health Organization. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people. Geneva, Switzerland: World Health Organization; 2011.

10 National AIDS and STI Control Programme (NASCOP). Kenya National Guidelines for prevention, management and control of sexually transmitted infections. Nairobi, Kenya: National AIDS and STI Control Programme (NASCOP); 2018.

11 Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. *Sex Transm Infect* 1999; 75: 3–17. doi:10.1136/sti.75.1.3

12 Aral SO. Sexually transmitted diseases: magnitude, determinants and consequences. *Int J STD AIDS* 2001; 12(4): 211–5. doi:10.1258/0956462011922814

13 Beck EC, Birkett M, Armbruster B, Mustanski B. A data-driven simulation of HIV spread among young men who have sex with men: role of age and race mixing and STIs. *JAIDS J Acquir Immune Defic Syndr* 2015; 70(2): 186–94. doi:10.1097/QAI.0000000000000733

14 Lewis DA. Will targeting oropharyngeal gonorrhoea delay the further emergence of drug-resistant *Neisseria gonorrhoeae* strains? *Sex Transm Infect* 2015; 91: 234–7. doi:10.1136/sextrans-2014-051731

15 Van Der Pol B, Chernesky M, Gaydos CA, Hook EW III, Joseph AM, Christensen K, *et al.* Multicenter comparison of nucleic acid amplification tests for the diagnosis of rectal and oropharyngeal *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections. *J Clin Microbiol* 2022; 60(1): e01363-21. doi:10.1128/JCM.01363-21

16 Aboud L, Xu Y, Chow EPF, Wi T, Baggaley R, Mello MB, *et al.* Diagnostic accuracy of pooling urine, anorectal, and oropharyngeal specimens for the detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*: a systematic review and meta-analysis. *BMC Med* 2021; 19(1): 285. doi:10.1186/s12916-021-02160-9

17 Sultan B, White JA, Fish R, Carrick G, Brima N, Copas A, *et al.* The "3 in 1" study: pooling self-taken pharyngeal, urethral, and rectal samples into a single sample for analysis for detection of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* in men who have sex with men. *J Clin Microbiol* 2016; 54(3): 650–6. doi:10.1128/JCM.02460-15

18 Speers DJ, Chua I-LJ, Manuel J, Marshall L. Detection of *Neisseria gonorrhoeae* and *Chlamydia trachomatis* from pooled rectal, pharyngeal and urine specimens in men who have sex with men. *Sex Transm Infect* 2018; 94: 293–7. doi:10.1136/sextrans-2017-053303

19 Thielemans E, Wyndham-Thomas C, Henrard S, De Vleeschouwer A, Steensels D, Montesinos I, *et al.* Screening for *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in men who have sex with men: diagnostic accuracy of nucleic acid amplification test on pooled urine, anorectal, and pharyngeal specimens. *Sex Transm Dis* 2018; 45(3): 195–8. doi:10.1097/OLQ.0000000000000722

20 De Baetselier I, Osbak KK, Smet H, Kenyon CR, Crucitti T. Take three, test one: a cross-sectional study to evaluate the molecular detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in pooled pharyngeal, anorectal and urine samples versus single-site testing among men who have sex with men in Belgium. *Acta Clin Belg* 2020; 75(2): 91–5. doi:10.1080/17843286.2018.1545376

21 Durukan D, Read TRH, Bradshaw CS, Fairley CK, Williamson DA, De Petra V, *et al.* Pooling pharyngeal, anorectal, and urogenital samples for screening asymptomatic men who have sex with men for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. *J Clin Microbiol* 2020; 58(5): e01969-19. doi:10.1128/JCM.01969-19

22 Almeria J, Pham J, Paris KS, Heskett KM, Romyco I, Bristow CC. Pooled 3-anatomic-site testing for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*: a systematic review and meta-analysis. *Sex Transm Dis* 2021; 48(12): e215–22. doi:10.1097/OLQ.0000000000001558

23 Arnett JJ. Emerging adulthood: a theory of development from the late teens through the twenties. *Am Psychol* 2000; 55(5): 469–80. doi:10.1037/0003-066X.55.5.469

24 Fromme K, Corbin WR, Kruse MI. Behavioral risks during the transition from high school to college. *Dev Psychol* 2008; 44(5): 1497–504. doi:10.1037/a0012614

25 Renn K. LGBTQ students on campus: issues and opportunities for higher education leaders. Higher Education Today. 2017. Available at https://www.higheredtoday.org/2017/04/10/lgbtq-students-higher-education/ [Cited 10 June 2021].

26 Fan S, Yang Z, Hou F, Yu M, Luo Z, Liao M, *et al.* HIV and syphilis and sexual risk behaviours among men who have sex with men attending

university in China: a systematic review and meta-analysis. *Sex Health* 2019; 16(6): 554–65. doi:10.1071/SH18231
27 Brink JG. Considerations for South African higher education: a 'national student men who have sex with men' sexual behavior survey. *S Afr J High Educ* 2017; 31(4): 184–207. doi:10.20853/31-4-877
28 Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "What if I get sick, where shall I go?": a qualitative investigation of healthcare engagement among young gay, bisexual and other men who have sex with men in Nairobi, Kenya. 2022. Available at doi:10.21203/rs.3.rs-1994768/v1
29 Mwaniki SW, Mugo PM, Palanee-Phillips T. Project BESPOKE (integrated bio-behavioral assessment of HIV and STI among young tertiary student men who have sex with men in Nairobi, Kenya): a respondent-driven sampling survey protocol. *Front Public Health* 2021; 9: 619694. doi:10.3389/fpubh.2021.619694
30 Study in Kenya. Universities and colleges in Nairobi County. 2021. Available at https://studyinkenya.co.ke/universities-and-colleges-in-nairobi-county?page=1 [Cited 24 June 2022].
31 WHO, CDC, UNAIDS FHI 360. Biobehavioural survey guidelines for populations at risk for HIV. Geneva: World Health Organization; 2017.
32 Cochran WG. Sampling techniques. 3rd edn. New York: John Wiley & Sons, Ltd; 1977.
33 Higher Education HIV/AIDS Programme South Africa (HEAIDS). HIV prevalence and related factors: higher education sector study South Africa. Johannesburg, South Africa: HEAIDS; 2009.
34 Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. HIV prevalence and associated risk factors among young tertiary student men who have sex with men (MSM) in Nairobi, Kenya: a respondent-driven sampling survey. 2022. Available at doi:10.21203/rs.3.rs-1451893/v1
35 Mwaniki SW, Kaberia PM, Mugo PM, Palanee-Phillips T. "My friends would believe my word": appropriateness and acceptability of respondent-driven sampling in recruiting young tertiary student men who have sex with men for HIV/STI research in Nairobi, Kenya. *Int J Environ Res Public Health* 2022; 19(12): 7331. doi:10.3390/ijerph19127331
36 University of California San Francisco (UCSF). Integrated HIV bio-behavioural surveillance toolbox. Available at https://globalhealthsciences.ucsf.edu/resources/integrated-hiv-bio-behavioral-surveillance-toolbox [Cited 24 September 2021].
37 Dean JA, Bell SFE, Coffey L, Debattista J, Badman S, Redmond AM, *et al.* Improved sensitivity from pooled urine, pharyngeal and rectal specimens when using a molecular assay for the detection of chlamydia and gonorrhoea near point of care. *Sex Transm Infect* 2021; 97(6): 471–2. doi:10.1136/sextrans-2020-054835
38 Handcock M, Fellows I, Gile K. RDS analyst: software for the analysis of respondent-driven sampling data, version 0.72. Available at http://wiki.stat.ucla.edu/hpmrg/index.php/RDS_Analyst_Install [Cited 7 October 2021].
39 Gile KJ. Improved inference for respondent-driven sampling data with application to HIV prevalence estimation. *J Am Stat Assoc* 2011; 106(493): 135–46. doi:10.1198/jasa.2011.ap09475
40 UNAIDS (Joint United Nations Programme on HIV/AIDS). Recommended population size estimates of men who have sex with men. 2020. Available at https://www.unaids.org/sites/default/files/media_asset/2020-recommended-population-size-estimates-of-men-who-have-sex-with-men_en.pdf [Cited 7 October 2021].
41 Avery L, Rotondi N, McKnight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: results from a simulation study. *BMC Med Res Methodol* 2019; 19(1): 202. doi:10.1186/s12874-019-0842-5
42 Adamson PC, Bhatia R, Tran KDC, Bui HTM, Vu D, Shiraishi RW, *et al.* Prevalence, anatomic distribution, and correlates of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections among a cohort of men who have sex with men in Hanoi, Vietnam. *Sex Transm Dis* 2022; 49: 504–10. doi:10.1097/OLQ.0000000000001626
43 Dewart CM, Bernstein KT, DeGroote NP, Romaguera R, Turner AN. Prevalence of rectal chlamydial and gonococcal infections: a systematic review. *Sex Transm Dis* 2018; 45(5): 287–93. doi:10.1097/OLQ.0000000000000754
44 Chow EPF, Camilleri S, Ward C, Huffam S, Chen MY, Bradshaw CS, *et al.* Duration of gonorrhoea and chlamydia infection at the pharynx and rectum among men who have sex with men: a systematic review. *Sex Health* 2016; 13(3): 199–204. doi:10.1071/SH15175
45 Maina AN, Mureithi MW, Ndemi JK, Revathi G. Diagnostic accuracy of the syndromic management of four STIs among individuals seeking treatment at a health centre in Nairobi, Kenya: a cross-sectional study. *Pan Afr Med J* 2021; 40: 138. doi:10.11604/pamj.2021.40.138.25166
46 Wang H, Yu S, Cross W, Lam L, Banik B, Zhang K. Condom use consistency and associated factors among college student men who have sex with men from seven colleges in Changsha city: a cross-sectional survey. *HIV/AIDS - Res Palliat Care* 2021; 13: 557–69. doi:10.2147/HIV.S305932
47 Johansson K, Persson KI, Deogan C, El-Khatib Z. Factors associated with condom use and HIV testing among young men who have sex with men: a cross-sectional survey in a random online sample in Sweden. *Sex Transm Infect* 2018; 94(6): 427–33. doi:10.1136/sextrans-2017-053369
48 Lachowsky NJ, Saxton PJW, Hughes AJ, Dickson NP, Summerlee AJS, Milhausen RR, *et al.* Younger gay and bisexual men's condom use with main regular sexual partner in New Zealand. *AIDS Educ Prev* 2015; 27(3): 257–74. doi:10.1521/aeap.2015.27.3.257
49 Yeo TED, Fung TH. Between '0' and '1': safer sex and condom use among young gay men in Hong Kong. *Cult Health Sex* 2016; 18(3): 294–307. doi:10.1080/13691058.2015.1080298
50 Kilonzo E. Kenya set for free studded condoms ahead of Valentine's Day. Nation Africa. 2017. Available at https://nation.africa/kenya/news/Kenya-free-studded-condoms-Valentine-s-Day-HII-Aids/1056-3810724-la49guz/index.html
51 Jones J, Weiss K, Mermin J, Dietz P, Rosenberg ES, Gift TL, *et al.* Proportion of incident human immunodeficiency virus cases among men who have sex with men attributable to gonorrhea and chlamydia: a modeling analysis. *Sex Transm Dis* 2019; 46(6): 357–63. doi:10.1097/OLQ.0000000000000980
52 Scott HM, Klausner JD. Sexually transmitted infections and pre-exposure prophylaxis: challenges and opportunities among men who have sex with men in the US. *AIDS Res Ther* 2016; 13: 5. doi:10.1186/s12981-016-0089-8
53 Ojino R, Mich L. Mobile applications in university education: the case of Kenya. *J E-Learn Knowl Soc* 2018; 14(1): 111–25. doi:10.20368/1971-8829/1369
54 Knight R, Karamouzian M, Salway T, Gilbert M, Shoveller J. Online interventions to address HIV and other sexually transmitted and blood-borne infections among young gay, bisexual and other men who have sex with men: a systematic review. *J Int AIDS Soc* 2017; 20(3): e25017. doi:10.1002/jia2.25017
55 Fearon E, Bourne A, Tenza S, Palanee-Phillips T, Kabuti R, Weatherburn P, *et al.* Online socializing among men who have sex with men and transgender people in Nairobi and Johannesburg and implications for public health-related research and health promotion: an analysis of qualitative and respondent-driven sampling survey data. *J Int AIDS Soc* 2020; 23(S6): e25603. doi:10.1002/jia2.25603
56 Bowen D, Jabson J, Kamen C. mHealth: an avenue for promoting health among sexual and gender minority populations? *mHealth* 2016; 2: 36. doi:10.21037/mhealth.2016.09.01
57 Google Play. Rada University of Nairobi. Available at https://play.google.com/store/apps/details?id=com.radauon.radauon2&hl=en&gl=US [Cited 11 May 2022].
58 Unemo M. Accurate, rapid, point-of-care tests for sexually transmitted infections. *Lancet Infect Dis* 2021; 21(5): 584–6. doi:10.1016/S1473-3099(20)30790-8
59 Adebajo S, Obianwu O, Eluwa G, Vu L, Oginni A, Tun W, *et al.* Comparison of audio computer assisted self-interview and face-to-face interview methods in eliciting HIV-related risks among men who have sex with men and men who inject drugs in Nigeria. *PLoS ONE* 2014; 9(1): e81981. doi:10.1371/journal.pone.0081981
60 van der Helm JJ, Hoebe CJPA, van Rooijen MS, Brouwers EEHG, Fennema HSA, Thiesbrummel HFJ, *et al.* High performance and acceptability of self-collected rectal swabs for diagnosis of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in men who have sex with men and women. *Sex Transm Dis* 2009; 36(8): 493–7. doi:10.1097/OLQ.0b013e3181a44b8c

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