SOUTH AFRICAN MEN'S HEALTH MONITORING SURVEY:

A BIOLOGICAL AND BEHAVIOURAL SURVEY AMONG MEN WHO HAVE SEX WITH MEN IN SOUTH AFRICA, 2019 (SAMHMS-II)

Final Report

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Ag	Antigen
Ab	Antibody
AE	Adverse event
ART	Antiretroviral therapy
ATS	Anonymous testing site
BBS	Biological and behavioural survey (or biobehavioural survey)
CAPI	Computer-assisted personal interviewing
CBO	Community-based organization
CDC	U.S. Centers for Disease Control and Prevention
CGH	Center for Global Health
CI	Confidence Interval
DBS	Dried blood spot
DEFF	Design effect
DQA	Data quality assurance
ELISA	Enzyme-linked immunosorbent assay
FGD	Focus group discussion
MSM	Men who have sex with men
FWA	Federal-wide assurance
HIV	Human immunodeficiency virus
HPLC	High performance liquid chromatography
HREC	Human research ethics committee
HTS	HIV testing services
ID	Identification
IRB	Institutional review board
KII	Key informant interview
KP	Key population
MCMC	Markov Chain Monte Carlo
MOU	Memorandum of Understanding
MRM	Multiple reaction monitoring
MSM	Men who have sex with men
NDOH	National Department of Health
NGO	Non-governmental organization
NICD	National Institute for Communicable Diseases
NSP	National Strategic Plan
PEP	Post-exposure prophylaxis
PI	Principal investigator

PID	Participant identifier
PMTCT	Prevention of mother to child transmission
POCT	Point-of-care test
PrEP	Pre-exposure prophylaxis
PST	Plasma separation tubes
QA	Quality assurance
QC	Quality control
RDS	Respondent-driven sampling
RDS-A	Respondent-driven sampling analyst
SAMHMS	South Africa Men's Health Monitoring Study
SANAC	South African National AIDS Council
SANAS	South African National Accreditation System
SMAP	Scientific manuscript advisory panel
SOP	Standard operating procedures
SS	Successive sampling
SS-PSE	Successive sampling population size estimation
STI	Sexually transmitted infection
SWEAT	Sex Workers Education and Advocacy Task Force
TA	Technical assistance
TB	Tuberculosis
TLS	Time-location sampling
TNA	Total nucleic acid
TWG	Technical working group
UCSF	University of California, San Francisco
UCT	University of Cape Town
UNAIDS	The Joint United Nations Programme on HIV/AIDS
USD	United States dollars
UTC	Unique testing code
VCT	Voluntary counselling and testing
ZAR	South African rand

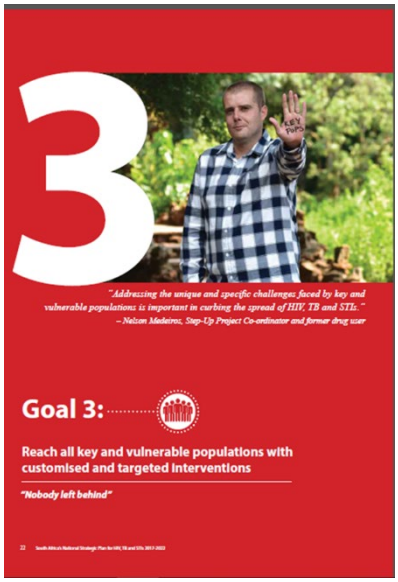
1 Background

1.1 HIV in sub-Saharan Africa

Countries in sub-Saharan Africa carry a disproportionate human immunodeficiency virus (HIV) burden [1]. In 2019, approximately 38 million people worldwide were living with HIV; of these, just over two-thirds (25.6 million) were living in sub-Saharan Africa [1]. Most countries in the region have made significant progress in reducing the number of new HIV infections and AIDS-related deaths. These achievements have been mainly facilitated by the scale-up of HIV testing services (HTS) coupled with increased access to antiretroviral therapy (ART) for all people living with HIV (PLHIV) [1]. In addition, country governments in the region have also increased domestic funding of HIV programmes to complement the support received from international donors such as The United States President's Emergency Plan for AIDS Relief (PEPFAR) and the multilateral Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) [1-4]. Despite the notable achievements and the increased investment in HIV programmes, most countries in sub-Saharan Africa are currently off-track in meeting the targets set in 2016, when global leaders in the United Nations General Assembly signed a political declaration of accelerating efforts to end the HIV epidemic by 2030 [1,5].

1.2 South Africa's response to the HIV epidemic

Globally, South Africa has the largest number of PLHIV [1,6]. In 2017, about 7.9 million people of all ages were living with HIV in South Africa [6]. Among people aged 15–49 years, the HIV prevalence was 20.6%, and was higher among women (26.3%) than men (14.8%) [6]. Further, there were an estimated 231,000 new infections across all ages in the same year. Of the nearly 200,000 new infections among people aged 15–49 years, more infections occurred among women than men. Although the HIV incidence remains high, the most recent estimates of 231,000 new infections in the 2017 National HIV Prevalence, Incidence, Behaviour and Communication Survey, represent a decline of 39 percentage points from the preceding survey in 2012 which estimated 378,700 new infections across all ages [6,7].



In recent years, South Africa has been at the forefront of addressing the HIV epidemic with the timely adoption and implementation of progressive policies to strengthen HIV prevention and treatment programmes. For example, South Africa was one of the first countries to adopt the Joint United Nations Programme on HIV/AIDS (UNAIDS) Fast-Track strategy to end HIV by 2030 [8,9]. In 2017, the South African government incorporated the 90-90-90 targets into the country's fourth consecutive National Strategic Plan for HIV, Tuberculosis (TB) and Sexually Transmitted Infections (STIs) for the period 2017–2022 (hereafter referred to as the NSP) [10]. The 90-90-90 targets provided a framework that viewed HIV care and treatment services along the care continuum. The three targets were aimed at ensuring that 90% of all PLHIV know their HIV status; of these, 90% receive ART; and of these, 90% have viral suppression [8,9]. If the 90-90-90 targets are met, 90% of all PLHIV will be aware of their HIV status, 81% of all PLHIV will be on ART, and 73% of all PLHIV will be virally suppressed [9].

In addition, the NSP also recognised the importance of key populations for HIV to the dynamics of HIV transmission within the context of a generalised epidemic in South Africa. In 2017, guidelines were

developed for South Africa's response to HIV, AIDS, STIs, and TB for lesbian, gay, bisexual, transgender and intersex people [11].

1.3 Men who have sex with men: a KP for HIV

Men who have sex with men (MSM) are men who engage in sexual activity with other men regardless of whether they also have sex with women or self-identify as heterosexual [4]. In South Africa, early studies conducted between 2011 and 2014 among MSM report HIV prevalence estimates ranging from 13% to 50% across different study settings [12-14]. Notably, these estimates are comparable to those from other cities in sub-Saharan Africa, including Blantyre, Lilongwe, Dakar, Gaborone, Abidjan, and Mombasa, where 17% to 50% of MSM are HIV positive [9]. Despite existing legal and constitutional protection for MSM in South Africa, multi-level barriers prevent MSM from accessing public sector HIV prevention and treatment services [8,10]. Contributing factors include enacted stigma from communities and clinic staff, poor reach of public health messaging and limited reach of MSM-friendly services. In addition, at the individual-level, internalized stigma, high-risk sexual behaviours, and substance abuse exacerbate the poor HIV care continuum outcomes [11,12].

1.4 The South Africa Men's Health Monitoring Study

The first multi-site bio-behavioural survey (BBS) in South Africa (South Africa Men's Health Monitoring Study-I (SAMHMS-I) to include population size estimates and HIV treatment cascade indicators was conducted between 2015 and 2018. The survey was conducted across eight sites which included four large metropolitan cities (eThekwini, Cape Town, Johannesburg, and Tshwane), two medium sized metropolitan cities (Mangaung and Nelson Mandela Bay), and two smaller provincial capital district municipalities (Capricorn, and Ngaka Modiri Molema).

This report is for the second bio-behavioural survey and population size estimation among men who have sex with men in South Africa: South Africa Men's Health Monitoring Study-II (SAMHMS-II). The main objectives of the survey were to:

- Measure the prevalence of HIV and viral load suppression among MSM in Cape Town, Johannesburg, and Mahikeng.
- Identify risk behaviours for HIV and STIs among MSM in Cape Town, Johannesburg, and Mahikeng.
- Assess current prevention/treatment program utilization among MSM in Cape Town, Johannesburg, and Mahikeng.
- Estimate the population size of MSM in Cape Town, Johannesburg, and Mahikeng.

1.4.1 Site selection

Based on available funding and consultation with key stakeholders, SAMHMS-II was conducted in three of the eight cities/towns that were included in the first round: Cape Town Metropolitan City (Western Cape Province), Johannesburg Metropolitan City (Gauteng Province), and Mahikeng Town (North West Province). These locations were selected for the second survey principally because one of the objectives of the surveillance was to monitor the burden of disease over time. A secondary consideration in selecting Cape Town and Johannesburg as survey cities, was based on the potential to obtain a better understanding of KP by conducting SAMHMS-II in settings where similar surveys had been conducted among other KP for HIV in South Africa (e.g., FSW, and transgender people). Mahikeng was specifically chosen to represent the rural and smaller metros.

1. **Cape Town Metropolitan City**
   Cape Town is the provincial capital of the Western Cape Province and is the second-most populous city in South Africa with an estimated 4 million people [15]. The city is one of South Africa's most popular

tourism areas but is characterized by strong gang culture. About 30% of households in the city live in poverty and consist of mostly coloured and Black African residents [15]. Most of the poor households are located within high density peripheral townships and established informal settlements [15]. In 2017, the HIV prevalence in Cape Town was 9.5% (95% confidence interval (CI): 6.8%–13.1%) compared with the national HIV prevalence estimate of 14.0% (95% CI: 13.1%–15.0%) [6]. Among PLHIV aged 15-64 years in Cape Town; 87.8% (95% CI: 79.5%–93.1%) were aware that they were living with HIV; of these 76.2% (95% CI: 68.6%–82.5%) were receiving ART; and, of these, 92.4% (95% CI: 78.4%–97.6%) were virally suppressed [6].

2. Johannesburg Metropolitan City

Johannesburg is the largest city in South Africa with a population of approximately 5.8 million people [16]. The large population can be attributed to migration patterns associated with the city's roles as the economic hub of South Africa, and the African continent [16]. However, the rate of population growth in the city has far outpaced the rate of economic growth, which has resulted in a significant proportion of the population living in poverty [16]. In 2017, the HIV prevalence among the general population in Johannesburg was 12.9% (95% CI: 9.6%–17.2%) compared with the national estimate of 14.0% (95% CI: 13.1%–15.0%) [6]. Among PLHIV aged 15-64 years in Johannesburg; 81.3% (95% CI: 62.4%–91.9%) were aware that they were living with HIV; of these, 67.2% (95% CI: 49.5%–81.1%) were receiving ART; and, of these, 88.8% (95% CI: 76.4%–95.1%) were virally suppressed [6].

3. Mahikeng City

Mahikeng City is the capital and administration city of the North West Province, with an estimated 50,000 people. It shares boundaries with three district municipalities, and a national boundary with Botswana on the northern side. The district is primarily driven by an agrarian economy, but also benefits from mining as part of the platinum belt in North West Province. In 2017, the HIV prevalence among the general population in North West Province (no estimates for Mahikeng City) was 15.6% (95% CI: 13.6%–17.9%) compared with the national estimate of 14.0% (95% CI: 13.1%–15.0%) [6]. Among PLHIV aged 15-64 years in North West Province; 77.6% (95% CI: 58.7%–89.4%) were aware that they were living with HIV; of these, 64.8% (95% CI: 57.8%–71.2%) were receiving ART; and, of these, 90.8% (95% CI: 85.2%–94.5%) were virally suppressed [6].

2 Methodology

2.1 Survey design and sampling

SAMHMS-II was a cross-sectional survey among MSM using a respondent-driven sampling (RDS) approach [17]. RDS is a probability-based sampling method which relies on peer-to-peer recruitment among populations that are socially networked. RDS may improve the chances of reaching less visible members of the target population and it helps maintain the privacy of survey participants [18]. If survey respondents accurately report their personal network size and if peers are randomly recruited from the recruiter's network, then RDS data analysis techniques can be applied to produce population-based estimates [18].

Before recruiting MSM into the SAMHMS-II, we conducted a formative assessment to determine the appropriateness of using RDS as the sampling methodology. Formative assessments were conducted using key informant interviews (KII) and focus group discussions (FGD) with a purposively sampled MSM population and healthcare workers providing services for this population [19,20]. Similar to SAMHMS-I, the formative assessment findings from each of the three survey cities confirmed that MSM knew or recognised

each other as members of this population, they were socially networked and close enough to other MSM to facilitate recruitment, and they were confident that the number of MSM in their cities far exceeded the targeted sample sizes [18].

During the KII and FGD in each of the three cities, participants were asked to propose names of MSM who were well connected within their networks, who were well regarded by their peers, who had large and diverse social and sexual networks, and who were likely to be successful recruiters of other MSM. This process was to identify potential ”seeds” that could start chains of recruitment among social networks of MSM in each of the three cities. The survey team used a “seed selection tool” in Microsoft Excel to select and plant seeds strategically to obtain a representative sample. The survey team aimed to select a diverse group of seeds in terms of some of the following characteristics: age, education level, area of residence in the survey city, race, ethnicity, citizenship, known HIV status, and substance use practices (e.g., injecting drug use). Once seeds were identified, survey staff approached candidates to provide further details of the envisaged role. MSM who were willing to serve as seeds, were first screened for eligibility to participate, and provided written informed consent for survey participation and then completed the questionnaire before receiving coupons to commence the recruitment chains.

2.2 Survey population

Participation in SAMHMS-II was based on the following eligibility criteria:

- Male sex at birth
- Age ≥ 18 years
- Self-reported anal or oral sex with a biological male in the past 6 months with ability to answer screening questions to verify knowledge of sexual practices
- In possession of a valid referral coupon
- Lived, worked, or socialized in the study area during the past 6 months
- Capable and willing to provide informed consent to participate
- Consented to administration of BBS questionnaire
- Consented to providing blood specimens for laboratory-based HIV testing, antiretroviral drug measurements, and viral load measurement
- Consented to receiving HIV point-of-care test results and laboratory HIV test results in case of differences between HIV point-of-care test results and laboratory HIV test results
- Provided contact information to receive actionable test result and in case of discrepant results
- No prior participation in the survey

2.3 Sample size estimation

The sample sizes were calculated to estimate the proportion of PLHIV with viral load suppression per survey city, given an estimated level of HIV prevalence and desired precision of an expected viral load suppression estimate. The sample size for each city was calculated for one proportion, simple asymptotic estimation of viral load suppression using the tool developed by CDC (sample size calculator for viral load suppression given the expected HIV prevalence for KP group). In addition, these assumptions and calculations were also set at levels that the survey team believed to be feasible and reasonable target sample sizes with regards to the available time and financial resources.

The sample size calculations for each survey city were based on the following assumptions:

1. **A design effect of 1.5** was considered reasonable for this survey. This was based on two RDS surveys conducted among MSM in Uganda and South Africa observed design effects for 11 key variables that ranged from 1.20 to 4.65 with a mean of 1.87 [14,21]. Therefore, a design effect of 1.5 was deemed reasonable for this survey of similar RDS design and similar measures and produces a feasible sample size to recruit in multiple locations in South Africa.
2. **A 10% increase in HIV prevalence from SAMHMS-I to SAMHMS-II for each of the three cities**. This was based on an expected increase in survival due to increased ART coverage as well as an assumed steady rate of HIV incidence in this population.
3. **Expected viral load suppression frequency of 90% (95% CI: 85%–95%)** based on the South Africa National Health Laboratory Service (NHLS) viral load data for those receiving ART (the viral load suppression was approaching 90%) (unpublished routine programme data). In addition, this assumption was considered to yield feasible and reasonable target sample sizes.
4. **A precision of 5%** around viral load suppression estimate.
5. **The non-response rate set at 3%** was applied to account for a potential reduction in sample size due to unsuccessful blood draws, shipping and lab issues, and indeterminate results.

Based on the assumptions outlined above, the required minimum sample sizes for each survey city were: 840 participants for Cape Town, 543 participants for Johannesburg, and 895 participants for Mahikeng.

2.4 Fieldwork procedures

2.4.1 Training of field staff

Each survey site was supported by 10 survey staff: Site Supervisor, Receptionist, Coupon Manager, Flow Manager, three Interviewers, two HIV Counsellors, and a Driver. The roles of each survey staff are outlined in Table 2-1. Before commencing quantitative data collection, survey team members took part in a one-week training conducted centrally for all the survey sites. The training included: an overview of the epidemiology of HIV globally and in South Africa, sensitization to issues affecting MSM in South Africa, principles and ethics of research (including confidentiality of participant information), an overview of RDS methodology, survey eligibility criteria, data collection and management procedures, and the roles and responsibilities of survey staff. The training included both didactic and practical simulations of survey procedures. Counsellors received an additional 1-day training from the National Institute for Communicable Diseases (NICD) HIV laboratory on HIV rapid testing, blood collection procedures, as well as the packaging and tracking of blood specimens sent to the NICD lab. During this training, team members also completed training on Good Clinical Practice, in alignment with the South African Good Clinical Practice Guidelines and the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) 2016.

Table 2-1: Staff roles and responsibilities, South Africa Men's Health Monitoring Study-II, 2019

Roles	Responsibilities
Site Supervisor	Provided oversight and support to staff on daily site activities Communicated on a regular basis with the principal investigator Ensured the safety and welfare of participants at the survey site
Receptionist	Welcomed visitors to the survey site Checked the validity of coupons and opened files for potential participants

	Scheduled appointments for potential participants to undergo survey procedures
Flow Manager	Assisted receptionist in tracking and managing the flow of participants at the survey site Provided participants with refreshments and ensure their welfare at the survey site
Coupon Manager	Reviewed validity of coupons after referral by receptionist Screened coupon holders for eligibility to participate in the survey Performed fingerprint scanning and issued participants with participant identifiers (PIDs) Managed the coupon-tracking system Issued referral coupons and gave instructions for peer recruitment Managed issuing of primary and secondary compensations
Interviewers	Reviewed the eligibility criteria for each individual after registration by the coupon manager Obtained and recorded informed consent from participants for all aspects of the survey Conducted quantitative interviews to collect participant data from using the QDS Computer Assisted Personal Interview (CAPI) software
Counsellors	Provided point-of-care HIV testing and counselling services at the survey site Collected blood specimens, and managed the processes of transportation and tracking of blood specimens to the laboratory Provided referrals for participants requiring HIV medical care, based on either point-of-care or laboratory results
Driver	Transported staff and supplies for survey activities

2.4.2 Management of survey coupons

After successful enrolment and completion of survey procedures, participants were given individually coded referral coupons for inviting their peers to enrol in the survey. The coupon codes were serially assigned and were subsequently used as a participant identifier (PID) when the coupon bearer was enrolled into the study. The use of coded coupons allowed the survey team to link recruitment chains stemming from each participant. These links were essential for RDS data analysis, particularly adjusting for network size and the degree to which participants in a social circle have similar or identical characteristics (homogeneity) [22]. Coupons also included contact information of the survey site, hours and days of operation, and the compensation amount.

Issuance and receipt of coupons were monitored manually using a coupon logbook and electronically using a site-specific customized Microsoft Excel spreadsheet tailored specifically for RDS. When participants were issued with coupons, their PID (number on the coupon they brought to the site) was entered into the coupon management system as the unique identifier to open a new record. Under each new record, we captured information on the number of coupons issued, coupon PID, date of coupon issue, and the date coupons were returned to the survey site. This information also was collected in a paper-based coupon logbook as a backup data source. Each participant received a primary compensation of 170 South African rand (ZAR) (equivalent to approximately 12 United States dollars [USD] at the time of the survey) for their participation in the survey and reimbursement of travel costs to the survey site. Participants also received a secondary compensation for each peer successfully enrolled into the study. The secondary compensation was valued at ZAR 30 (equivalent of USD 2.14 at the time of the survey) and issued in the form of a supermarket voucher.

Possession of a valid referral coupon was an eligibility criterion. To prevent re-use of coupons, survey staff collected and voided the coupons participants presented at the survey office for screening and enrolment.

We also used electronic fingerprint scanners to avoid duplicate enrolments at first visits and to confirm enrolment into the study during the follow-up visit. The PersonID fingerprint software translated three fingerprints into a code containing numbers and letters that cannot be used to recreate fingerprint images; no image of the fingerprint was stored on the device.

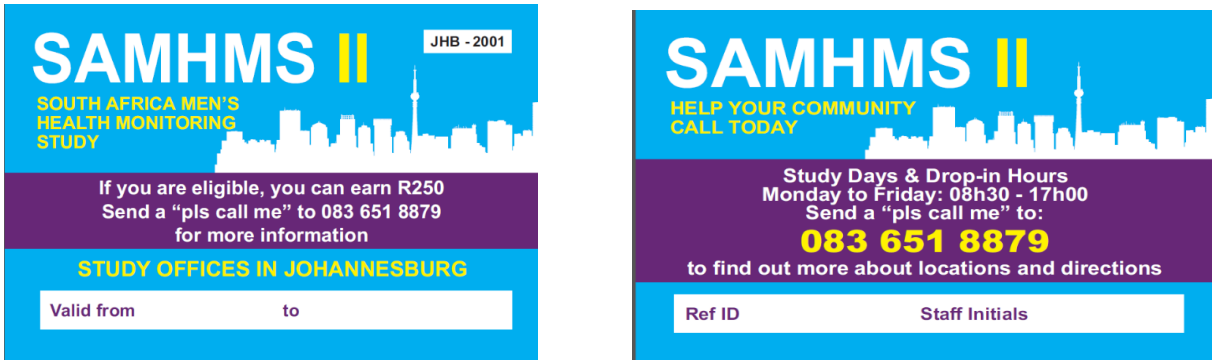


Figure 2-1: Example of survey coupon used for South Africa Men's Health Monitoring Study-II, 2019

2.4.3 Informed consent

South Africa has 11 official languages, including English, which is widely spoken and understood throughout the country [23]. Survey information sheets and consent forms were made available in the languages identified from formative assessments conducted prior to survey implementation (isiZulu, Xhosa, Afrikaans, Sesotho, and English) [23]. The process of translating the consent forms into regional languages involved forward translation from English into the regional language by professional translators fluent in both English and the regional language. Then, a different and independent translator back-translated the information sheet and consent form from the regional language back into English. The back-translated versions of the English documents were compared to the original English consent form for accuracy and adjustments were made where required.

Interviewers provided eligible participants with a copy of the information sheet and consent forms. The potential participants read or had the survey information sheet read to them in their selected language. The information sheet and informed consent form provided details of survey procedures, potential risks, benefits, and contacts in South Africa to report complaints or concerns. All potential participants were given an opportunity to ask questions. Once interviewers were confident that potential participants understood the survey procedures, MSM willing to participate in the survey were asked to sign or place a mark and date the consent form. To enrol in the survey, participants had to consent to all the survey requirements listed below:

- Completing the behavioural questionnaire
- Providing blood specimens for laboratory-based HIV testing, anti-retroviral (ARV) measurements, and viral load measurements
- Receiving HIV point-of-care test results and laboratory HIV test results in case of differences between HIV point-of-care test results and laboratory HIV test results
- Providing contact information to receive actionable test results and in case of discrepant results

At each of the three sites, the signed consent forms were stored in a locked cabinet located in a centralized lockable room which had restricted access to survey staff only. Also, the signed consent forms were stored separately from other survey records such as the coupon-tracking logbooks. A copy of the information sheet and consent forms were provided to participants, and a copy was kept for the survey site records. At the end of the survey, all consent forms were transported and archived at the Aurum Institute's main office in Parktown, Johannesburg.

2.4.4 Survey questionnaire

Behavioural data were collected using a standardized questionnaire which was adapted for MSM in South Africa and aligned with national programme priorities and performance indicators. The questionnaire was also used to collect data among MSM for monitoring HIV indicators that conform to international standards (e.g., UNAIDS indicators) [1,8]. The questionnaire covered the following domains: demographics, behaviours potentially correlated with HIV infection and other STIs, symptoms of STIs among MSM, as well as on HIV-related knowledge, attitude, practices, stigma, discrimination, perceptions of risk, access to HIV care, and HIV testing behaviour.

The questionnaire was reviewed by study investigators and members of the survey team and tested prior to data collection and during the training workshops. The questionnaire was programmed for electronic data capture using IBM Clinical Development Software v2017.1.0 (https://www.ibm.com/za-en/marketplace/clinical-development) and administered by interviewers on a laptop computer using CAPI software. The final version of the survey questionnaire was made available in English. For participants who selected other South African languages, interviewers interpreted the questions based on intent and current terms in each South African language.

The survey questionnaire included three screening questions on alcohol use adapted from the Alcohol Use Disorders Identification Test-Concise (AUDIT-C) tool [24]. Each AUDIT-C question had five possible responses, with a score ranging from 0 points to 4 points. Consistent with categorisation among men, participants with a score of 3 or more were considered positive for hazardous drinking or active alcohol use disorders [24].

2.4.5 Point-of-care HIV testing

Participants were offered and separately consented for on-site point-of-care (POC) HIV rapid testing. However, participants who declined POC-HIV testing still qualified to participate in the survey if they met eligibility criteria outlined in Section 2.2. For POC-HIV testing, counsellors used whole blood collected in an anticoagulant-coated blood tube. In addition to POC-HIV testing, the whole blood specimen was also used for preparing dried blood spots (DBS) that were sent for laboratory testing (section 2.5). Prior to POC-HIV testing, counsellors provided pre-test counselling to all participants. Pre-test counselling included discussions on HIV infection and transmission, the meaning of test results, risks associated with sexual behaviours, as well as means to prevent and treat HIV and STIs. HIV testing was conducted using a serial testing algorithm per the South Africa national testing guidelines (Figure 2-2) and using commercial kits approved (at the time of survey implementation) [25]. Participants were first screened for HIV using Abon HIV 1/2/O Triline Rapid test (Abon Biopharm, Hangzhou, China). Non-reactive results were considered HIV negative, and reactive results were confirmed using First Response HIV1-2.0 Card test (Premier Medical Corporation Private Limited, Mumbai, India). When HIV rapid test results were discrepant (reactive screening test and non-reactive confirmatory test), the testing algorithm was repeated. If the results

remained discrepant, counsellors advised the participants that they would contact them with the laboratory-based HIV test result (usually after 4 weeks).

Issuing results, post-test counselling, and referral to care and treatment were provided immediately following the rapid tests for HIV. Post-test counselling messages were tailored to participants' HIV results and risk profiles. Post-test counselling for participants who tested HIV-negative included discussions on goals for risk reduction; maintenance of risk reduction; and explanation of risk reduction methods (e.g., condom use). Counselling of HIV-positive participants included an assessment of psychosocial needs, a discussion on living with HIV-infection, and the importance of starting and remaining on ART. At the end of the counselling session, all participants were issued with free condoms and lubricants.

Quality controls (QC) were used to monitor the quality of HIV rapid test kits and reagents by testing known positive and negative samples to validate the reliability of the test system. The QC measures were also important for assessing counsellor compliance to standard testing procedures and requirements. The QC procedures for POC-HIV testing were performed daily (usually at the beginning of each day), and when a new shipment of test kits was received at the testing site. Survey staff were trained on and provided with a trouble-shooting guide for invalid results, which listed the problem, potential cause of the problem, and the action to be taken.

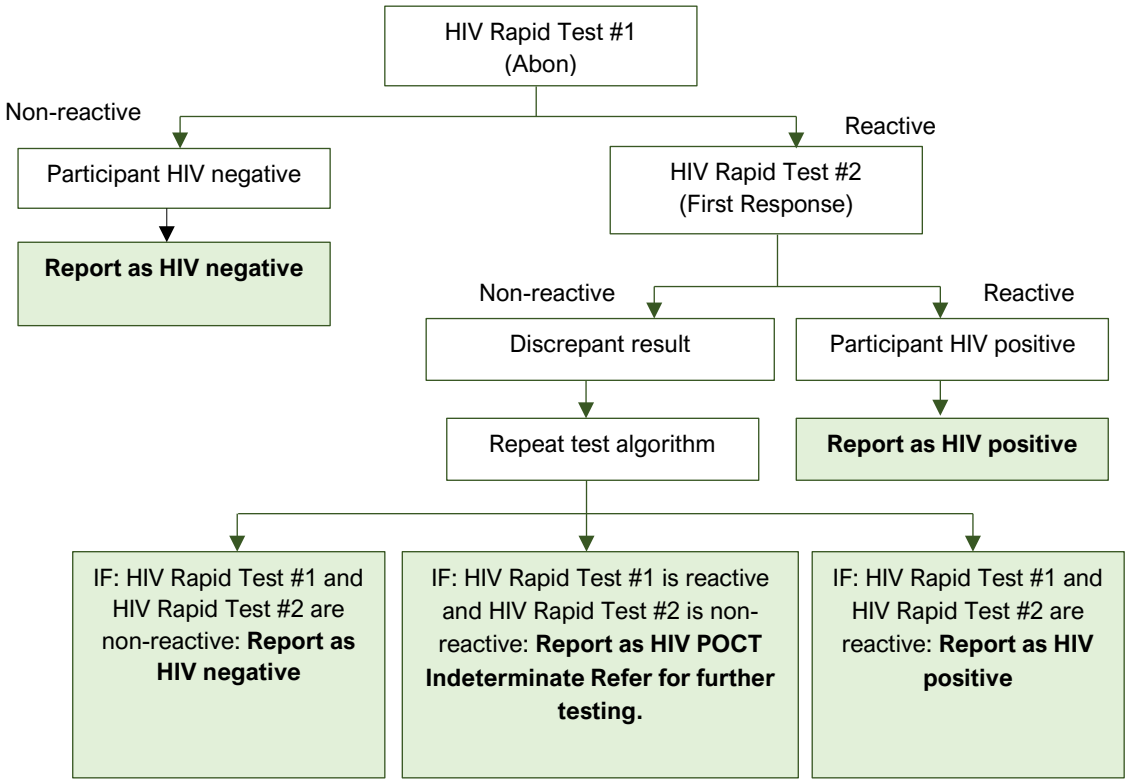


Figure 2-2: Algorithm for point-of-care HIV testing, South Africa Men's Health Monitoring Study-II, 2019

2.5 Laboratory methods

2.5.1 Shipment and tracking of blood specimens

Participant specimens for laboratory testing were collected on DBS cards. The DBS cards were prepared by spotting 75µL of whole blood in dotted circles of Whatman 903 filter paper. Five spots per specimen (one card) were prepared and labelled with bar-coded labels containing the PID. After adding the blood

specimen to the DBS cards, they were left to dry overnight at room temperature and then stored in zip-lock bags with desiccant and humidity indicators. The bags were stored in waterproof containers at the survey sites at 2-8°C and shipped at least once a week to the laboratory for HIV antibody testing, HIV viral load testing, and ARV measurements. Upon receipt of blood specimens, the laboratory staff linked the PIDs to uniquely generated numbers allocated to each specimen by the Laboratory Information System (LIS). In the laboratory, specimens were stored at -20°C.

2.5.2 HIV antibody testing

At the laboratory, DBS cards were punched into an uncoated microtiter plate that was pre-labelled with the corresponding LIS-generated numbers linked to the participant's PIDs. The puncher was decontaminated by punching 4 blank spots after each DBS spot to ensure no carryover. Each filter paper disc was eluted overnight at 4˚C with phosphate buffered saline (pH 7.3–7.4). An aliquot of the eluted sample was then used for performing the HIV antibody test. The laboratory used fourth generation HIV enzyme immunoassays (EIA) for HIV antibody detection. The Genscreen Ultra HIV Ag-Ab (Bio-Rad Laboratories, Marnes-la-Coquette, France), a fourth generation EIA was used as the screen test (Test 1). If the results for Test 1 were non-reactive, they were interpreted as HIV-negative. A second test (Test 2) was performed on all specimens that were reactive for Test 1, using another fourth generation EIA, (Diasorin Murex HIV Ag/Ab Combo, Dartford UK).

All positive results and discrepant EIA results were confirmed for HIV infection by Western blotting (GS HIV -1 Western Blot, WB, [Bio-Rad Laboratories, Redmond, WA, USA]). A positive Western Blot result was reported when at least two major bands were present, i.e., one band for gp160 and another major band for gp120, gp41, or p24. A negative result was reported when no bands were present. An indeterminate result was reported when one or more bands were present, but the results did not meet the criteria for a positive result. Specimens with intermediate results were referred for qualitative total nucleic acid (TNA) analysis. If HIV RNA or DNA was detected on the TNA assay, the results were interpreted as HIV-positive. Conversely, if HIV RNA or DNA was not detected the results were interpreted as HIV-negative. All specimens were destroyed 4 weeks after completion of the study, to make provision for any additional laboratory testing which may have been requested after returning of results to participants (e.g., if the laboratory HIV antibody testing results differed from the POC HIV test results).

2.5.3 HIV viral load testing

HIV viral load testing was performed for laboratory-confirmed HIV-positive specimens using the Abbott m2000 HIV Real-Time System (Abbott Molecular Inc., Des Plaines, IL, USA) at the NICD reference laboratory. On this platform, the analytical cut-off values for undetectable viral load were <20 copies/mL. For HIV programme indicators, participants were considered virally suppressed if the viral load was <1000 copies/mL.

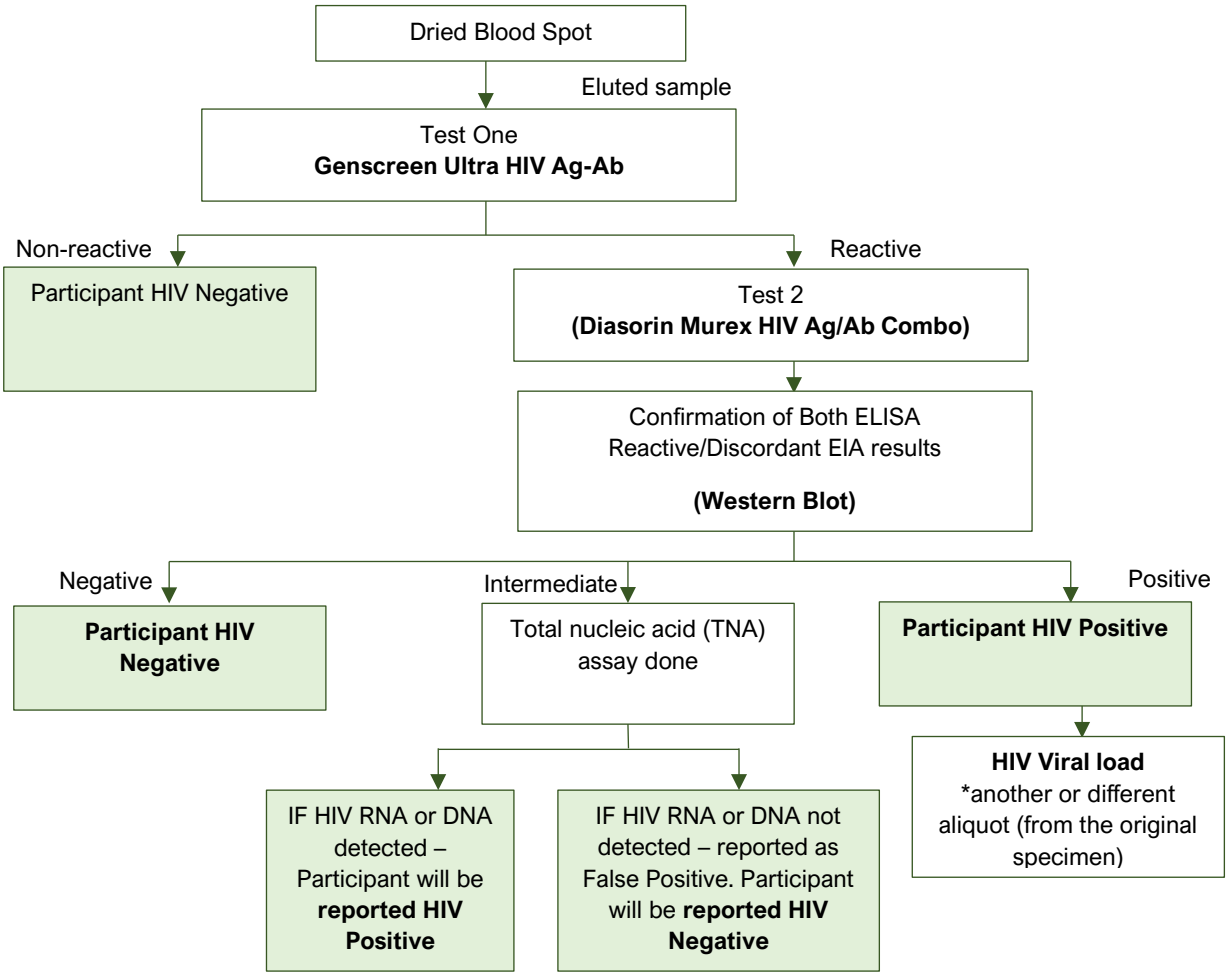


Figure 2-3: Algorithm for laboratory HIV testing, South Africa Men's Health Monitoring Study-II, 2019

2.5.4 Antiretroviral testing

High-performance liquid chromatography (HPLC) coupled to tandem mass spectrometry was used to detect antiretroviral drugs that formed the backbone of ART at the time of the survey. The qualitative detection of nevirapine, efavirenz, and lopinavir was carried out using a validated method developed by the Division of Clinical Pharmacology in the Department of Medicine at the University of Cape Town. The detection of antiretroviral drugs was performed using an Applied Biosystems API 4000 tandem mass spectrometer (Foster City, CA, USA) in the multiple reaction monitoring (MRM) detection mode for each drug using appropriate MRM transitions. Blank and QC cut-off samples were included with each run. Each drug was assayed in the presence of all the others. No observable interference in the detection of one drug by the others was anticipated. The limit of detection is set to 0.2 µg/mL for each of the drugs, with a signal to noise ratio of at least 5:1 for all the drugs.

2.6 Ethical considerations

2.6.1 Ethics approvals

The survey protocol was approved by the Research Ethics Committee of the University of the Witwatersrand (Ref: 181109), CDC (Division of Global HIV & TB and Center for Global Health [CGH HSR #2019-054a]), and the South Africa Department of Health. The protocol was reviewed in accordance with CDC's human research protection procedures and determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes.

2.6.2 Maintaining participant confidentiality

To protect participant anonymity and data confidentiality the survey team implemented several key measures outlined below:

- Participants were only asked to provide their locator details (including names and contact numbers), for the purpose of contacting them to provide laboratory results requiring referrals for care. These lists were stored in locked cabinets in the Site Supervisor's office at the end of each day.
- Names or other identifying information were not written on the survey forms, or on any lab specimens.
- Consent forms were stored in locked file cabinets, in locked offices and access was limited in the same manner as for electronic data.
- When participants provided their fingerprints to avoid duplicate enrolments, no images of the participant's fingerprint were stored on the fingerprint device. Instead, the fingerprints were transformed into a randomly generated alphanumeric code by using an algorithm and a specific combination of participant's fingerprints. This code could not be used to recreate fingerprint images.
- All survey staff signed Employee Confidentiality Agreements.
- All survey procedures (i.e., screening, interviewing, HIV testing, blood collection, and issuing of coupons) were conducted in private office rooms.
- To avoid stigma by the public, survey sites did not bear any signage indicating the purpose of the survey nor description of the survey population.

2.6.3 Return of POC and laboratory test results

HIV antibody results: In line with the South African National HTS guidelines, participants were issued with their POC-HIV test results immediately following testing [25]. Results from serological HIV testing were returned to the survey site about 4 weeks from the date of blood sample submission to the laboratory. Only participants whose laboratory HIV test result differed from the point-of-care test result were contacted telephonically and issued with the HIV test result from the laboratory. Post-test counselling also was provided to participants when survey staff returned HIV test results.

HIV viral load results: HIV viral load results were returned to the survey site about 4 weeks from the date of blood sample submission to the laboratory. The return of viral load results was not mandatory, but participants were asked to indicate, to the counsellor, their willingness to receive their results. As part of routine HIV care and management in South Africa, participants who were receiving ART at the time of survey participation already had schedules for viral load measurements. Also, participants with new HIV diagnoses who were referred to a health facility for further care and management were scheduled to receive their first HIV viral load measurement at 6 months from the time they initiated ART.

Antiretroviral drug test results: Antiretroviral drug measurement results were not returned to participants. The turnaround time for receiving antiretroviral drug test results ranged between 12 and 16 weeks from the time of shipping to the laboratory. This made the return of antiretroviral drug test results impractical for the survey team.

2.7 Population Size Estimation Procedures

Population size estimates (PSE) for MSM are essential for planning the provisions of appropriate interventions, allocation of resources and target setting for programmes.

There is no gold standard for PSE methods. Estimates were established through triangulation of results from multiple empirical methods. The methods included in the current population size exercise were: (i) the unique object, event, and service multipliers, (ii) successive sampling PSE (SS-PSE), and (iii) a synthesis of the methods using the Anchored Multiplier [22].

2.7.1 Multiplier methods

The multiplier methods requires two data sources [26]: the "benchmark" (n), which is a count of the number of MSM who accessed a service during a pre-specified timeframe (e.g., HIV testing), or attended an event, or the number of MSM who have received the unique object (e.g., bangle), and the "multiplier" (p), which is the proportion of participants who report receiving the service, attending the event, or receiving the unique object. Dividing the benchmark by the multiplier gives an estimate of the size of the target population (e).

$$Multiplier\ Method = e = \frac{n}{p}$$

Since MSM were recruited by RDS and prior population size estimates were available, we used Gile's estimator and imputed visibility (see below for details), [27]

a) **Unique Object Multiplier:** Following standard methods for unique object distribution for PSE, one month before the data collection started, a fixed number of unique objects (i.e., bangles) were distributed by outreach teams to eligible MSM at various known street-based and venue-based hotspots. The bangles which had different colours for each survey city were distributed by the survey staff wearing distinctive clothing (i.e., branded t-shirts). MSM receiving the bangles were instructed to remember the object and not to give the object to anyone else. The project staff used paper and electronic logs to keep track of when and where they distributed objects, and how many were distributed. No identifying information was collected from the recipients of the bracelets. The short distribution period, time just before survey launch, and the distinctive clothing were intended to help maximize accurate recall of having received an object among participants later recruited into the survey. During the survey, the enrolled participants answered the following question:

> "In the previous 6 months, did you receive an object, like the one I am showing you now (INTERVIEWER, show participant the object)?"

b) **Unique Event Multiplier:** In each survey city, MSM were invited, with assistance from program partners to a themed event. To improve the participation, we provided transportation or transportation reimbursements. During the event, the number of MSM in attendance were counted using a logbook. During the survey, the enrolled participants answered the following question:

> Cape Town: "On the 25th of May 2019 did you attend an event hosted by ANOVA held at Social Bar in Green Point, with the theme *#Unity through Diversity*?"

Johannesburg: “On the 25th of May 2019 did you attend an event hosted by the Aurum Institute at the Hillbrow Theatre with the theme *#Bay I am coming, are you coming*?”

Mahikeng: “On the 25th of May 2019 did you attend an event hosted by the Aurum Institute held at Monakaladi Garden with the theme *#Ek se, ke so*?”

c) **Service Data Multiplier**: Service providers to MSM in each city were asked to provide unduplicated counts of MSM reached by their program for HIV testing in a specified period. However, in Johannesburg there was a new programme partner at the time of conducting the survey, and the main provider for MSM services in Mahikeng could not provide de-duplicated records. Therefore, we excluded the service data multiplier from PSE calculations.

2.7.2 Successive sampling-population size estimation

Successive sampling population size estimation (SS-PSE) along with network size imputation allows population size to be estimated without relying on separate studies or additional data which may in themselves be biased [28,29]. SS-PSE is a relatively new method and a potential alternative to estimate the size of hard-to-reach populations. It relies primarily on data collected within the RDS survey (participant’s personal network size or degree, recruitment patterns, and date of survey participation) and upon prior knowledge about the population size.

The statistical methodology for SS-PSE assumes individuals with higher social visibility are more likely to be recruited earlier in the RDS process [29]. By this logic, fewer high reported degrees in later waves of RDS recruitment represent a depletion of those population members with higher visibility. In this case, the sample represents a substantial portion of the population. Notably, this assumes visibility and reported degree are positively associated; that is, the size of an individual’s personal network with respect to the target population influences the probability that an individual will be observed during the RDS recruitment process. However, if the reported personal network sizes or degrees remain approximately constant throughout the recruitment waves, the sample size is likely to represent a smaller portion of the population. If reported degrees increase across waves, this could indicate that RDS recruitment is not operating as expected and would serve as a warning when interpreting the results.

2.7.3 Anchored multiplier

The Anchored Multiplier calculator synthesizes multiple estimates of the size of a population into a single estimate [30]. It uses a Bayesian modelling framework to combine empirical estimates (e.g., PSE from different multipliers, SS-PSE) with a prior belief (e.g., an estimate from a previous study). Data input can take the form of raw numbers or population percentages. The calculator will fit the data input to a beta probability distribution that reflects the certainty (i.e., the strength) of the data point. Stronger data points (i.e., those with narrower CI) will have greater influence on the final estimate than weaker data points (i.e., those with wider CI). The calculator will always display the “Anchored Multiplier” estimate. When there is additional variance between the estimated population sizes entered that needs to be considered, the calculator will also provide the variance adjusted estimate (“Anchored Multiplier-VA”). It is recommended to use the variance adjusted estimate to be conservative. The calculator is available online at https://globalhealthsciences.ucsf.edu/resources/tools. The “consensus” population sizes from SAMHMS-I (Table 2-2) were used as the estimates for prior knowledge (e.g., an estimate from a previous study).

Table 2-2: Consensus population size estimates, South Africa Health Monitoring Study I, 2014

City	Point PSE	*Lower bound of PSE	*Upper bound of PSE
Cape Town	29,901	23,921	35,881
Johannesburg	37,549	30,039	45,059
Mahikeng	3,779	3,023	4,535

*No lower or upper bounds were recorded for SAMHMS-I, so based on available information, reasonable bounds representing approximately 20% of the priors, were constructed.
PSE: population size estimation

2.8 Data Management

2.8.1 Registration and tracking of participants

The registration of eligible MSM presenting at each survey site was managed using an electronic fingerprint scanner coupled with commercially available software, PersonID (360Biometrics, San Jose, CA). The software translated a fingerprint into a randomly generated alphanumeric code by using an algorithm and a specific combination of participant's fingerprints. This code was used to identify duplicate participants and to re-establish the identity of participants who present themselves during secondary visits (i.e., for secondary compensations) or to receive test results.

2.8.2 Management of coupons

Issuance and receipt of coupons were monitored electronically using a site-specific customized spreadsheet tailored specifically for RDS (RDS Coupon Manager) and manually using a coupon logbook. The coupon manager entered coupon data into the RDS coupon manager daily and uploaded the files to a private folder on an encrypted server and made available to the Data Managers. Scheduled backups of data were performed on a weekly basis.

2.8.3 Survey data

Survey data were entered in electronic format directly by the interviewer using computer-assisted personal interviewing (CAPI) during the interview process using QDS™ software. Access to the database for data entry, query resolution, and reporting were controlled by the Data Manager and tracked by the system. To ensure quality of data, we programmed built in checks into the QDS™ control file and automatic verification of completeness and internal consistency. Prior to closing the interview files, interviewers were asked to check for correctness and completeness of the completed questionnaires. At the end of each day, the site supervisor copied all QDS™ files from the individual interviewer laptops onto a password-protected computer at the study office. Electronic copies of these files were uploaded to a private folder on an encrypted server and made available to the Data Managers. Scheduled backups of data were performed on a weekly basis.

2.8.4 On-site rapid testing results

The site supervisor entered all POC-HIV test results into a spreadsheet, with the PID as the unique identifier. Electronic copies of these files were uploaded to a private folder on an encrypted server and made available to the data managers. Scheduled backups of data were performed on a weekly basis.

2.8.5 Laboratory results

HIV antibody test results and HIV viral load results from the NICD laboratory were entered into a spreadsheet and sent to the survey team every 4 weeks. A spreadsheet with all laboratory results for antiretroviral drug measurements were sent to the survey team after the end of the survey. All laboratory test results used the PID as the unique identifier. Electronic copies of these files were uploaded to a private folder on an encrypted server and made available to the Data Managers.

2.8.6 Data quality and cleaning

The QC procedures included reviewing of survey questionnaires for completeness and accuracy. Logical data checks were also performed on the data. Queries for incomplete and incorrect data were sent to sites electronically for error resolution. Most errors were reviewed and corrected on a weekly basis. In addition to system checks, the data were also routinely reviewed by data management and statistics staff for continuity and longitudinal integrity. The survey was monitored by internal data monitors.

2.9 Data Analysis

2.9.1 Analysis of recruitment patterns

Data from the behavioural questionnaire, laboratory results, POC-HIV test results, and the RDS Coupon Manager were merged, recoded, and cleaned in STATA (Version 15, College Station, TX). The raw dataset was exported to RDS Analyst (RDS-A), an R-based software package for the analysis of RDS data (http://wiki.stat.ucla.edu/hpmrg/index.php/RDS_Analyst_Install). RDS-A recruitment diagnostic assessments were performed to explore the limitations of inferences that could be made from the survey data to the population. The survey team performed and monitored recruitment diagnostics during the survey period, and at the end of the survey using the final dataset. Recruitment trees were plotted to assess whether MSM were adequately networked. Further, mixing patterns of networks in RDS-A were assessed, using recruitment homophily (likelihood of people recruiting people like themselves) for key variables such as age, contact with peer educators, injecting drug use, and HIV status. For this survey, homophily from 1.0 to 1.3 was considered as evidence of acceptable mixing patterns of networks. Also, the survey team used RDS-A to assess when the estimators for the key variables (i.e., age, contact with peer educators, injecting drug use, and HIV status) were stable and no longer influenced by the characteristics of the seed. This is commonly referred to as ‘convergence’.

2.9.2 Analysis of bio-behavioural data

RDS-A was used to create survey weights, which generated estimates representative of the population from which the participants were drawn. Generally, sampling weights are calculated as the inverse of the probability of being sampled. In the RDS methodology used for this survey, the probability for being sampled was based on each participant’s social network size. Using RDS-A, the weight assigned to each participant was based on the inverse of the network size. Participants with a small social network size were less likely to receive a coupon and were assigned a higher weight. In contrast, individuals with a larger social-network size had a higher chance of receiving a coupon and were assigned lower weights.

For this survey, a participant’s social network size was determined by the following set of questions. The answer to Question 2 was used to determine the participant’s social network size. Where information on network size was missing, we assigned the maximum network size, thereby assigning the smallest weight.

Question 1: "How many MSM in <Study Area: Cape Town, Johannesburg, Mahikeng> do you know by name and they know yours?"
Question 2: Of those, about how many would you consider recruiting into this study?

The confidence intervals for the proportions presented in Section 3 were calculated by exporting the RDS data with RDS-A generated sampling weights to STATA (i.e., using the *svyset* command and specifying the RDS-A weights as the sampling weights (*pweight).*

3 Results

3.1 Recruitment

During May 1, 2019–September 30, 2019; 2,145 MSM were enrolled across the three survey sites. In Cape Town, six seeds were planted to reach a sample size of 737 participants. In Johannesburg, 10 seeds were planted, and 604 participants were enrolled. In Mahikeng, 13 seeds were planted to reach a sample size of 804 participants. Selected demographic characteristics of the seeds are described in Appendix B.

Across all three survey cities, participants received a maximum of five coupons for peer recruitment. In Cape Town 797 of the 2,595 (30.7%) issued coupons were returned to the site by peer recruits. In Johannesburg, 707 of 2,455 (28.8%) issued coupons were returned to the site by peer recruits. In Mahikeng, 896 of 1,894 (47.3%) issued coupons were returned to the site by peer recruits.

3.2 Sociodemographic characteristics

Socio-demographic characteristics of participants in each city are presented in Table 3-1. Participants in Cape Town (median age 29 years [interquartile range (IQR): 23–37 years]) and Johannesburg (median age, 29 years [IQR 23–34 years]) were of a similar median age, whereas participants in Mahikeng were slightly younger (median age, 25 years [IQR 22–30 years]). The majority of participants were South African citizens; Mahikeng had the lowest proportion of non-South African citizens (1.1%). In Cape Town, most participants (58.3%) had not completed education beyond primary school. In Johannesburg (76.5%) and Mahikeng (80.4%), the majority of participants had completed secondary school and above. Most participants across all three cities reported no sources of income.

Table 3-1: Sociodemographic characteristics, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95%CI	n	%	95%CI
Age (years)									
18-24	214	29.3	24.3–34.7	193	33.2	28.4–38.4	374	45.1	41.1–49.2
25-34	291	38.7	33.4–44.2	270	42.9	37.8–48.2	319	38.6	34.6–42.7
≥35	232	32.1	27.3–37.2	141	23.9	19.6–28.7	111	16.4	13.3–20.0
Median (interquartile range)	29 (23–37)			29 (23–34)			25 (22–30)		
Citizenship									
South Africa	659	88.6	84.4–91.8	523	84.9	80.8–88.3	794	98.9	97.5–99.5
Non-South African	78	11.4	8.2–15.7	81	15.1	11.7–19.3	10	1.1	0.5–2.5
Race									
Black/African	412	54.3	48.6–59.7	580	95.3	91.8–97.3	767	95.9	94.2–97.3
Coloured	271	37.3	32.0–42.8	18	3.3	1.7–6.2	36	3.9	2.7–5.8

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95%CI	n	%	95%CI
Indian	1	<0.1	<0.1–0.1	4	1.1	0.2–4.7	0	-	-
White	53	8.5	5.9–12.1	2	0.4	0.1–1.7	1	<0.1	<0.1–0.3
Marital status: Committed to…									
A man as married	80	10.6	7.7–14.4	58	10.3	7.5–14.0	250	34.8	30.9–39.0
A woman as married	61	4.4	3.1–6.2	95	11.1	8.3–14.6	71	7.0	5.3–9.2
Both man and woman as married	34	3.0	2.0–4.6	38	6.4	4.3–9.4	87	11.9	9.3–15.0
Neither man nor woman as married	562	82.0	77.9–85.5	413	72.2	67.4–76.6	396	46.4	42.3–50.5
Enrolled as student or scholar									
Yes	77	9.0	6.3–12.6	99	13.2	10.2–17.0	226	27.2	23.7–31.0
No	660	91.0	87.4–93.7	505	86.8	83.0–89.8	578	72.8	69.0–76.3
Highest Education Completed									
Secondary School and above	382	41.7	36.6–47.1	480	76.5	71.5–80.8	656	80.4	76.8–83.6
Primary school and below	355	58.3	52.9–63.4	124	23.6	19.3–28.5	148	19.6	16.4–23.2
Main source of income									
Full-time employment	64	6.7	4.4–10.1	52	6.7	4.7–9.5	92	12.6	10.0–15.8
Part-time or self employed	94	12.6	9.4–16.7	227	36.7	31.7–42.0	156	18.7	15.7–22.0
No income	550	77.9	73.0–82.2	311	54.4	49.0–59.6	546	67.4	63.4–71.2
Income sources other than employment	29	2.8	1.5–5.5	14	2.2	1.2–4.2	10	1.3	0.6–2.9

CI –confidence interval; n –number with characteristic described

3.3 Sexual behaviour and practices

About half of the participants in Cape Town (53.3%) and Johannesburg (50.1%) reported ever having sex with a woman. In comparison, a higher proportion of participants in Mahikeng (84.3%) reported ever having sex with a woman (Table 3-2).

Table 3-2: Sexual practices with women and age at first anal sex with a man, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Women sexual partners									
Ever had sex with a woman	343	53.3	47.8–58.7	259	50.1	44.6–55.2	624	84.3	81.5–86.7
Age at first anal sex with a man (years)									
<18	340	39.2	34.1–44.7	289	38.4	33.5–43.7	208	20.5	17.6–23.8
18–24	282	39.8	34.5–45.3	238	44.9	39.6–50.2	441	57.1	53.0–61.2
25–34	82	14.4	10.8–19.0	58	11.9	8.8–15.7	120	15.9	13.1–19.2
≥35	33	6.6	4.4–9.8	19	4.8	2.7–8.5	35	6.5	4.4–9.4
With regards to the last male sexual partner in the past 3 months….									
***Relationship status with last male sexual partner**									
Casual partner	328	52.8	47.3–58.2	197	27.6	23.3–32.3	533	67.0	63.0–70.8
Regular partner	301	33.3	28.6–38.4	150	25.8	21.3–30.8	222	27.5	23.9–31.4
Transactional partner	104	13.9	10.5–18.1	257	46.7	41.4–52.1	45	5.5	4.0–7.6
Knowledge of HIV status of last male sexual partner									
HIV-positive	68	8.8	6.1–12.6	47	5.5	3.6–8.4	39	4.1	2.8–5.8
HIV-negative	411	67.4	62.5–72.0	300	42.3	37.1–47.6	214	26.0	22.6–29.9
Don't know status	254	23.7	20.0–27.9	257	52.2	46.9–57.5	547	69.9	66.0–73.5

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Does last male sexual partner also have sex with women									
Yes	167	19.1	15.2–23.8	157	18.2	14.9–22.1	186	21.4	18.3–24.9
No	365	43.8	38.5–49.2	135	24.1	19.8–29.0	425	50.2	46.0–54.3
Unsure	201	37.1	31.7–42.9	312	57.6	52.4–62.7	189	28.5	24.7–32.5
Sexual practice with last male sex partner									
Insertive	280	43.8	38.4–49.4	274	53.4	48.1–58.6	445	56.5	52.3–60.5
Receptive	324	36.7	31.7–42.0	237	32.9	28.3–37.9	250	28.2	24.7–31.9
Both Insertive and receptive	111	15.3	11.9–19.6	92	13.7	10.4–17.8	104	15.0	12.2–18.4
No anal sex with last male sex partner	8	1.3	0.6–2.9	1	0.1	<0.1–0.6	1	0.3	<0.1–2.4
Decline to answer	10	2.8	1.3–6.1	0	-	-	0	-	-
Condom use at last anal sex with male partner									
Yes	509	72.1	66.9–76.8	447	76.2	71.4–80.4	611	73.6	69.6–77.2
No	206	27.9	23.2–33.1	156	23.8	19.6–28.6	188	26.4	22.8–30.4

- CI –confidence interval; n –number with characteristic described

In Cape Town (52.8%) and Mahikeng (67.0%), most participants reported that their last sexual encounter with a man was with a casual partner (not committed to the person & no payment or exchange)(Table 3-3). In Johannesburg (46.7%), almost half of participants reported that their last sexual encounter with a man, was with a transactional partner where there was an exchange of sex for money, goods, or services. Most participants in Cape Town (67.4%), believed their last male sexual partner to be HIV-negative. In Johannesburg (52.2%) and Mahikeng (69.9%) most participants did not know the HIV status of their last male sexual partners. Most participants in all three cities reported (1) first having anal sex with a man by the age of 24 years, and (2) using a condom at their last sexual encounter with a man.

Table 3-3: Sexual behaviour and practices with last male sexual partner in the past 3 months, South Africa Men's Health Monitoring Study-II, 2019

Measure	*Cape Town N=733			Johannesburg N=604			**Mahikeng N=800		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
With regards to the last male sexual partner in the past 3 months….									
***Relationship status with last male sexual partner**									
Casual partner	328	52.8	47.3–58.2	197	27.6	23.3–32.3	533	67.0	63.0–70.8
Regular partner	301	33.3	28.6–38.4	150	25.8	21.3–30.8	222	27.5	23.9–31.4
Transactional partner	104	13.9	10.5–18.1	257	46.7	41.4–52.1	45	5.5	4.0–7.6
Knowledge of HIV status of last male sexual partner									
HIV-positive	68	8.8	6.1–12.6	47	5.5	3.6–8.4	39	4.1	2.8–5.8
HIV-negative	411	67.4	62.5–72.0	300	42.3	37.1–47.6	214	26.0	22.6–29.9
Don't know status	254	23.7	20.0–27.9	257	52.2	46.9–57.5	547	69.9	66.0–73.5
Does last male sexual partner also have sex with women									
Yes	167	19.1	15.2–23.8	157	18.2	14.9–22.1	186	21.4	18.3–24.9
No	365	43.8	38.5–49.2	135	24.1	19.8–29.0	425	50.2	46.0–54.3
Unsure	201	37.1	31.7–42.9	312	57.6	52.4–62.7	189	28.5	24.7–32.5
Sexual practice with last male sex partner									
Insertive	280	43.8	38.4–49.4	274	53.4	48.1–58.6	445	56.5	52.3–60.5
Receptive	324	36.7	31.7–42.0	237	32.9	28.3–37.9	250	28.2	24.7–31.9
Both Insertive and receptive	111	15.3	11.9–19.6	92	13.7	10.4–17.8	104	15.0	12.2–18.4
No anal sex with last male sex partner	8	1.3	0.6–2.9	1	0.1	<0.1–0.6	1	0.3	<0.1–2.4
Decline to answer	10	2.8	1.3–6.1	0	-	-	0	-	-

Measure	*Cape Town N=733			Johannesburg N=604			**Mahikeng N=800		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Condom use at last anal sex with male partner									
Yes	509	72.1	66.9–76.8	447	76.2	71.4–80.4	611	73.6	69.6–77.2
No	206	27.9	23.2–33.1	156	23.8	19.6–28.6	188	26.4	22.8–30.4

- *The denominators for this analysis are 733 for Cape Town (4 participants never had sex with a male partner in the 3 months preceding the survey, but still met inclusion criteria of self-reported anal or oral sex with a biological male in the past 6 months)
- **The denominators for this analysis are 800 for Cape Town (4 participants never had sex with a male partner in the 3 months preceding the survey, but still met inclusion criteria of self-reported anal or oral sex with a biological male in the past 6 months)
- ***Relationship status with last male sexual partner: Casual partner = not committed to the person & no payment or exchange; Regular partner = committed to the person& no payment or exchange; Transactional partner = exchanged sex for money, goods, or services.
- CI –confidence interval; n –number with characteristic described

3.4 HIV testing

At the time of the survey, most participants in all three cities had tested at least once for HIV, with the majority having conducted their most recent HIV tests at a government facility (Table 3-4). In Cape Town, 15.9% (95% CI: 12.7%–19.9%) of participants reported being HIV-positive. In Johannesburg 22.5% (95% CI: 18.6%–27.0%) of participants reported being HIV-positive. In Mahikeng, 11.2% (95% CI: 8.7%–14.5%) participants reported being HIV-positive. In Cape Town and Mahikeng, less than 2 in 10 participants had ever heard about HIV-self screening, compared to Johannesburg where about 4 in 10 participants had ever heard about HIV self-screening at the time of survey participation.

Table 3-4: Access to and utilisation of HIV testing services, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever tested									
Yes	700	93.2	89.1–96.0	569	92.3	88.7–94.9	715	86.5	83.2–89.2
No	37	6.7	4.1–10.9	35	7.7	5.1–11.4	89	13.5	10.8–16.8
Place where most recent HIV test was conducted									
Government facility	364	57.1	51.5–62.6	361	61.3	55.9–66.6	446	61.2	56.8–65.4
Mobile clinic/NGO	188	19.3	15.9–23.3	160	25.7	21.2–30.9	178	26.4	22.6–30.5
Most recent HIV test result									
HIV-negative	547	84.1	80.1–87.4	400	77.5	73.0–81.4	634	88.8	85.5–91.3
HIV-positive	153	15.9	12.7–19.9	169	22.5	18.6–27.0	81	11.2	8.7–14.5
Ever heard of self-screening									
Yes	255	18.9	15.9–22.3	273	39.8	34.9–45.0	177	17.3	14.6–20.5
No	482	81.1	77.4–84.1	331	60.2	55.0–65.1	627	82.7	79.5–85.4
Ever self-screened among those who have heard of HIV self-screening									
Yes	16	8.8	4.4–16.9	81	31.4	24.4–39.3	22	10.3	6.3–16.2
No	239	91.2	83.1–95.6	192	68.6	60.4–75.4	155	89.7	83.6–93.5

CI –confidence interval; n –number with characteristic described; NGO –nongovernmental organisation

3.5 Alcohol use

Most participants in the three cities can be classified as hazardous alcohol drinkers (categorisation described in section 2.44): Cape Town (63.7%), Johannesburg (89.7%), and Mahikeng (82.2%) (Table 3-5).

Table 3-5: Alcohol use (AUDIT-C score), South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
AUDIT-C score									
No drinking hazard	280	36.3	31.3–41.5	58	10.3	7.4–14.0	124	17.8	14.7–21.4
Hazardous drinking	457	63.7	58.5–68.7	546	89.7	86.0–92.6	680	82.2	78.6–85.5

AUDIT-C: Alcohol Use Disorders Identification Test-Concise; CI –confidence interval; n –number with characteristic described.

3.6 Non-medical drug use

Cannabis was a common drug of choice among participants in all three cities, with more than half of participants in all three cities reporting having ever used the drug for recreational purposes (i.e., in the past 6 months and > 6 months from the time of survey participation). The highest proportion of methamphetamine (tik) use in the 6 months preceding the survey was among participants in Cape Town (26.3%), followed by Johannesburg (3.4%) and lowest in Mahikeng (2.9%). Less than 1 in 10 participants across all three cities, ever injected drugs for recreation (Table 3-6). The highest proportion of injecting drug use was among participants in Cape Town (9.6%).

Table 3-6: Recreational drug use, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever used Heroin									
No	320	54.8	49.4–60.1	386	60.5	55.1–65.6	783	97.4	95.7–98.5
Yes, in the past 6 months	94	14.9	11.5–19.2	20	3.0	1.7–5.0	10	0.9	0.4–1.7
Yes, > 6 months ago	323	30.3	25.9–35.0	198	36.5	31.5–42.0	11	1.7	0.9–3.4
Ever used methamphetamine (tik)									
No	299	48.7	43.2–54.2	390	60.1	54.7–65.2	768	96	94.1–97.3
Yes, in the past 6 months	168	26.3	21.5–31.9	23	3.4	2.0–5.6	29	2.9	1.8–4.5
Yes, > 6 months ago	270	25.0	21.2–29.1	191	36.6	31.5–42.0	7	1.1	0.5–2.6
Ever used 3,4-Methylenedioxymethamphetamine (ecstasy)									
No	335	58.7	53.4–63.8	383	59.5	54.2–64.7	760	94.1	91.7–95.8
Yes, in the past 6 months	34	5.7	3.3–9.5	30	4.6	3.0–7.0	30	3.4	2.2–5.2
Yes, > 6 months ago	368	35.6	31.0–40.5	191	35.9	30.8–41.3	14	2.5	1.4–4.5
Ever used cannabis									
No	260	40.8	35.5–46.3	190	27.5	23.1–32.3	365	44.2	40.2—48.4
Yes, in the past 6 months	229	32.3	27.3—37.8	309	55.4	50.1—60.6	395	49.6	45.4—53.7
Yes, > 6 months ago	248	26.9	22.5—31.9	105	17.2	13.5—21.6	44	6.2	4.4—8.6
Ever used Methcathinone (cat)									
No	339	60.1	54.9—65.0	352	54.5	49.0—59.7	680	83.8	80.5—86.7
Yes, in the past 6 months	26	5.0	2.8–8.8	77	12.5	9.3—16.4	101	13.3	10.7—16.5
Yes, > 6 months ago	372	34.9	30.4—39.8	175	33.2	28.2—38.5	23	2.8	1.8—4.4
Ever used Crystal methamphetamine									
No	314	53.8	48.3—59.2	364	56.1	50.7—61.3	714	87.1	83.8—89.8
Yes–in the past 6 months	147	20.7	16.3—25.9	61	10.7	7.8—14.6	78	11.3	8.8—14.5
Yes, > 6 months ago	276	25.5	21.7—29.7	179	33.2	28.3—38.5	12	1.6	0.8—3.1
Ever used cocaine									
No	334	58.5	53.3—63.6	375	59.0	53.6—64.2	752	93.1	90.4—95.0

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Yes, in the past 6 months	42	5.7	3.6—8.8	48	6.1	4.3—8.6	43	5.5	3.7—7.9
Yes, > 6 months ago	361	35.8	31.1—40.8	181	34.9	29.9—40.3	9	1.5	0.7—3.0
Ever used *nyaope									
No	355	62.3	57.2—67.1	407	62.9	57.6—68.0	786	97.3	95.2—98.5
Yes, in the past 6 months	3	0.5	0.1—1.8	2	0.1	<0.1—0.5	5	0.6	0.2—1.9
Yes, > 6 months ago	379	37.2	32.4—42.3	195	37.0	31.9—42.3	13	2.2	1.1—4.1
Ever injected drugs									
Yes	66	9.6	6.6—13.9	7	0.84	0.3—2.4	9	1.1	0.5—2.4
No	671	90.4	86.1–93.4	597	99.2	97.6—99.7	795	98.9	97.6—99.5

CI –confidence interval; n –number with characteristic described.

*nyaope is a common street drug in South Africa which is a mixture of low grade heroin, cannabis products and other materials added as bulking agents.

3.7 Access to and utilisation of HIV prevention programmes

3.7.1 Condoms and lubricants

Most participants in all three cities found it very easy to obtain male condoms (Table 3-7): Cape Town (91.7%), Johannesburg (91.2%) and Mahikeng (84.1%). Most participants reported having ever used lubricants, but this varied by city: Cape Town (67.1%), Johannesburg (85.2%) and Mahikeng (70.7%).

Table 3-7: Access to and utilisation of condoms and lubricants, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ease to obtain male condoms									
Very easy	679	91.7	88.5–94.1	556	91.2	87.3–94.0	686	84.1	80.7–87.1
Somewhat easy	21	2.7	1.5–4.6	12	2.6	1.2–5.8	74	11.1	8.6–14.3
Not easy	37	5.6	2.6–6.7	36	6.2	4.1–9.4	44	4.8	3.0–6.3
Usual source for male condoms (multiple responses)									
Government facility	303	46.8	41.3–52.4	502	84.1	78.0–87.6	471	43.5	39.5–47.7
Peer educators and mobile clinics	305	28.2	23.9–33.0	158	22.8	18.8–27.4	45	3.8	2.7–5.3
HIV testing events	5	0.5	0.2–1.7	12	1.8	0.9–3.3	6	0.8	0.3–2.2
Private hospital/clinic	1	<0.1	<0.1–0.1	3	0.2	<0.1–0.6	3	0.3	0.1–1.2
Grocery store	28	3.6	2.1–5.9	117	17.2	13.7–21.3	214	25.9	22.5–29.7
Pharmacy	59	6.7	4.3–10.1	66	11.4	8.4–15.2	74	8.4	6.4–10.9
Friends	35	5.2	3.2–8.2	100	15.6	12.2–19.7	85	9.6	7.6–12.1
Sex partner	36	4.0	2.6–5.9	38	7.5	5.2–10.8	81	9.7	7.5–12.3
Bar	69	10.2	7.2–14.3	193	31.8	27.1–36.9	335	42.3	38.3–46.4
Ever used lubricant during anal sex									
Yes	612	67.1	61.2–72.6	544	85.2	80.5–89.0	585	70.7	66.7–74.3
No	125	32.9	27.4–38.8	60	14.8	11.0–19.5	219	29.3	25.7–33.3
***Type of lubricants used among lubricant users** (multiple responses)									
Water-based	470	68.7	62.7–74.1	450	79.1	74.2–83.2	266	40.2	35.6–45.0
Body creams	95	17.9	13.8–22.8	157	30.4	25.5–35.7	342	62.1	57.3–66.6
Household and general-purpose oils	0	-	-	2	0.2	0.1–0.9	2	0.2	<0.1–0.8
Saliva or water	4	0.6	0.2–1.8	39	6.2	4.1–9.1	30	6.0	4.0–9.0
Silicone-based	13	2.0	1.0–4.2	9	1.8	0.8–3.9	6	1.0	0.4–2.4
Soap	0	-	-	2	0.6	0.1–3.0	2	0.6	0.1–3.1

- CI –confidence interval; n –number with characteristic described; NGO: Non-governmental organisation
- Body creams include lotion and petroleum jelly; Household and general-purpose oils include butter, margarine, cooking oil, and other oils.

3.7.2 HIV pre-exposure prophylaxis

Less than half of participants in all three cities had ever heard about HIV PrEP (Table 3-8): Cape Town (36.8%), Johannesburg (41.1%), and Mahikeng (11.6%). The proportion of participants who had ever heard about HIV PrEP and used HIV PrEP was highest among participants in Cape Town (20.5%) followed by Johannesburg (10.7%) and lowest in Mahikeng (0.8%).

Table 3-8: Awareness and utilisation of HIV pre-exposure prophylaxis (PrEP) among men who have sex with men (MSM), South Africa Men's Health Monitoring Study-II, 2019

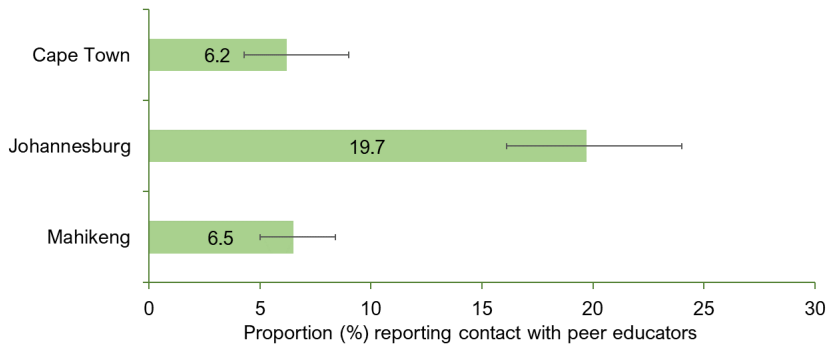
Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Before today, have you heard about taking a pill every day to prevent HIV infection?									
Yes	384	36.8	31.9–41.9	323	41.1	36.1–46.3	113	11.6	9.4–14.3
No	353	63.2	58.1–68.1	281	58.9	53.7–63.9	691	88.4	85.7–90.6
Among those who responded they had heard of PrEP… **Have you ever used PrEP; a pill every day to prevent HIV infection?**									
Yes	79	20.5	14.7–27.9	40	10.7	6.6–16.7	1	0.8	0.1–5.9
No	305	79.5	72.1–85.4	283	89.3	83.3–93.4	112	99.2	94.1–99.9
Among those who responded they had used PrEP… **Currently using PrEP**									
Yes	52	64.4	43.3–81.0	13	23.0	10.6–42.8	0	-	-
No	27	35.6	19.0–56.7	27	77.0	57.2–89.4	1	100.0	-
Willing to use PrEP among HIV-negative MSM who have never used PrEP									
Yes	78	57.1	44.5–68.8	83	89.1	77.7–95.1	37	47.5	34.5–61.0
No	41	23.2	15.1–33.8	7	9.9	4.2–21.4	26	37.1	24.7–51.4
Unsure	19	19.7	11.4–32.0	1	1.0	0.1–7.0	13	15.4	8.6–26.2

CI –confidence interval; n –number with characteristic described; PrEP - HIV pre-exposure prophylaxis

3.7.3 Contact with peer educators

Contact with peer educators in the 12 months preceding the survey was low in each city (Figure 3-1). Less than 1 in 10 MSM had contact with a peer educator in Cape Town (6.2%, 95% CI: 4.3–9.0%) and Mahikeng (6.5%, 95% CI: 5.0–8.4%). In comparison, a higher proportion of participants in Johannesburg (19.7%, 95% CI: 16.1–24.0%) had contact with peer educators.

Figure 3-1: Contact with peer educators in the 12 months preceding the survey, South Africa Men's Health Monitoring Study-II, 2019



Error bars represent 95% CI (confidence interval), i.e., the interval within which the true population parameter is expected to fall 95% of the time from repeated surveys with the same design.

3.7.4 Circumcision

The majority of participants in all three cities were circumcised (i.e., both traditional or medical circumcision). In Cape Town, about a third (35.2%) of participants had undergone medical circumcision (Table 3-9). In comparison, a higher proportion of participants in Johannesburg (50.6%) and Mahikeng (55.9%) had been medically circumcised.

Table 3-9: Circumcision, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Circumcised									
No	272	36.0	30.8–41.5	233	35.4	30.6–40.5	261	29.8	26.2–33.6
Yes, medical circumcision	237	35.2	30.1–40.7	288	50.6	45.3–56.0	449	55.9	51.8–60.0
Yes, traditional circumcision	228	28.8	24.3–33.8	83	14.0	10.7–18.0	94	14.3	11.5–17.7

CI –confidence interval; n –number with characteristic described.

3.8 Stigma and discrimination

3.8.1 Enacted stigma

In Cape Town (37.6%) and Johannesburg (39.4), just over one-third of participants reported being made fun or called names more than once because they were known to be MSM (Table 3-10). In Mahikeng, 15.4% of participants reported being made fun or called names more than once because they were known to be MSM. Less than 1 in 25 participants in all three cities, reported ever losing a job because they were known to be MSM.

Table 3-10: Stigma and discrimination, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Have any of the following ever happened because you were known to be MSM…									
Ever been hit, kicked, or beaten									
Never	631	89.1	85.8–91.7	518	90.6	87.7–92.8	784	98.4	97.4–99.0
Once	54	5.3	3.8–7.3	42	5.1	3.5–7.3	9	0.6	0.3–1.1
More than once	52	5.6	3.6–8.6	44	4.3	2.8–6.6	11	1.0	0.5–2.0
Ever been treated rudely or unfairly									
Never	383	63.5	58.5–68.4	319	60.2	55.0–65.2	637	84.5	81.7–87.0
Once	51	5.3	3.7–7.5	98	14.8	11.5–18.9	80	7.9	6.1–10.1
More than once	303	31.2	26.7–36.1	187	25.0	20.9–29.5	87	7.6	6.0–9.7
Ever been made fun or called names									
Never	336	57.4	52.1–62.6	232	46.9	41.6–52.2	575	77.6	74.2–80.7
Once	44	5.0	3.5–7.2	90	13.7	10.7–17.4	61	7.0	5.1–9.4
More than once	357	37.6	32.7–42.8	282	39.4	34.5–44.6	168	15.4	13.0–18.3
Ever lost employment or dismissed from a job									
Never	702	96.4	93.5–98.0	582	98.0	96.3–98.9	795	99.3	98.5–99.7
Once	26	2.8	1.3–5.8	21	1.9	1.0–3.7	7	0.6	0.2–1.4
More than once	9	0.8	0.3–1.9	1	0.1	<0.1–0.4	2	0.1	<0.1–0.6
Ever been rejected by family members									
Never	583	84.8	81.2–87.9	491	83.8	79.8–87.2	740	93.9	92.0–95.4
Once	73	6.9	5.1–9.3	56	7.6	5.4–10.6	39	3.6	2.5–5.0
More than once	81	8.3	5.9–11.4	57	8.6	6.1–11.9	25	2.5	1.6–4.0

Ever been excluded from activities traditionally reserved for men									
Never	687	93.1	89.5–95.5	533	89.6	86.2–92.3	755	96.1	94.7–97.2
Once	24	3.5	1.9–6.3	38	6.0	4.0–8.8	24	2.0	1.3–3.1
More than once	26	3.5	1.8–6.4	33	4.4	2.7–6.8	25	1.9	1.2–2.9
Ever been physically forced to have sex with someone									
Never	689	95.0	92.1–96.9	542	93.8	91.4–95.6	657	97.6	96.3–98.4
Once	30	2.8	1.7–4.6	44	4.2	2.8–6.1	14	1.4	0.8–2.4
More than once	18	2.2	0.9–5.1	18	2.0	1.1–3.8	11	1.0	0.5–2.0

CI –confidence interval; n –number with characteristic described.

3.8.2 Internalised stigma

Most participants in Cape Town (58.1%) and Johannesburg (77.2%) reported being good at ignoring people who called them names because they were known to be MSM (Table 3-11). In comparison, less than half of participants in Mahikeng (46.5%) reported being good at ignoring people who called them names because they were known to be MSM. Most participants in all three cities disagreed that they were ashamed of being MSM: Cape Town (87.6%), Johannesburg (93.7%), and Mahikeng (65.7%).

Table 3-11: Stigma and discrimination, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
If I could change being a MSM to be a man who has sex only with women, I would do it.									
Agree	30	6.7	4.3–10.4	54	12.4	9.1–16.7	107	15.7	12.8–19.3
Disagree	667	88.0	84.0–91.2	538	84.5	79.8–88.3	597	70.6	66.5–74.3
Neutral	40	5.3	3.5–7.8	12	3.1	1.5–6.4	100	13.7	11.0–16.9
If people call me names–I am good at ignoring it									
Agree	506	58.1	52.4–63.5	485	77.2	72.4–81.4	379	46.5	42.4–50.6
Disagree	184	35.1	29.8–40.8	93	17.0	13.3–21.4	339	43.1	39.1–47.3
Neutral	47	6.9	4.7–9.9	26	5.8	3.7–9.0	86	10.4	8.1–13.2
I feel ashamed of being a MSM									
Agree	28	5.9	3.6–9.4	16	2.3	1.3–4.2	131	18.2	15.1–21.7
Disagree	669	87.6	83.2–90.9	570	93.7	90.7–95.8	561	65.7	61.5–69.6
Neutral	40	6.5	4.3–9.9	18	3.9	2.2–6.6	112	16.2	13.2–19.6
Social involvement with other MSM makes me feel uncomfortable									
Agree	30	6.2	3.8–10.0	32	5.6	3.7–8.3	145	19.9	16.7–23.4
Disagree	653	85.4	80.6–89.2	549	88.7	84.7–91.7	563	66.3	62.2–70.2
Neutral	54	8.4	5.7–12.3	23	5.7	3.5–9.3	96	13.8	11.0–17.1
I feel I am not as good as others because I am a MSM									
Agree	26	4.5	2.8–7.3	22	3.6	2.1–5.9	35	2.8	1.9–4.0
Disagree	683	91.1	87.4–93.8	563	93.0	89.9–95.1	732	92.3	90.0–94.1
Neutral	28	4.4	2.5–7.6	19	3.4	2.0–5.9	37	4.9	3.4–7.1
I think less of myself when I am in public with a person who is obviously MSM									
Agree	29	5.5	3.4–8.9	31	6.7	4.1–10.6	96	13.0	10.5–16.1
Disagree	680	89.0	84.8–92.2	546	87.6	83.1–91.1	649	78.5	74.7–81.8
Neutral	28	5.5	3.3–8.8	27	5.7	3.6–8.9	59	8.5	6.4–11.4
I think being a MSM is against the will of God									
Agree	53	8.1	5.7–11.3	68	13.3	10.1–17.4	46	6.5	4.6–9.0
Disagree	655	86.2	81.8–89.7	520	83.9	79.6–87.4	697	83.7	80.1–86.8
Neutral	29	5.7	3.4–9.6	16	2.8	1.6–4.9	61	9.8	7.3–12.9

CI –confidence interval; n –number with characteristic described.

3.9 Sexually transmitted infections

The proportion of participants who experienced symptoms of an STI (asked in the survey as symptoms of discharge or an ulcer on the penis or anus) in the previous 6 months was smallest among participants in Cape Town (4.2%) followed by Mahikeng (7.7%) and highest in Johannesburg (13.8%) (Table 3-12). Across all three cities, most participants who experienced STI symptoms sought medical care and sought their medical care from public sector clinics ranging from 49.2% in Cape Town to 86.9% in Johannesburg.

Table 3-12: Self-reported knowledge of symptoms for sexually transmitted infections and utilisation of medical care, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Abnormal discharge or sore or ulcer in the past 6 months									
Yes	46	4.2	2.8–6.2	83	13.8	10.6–17.9	68	7.7	5.8–10.1
No	691	95.8	93.8–97.2	521	86.2	82.1–89.4	736	92.3	89.9–94.2
Sexual intercourse during the period of abnormal discharge or sore or ulcer									
Yes	24	58.7	38.1–76.6	21	27.1	16.5–41.3	33	56.4	42.2–69.7
No	22	41.3	23.4–61.9	62	72.9	58.8–83.5	35	43.6	30.3–57.8
Sought medical care for abnormal discharge or sore or ulcer									
Yes	44	92.5	71.4–98.4	54	64.8	50.4–77.0	48	71.0	56.5–82.3
No	2	7.5	1.6–28.6	29	35.2	23.1–49.6	20	29.0	17.7–43.5
Sought medical care for abnormal discharge or sore or ulcer from government clinic									
Yes	21	49.2	29.2–69.5	41	86.9	75.2–93.5	30	56.0	38.1–72.4
No	23	50.8	30.5–70.8	13	13.1	6.5–24.8	18	44.0	27.6–61.9

CI –confidence interval; n –number with characteristic described.

3.10 HIV knowledge

HIV knowledge was generally high among participants in all three cities. In Johannesburg, 72.7% of MSM thought that having sex with one faithful partner reduces the risk of HIV transmission, compared with 88.3% of participants in Cape Town and 90.0% of participants in Mahikeng (Table 3-13). The proportion of participants who thought that condoms did not reduce the chance of getting HIV, ranged from 4.0% in Cape Town to 14.4% in Johannesburg.

Table 3-13: HIV knowledge, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Having sex with only one faithful uninfected person reduces the risk of HIV transmission?									
Answered correctly	649	88.3	84.0–91.6	463	72.7	67.5–77.3	721	90.0	87.2–92.2
Answered incorrectly	83	11.2	8.0–15.5	140	26.9	22.4–32.0	80	9.8	7.6–12.5
Did not know	5	0.5	0.2–1.4	1	0.4	0.1–2.8	3	0.3	0.1–0.9
People can reduce their chance of getting HIV by using a condom every time they have sex?									
Answered correctly	713	96.0	93.4–97.7	546	85.7	80.9–89.3	736	91.1	88.3–93.2
Answered incorrectly	24	4.0	2.3–6.6	58	14.4	10.7–19.1	65	8.4	6.4–11.1
Did not know	0	-	-	0	-	-	3	0.5	0.1–2.1
A healthy-looking person can be living with HIV?									

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Answered correctly	729	99.1	98.2–99.6	557	89.4	85.4–92.5	709	85.8	82.3–88.7
Answered incorrectly	8	0.9	0.4–1.8	47	10.6	7.5–14.6	86	13.5	10.7–17.0
Did not know	0	-	-	0	-	-	9	0.7	0.3–1.4

CI –confidence interval; n –number with characteristic described.

3.11 History of TB screening and diagnosis

The proportion of participants who had ever been diagnosed with TB varied by city: Cape Town (24.7%), Johannesburg (10.5%), and Mahikeng (15.1%) (Table 3-14).

Table 3-14: History of TB screening and diagnosis, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever been screened for TB									
Yes	374	43.0	37.8–48.3	366	52.6	47.2–52.8	262	31.1	27.4–35.0
No	363	57.1	51.7–62.3	238	47.4	42.1–52.8	542	69.0	65.0–72.6
Ever diagnosed with TB									
Yes	81	24.7	18.6–32.0	47	10.5	7.3–14.9	35	15.1	10.5–21.3
No	293	75.3	68.0–81.4	319	89.5	85.1–92.7	227	84.9	78.7–89.5

CI –confidence interval; n –number with characteristic described; TB - Tuberculosis

3.12 HIV Prevalence

We found the highest HIV prevalence among participants in Johannesburg (44.3%), followed by Cape Town (26.8%), and Mahikeng (16.7) (Table 3-15).

Table 3-15: HIV prevalence, South Africa Men's Health Monitoring Study-II, 2019

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	Number HIV-positive	%	95% CI	Number HIV-positive	%	95%CI	Number HIV-positive	%	95%CI
Total	274	26.8	22.6–31.4	316	44.3	39.2–49.6	159	16.7	14.0–19.8
Age (years)									
18-24	58	19.1	13.4–26.4	70	29.9	22.4–38.6	40	7.5	5.3–10.5
25-34	122	30.2	23.2–38.2	155	48.3	40.4–56.3	81	20.6	16.1–26.0
≥35	94	29.7	22.2–38.4	91	57.2	46.1–67.6	38	32.6	23.0–43.8
Race									
Black/African	180	35.2	28.9–42.1	307	44.4	39.2–49.8	151	16.8	14.4–20.1
Coloured	80	18.0	12.7–25.0	7	48.6	20.2–77.9	7	11.4	5.1–23.7
Indian	1	100	-	1	7.8	0.6–52.3	0	0	-
White	13	10.9	5.5–20.5	1	76.7	17.0–98.2	1	100	-
Marital status: Committed to…									
A man as married	23	22.1	12.1–36.8	25	34.6	21.8–50.0	30	12.6	8.4–18.5
A woman as married	37	53.4	36.4–69.8	65	54.0	39.0–68.3	24	26.1	16.6–38.5
Both man and woman as married	8	25.8	10.9–49.5	10	29.2	14.1–50.9	18	18.2	10.8–28.9
Neither man nor woman as married	206	26.0	21.3–31.3	216	45.6	39.4–51.9	87	17.9	14.1–22.5

Measure	Cape Town N=737			Johannesburg N=604			Mahikeng N=804		
	Number HIV-positive	%	95% CI	Number HIV-positive	%	95%CI	Number HIV-positive	%	95%CI
Main source of income									
Full-time employment	31	25.6	14.3–41.3	38	56.9	38.6–73.4	29	22.3	14.8–32.2
Part-time or self employed	30	20.1	12.1–31.5	126	47.1	38.3–56.1	46	26.7	19.3–35.6
No income	199	26.8	22.1–32.1	144	40.7	34.0–47.8	81	12.4	9.6–15.8
Income sources other than employment	14	58.4	28.6–83.0	8	47.9	20.6–76.5	3	40.2	10.7–79.1
Highest Education Complete									
Secondary School and above	149	29.7	23.7–36.4	249	43.3	37.6–49.3	126	15.2	12.5–18.5
Primary school and below	125	24.7	19.1–31.2	67	47.5	36.5–58.7	33	22.5	15.4–31.7
Age at first anal sex with a man									
<18	155	34.4	27.3–42.1	169	53.3	45.0–61.4	63	23.9	18.1–31.0
18–24	93	24.5	18.2–32.1	105	34.7	27.8–42.2	52	10.2	7.5–13.8
25–34	16	11.0	5.3–21.5	33	51.4	36.4–66.2	37	28.1	19.9–38.1
≥35	10	29.6	14.0–52.1	9	44.2	19.2–72.6	7	22.1	9.6–43.2
Circumcised									
No	103	28.0	20.8–36.5	156	62.2	53.6–70.2	99	33.7	27.3–40.8
Yes, medical circumcision	65	15.3	11.0–21.0	117	31.6	25.1–38.9	48	8.8	6.3–12.1
Yes, traditional circumcision	106	39.2	30.6–48.5	43	45.1	31.8–59.1	12	12.1	6.2–22.2
***Relationship status with last male sexual partner**									
Casual partner	105	23.5	18.0–30.0	110	47.1	38.2–56.2	93	15.2	12.0–19.1
Regular partner	127	28.2	22.2–35.2	70	36.9	27.4–47.7	56	19.4	14.3–25.8
Transactional partner	42	36.9	23.7–52.5	136	46.7	38.9–54.7	10	21.7	11.2–37.6
***Condom use with last male sex partner in 3 months preceding survey**									
Yes	198	28.3	23.2–34.0	228	43.8	37.9–49.9	128	18.4	15.0–22.2
No	72	25.8	18.2–35.1	88	46.1	35.8–56.9	31	12.5	8.5–18.0
***Knowledge of HIV status of last male sexual partner**									
HIV-positive	50	72.4	54.2–85.3	40	82.7	61.1–93.6	20	46.6	29.7–64.3
HIV-negative	123	19.8	15.4–25.0	110	36.4	29.3–44.2	36	17.9	12.2–25.5
Don't know status	101	30.3	23.7–38.0	166	46.7	39.4–54.1	103	14.6	11.7–18.0
AUDIT-C score									
No drinking hazard	98	23.2	17.6–30.0	26	34.9	21.5–51.2	19	13.0	7.6–21.3
Hazardous drinking	176	28.8	23.2–35.1	290	45.4	39.9–49.6	140	17.5	14.5–20.9
Ever used drugs									
Yes	205	24.6	20.1–29.9	224	42.6	36.8–48.6	92	15.3	12.1–19.2
No	69	33.9	25.0–44.0	92	50.8	39.9–61.6	67	18.7	14.2–24.2
Contact with peer educators in the 12 months preceding the survey									
Yes	42	46.3	29.3–64.3	97	56.0	45.0–66.4	16	17.1	10.2–27.2
No	232	25.5	21.2–30.3	41.4	41.4	35.7–47.4	143	16.6	13.8–19.9

- *The denominators for these variables are 733 for Cape Town and 800 for Mahikeng (4 participants in each of these two cities never had sex with a male partner in the 3 months preceding the survey, but still met inclusion criteria of self-reported anal or oral sex with a biological male in the past 6 months)
- Relationship status with last male sexual partner: Casual partner = not committed to the person & no payment or exchange; Regular partner = committed to the person& no payment or exchange; Transactional partner = exchanged sex for money, goods, or services.
- CI –confidence interval; n –number with characteristic described.
- AUDIT-C: Alcohol Use Disorders Identification Test-Concise

3.13 Achievement of the 90–90–90 targets among men who have sex with men living with HIV

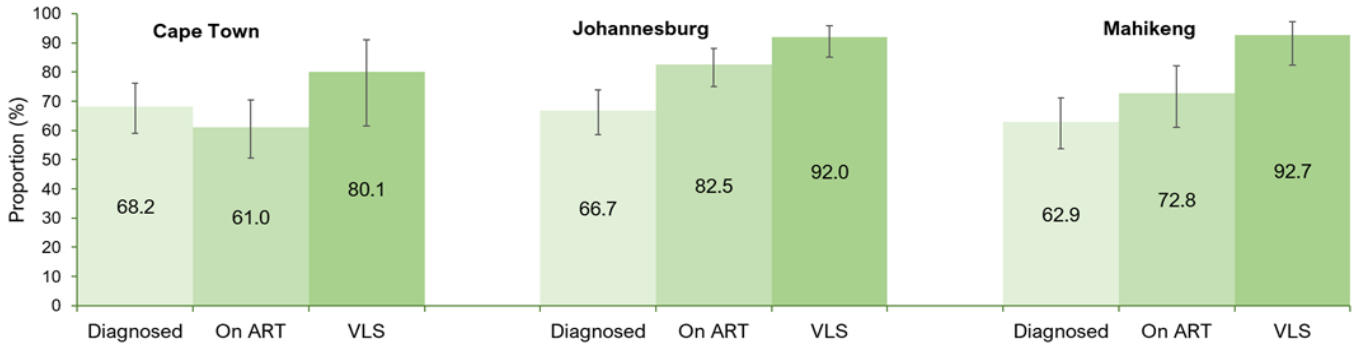
The proportion of participants living with HIV who were aware of their HIV-positive status was low, ranging from 62.9%–68.2% (Table 3-16, Figure 3-2). Among participants aware of their HIV status, 61.0%–82.5% were on ART. Viral load suppression among MSM aware of their HIV status and on ART ranged from 80.1%–92.7%.

Table 3-16: 90–90–90 cascade for men who have sex with men living with HIV, South Africa Men's Health Monitoring Study-II, 2019

	n[a]	N[a]	Point estimate adjusted for respondent driven sampling (%, 95% Confidence Interval [b])
Cape Town			
Aware of HIV status [c]	193	274	68.2 (59.1–76.2)
Aware of HIV status and on ART [d]	117	190	61.0 (50.5–70.5)
On ART and virologically suppressed [e]	104	117	80.1 (61.4–91.0)
Johannesburg			
Aware of HIV status	233	316	66.7 (58.6–73.9)
Aware of HIV status and on ART	191	232	82.5 (75.1–88.0)
On ART and virologically suppressed	177	191	92.0 (85.2–95.8)
Mahikeng			
Aware of HIV status	96	159	62.9 (53.7–71.2)
Aware of HIV status and on ART	68	95	72.8 (61.0–82.1)
On ART and virologically suppressed	63	68	92.7 (82.4–97.2)

a) Depending on the outcome reported; N = total number included in the denominator; n = number with measured outcome
b) 95% CI (confidence interval) indicates the interval within which the true population parameter is expected to fall 95% of the time from repeated surveys of the same design.
c) Awareness of HIV status was defined as self-reporting HIV-positive status and/or detection of antiretroviral drugs in the participant's blood specimen.
d) Being on antiretroviral therapy (ART) was based on the detection of antiretroviral drugs in the participant's blood specimen.
e) Viral load suppression is defined as HIV RNA <1,000 copies per ml of plasma among people living with HIV.

Figure 3-2: 90-90-90 cascade for men who have sex with men living with HIV, South Africa Men's Health Monitoring Study-II, 2019. The figure shows the proportion of PLHIV who know their HIV status (diagnosed); the proportion of PLHIV aware of their status and receiving ART (on ART); and the proportion on ART who have an HIV viral load <1,000 copies/mL (VLS).



Error bars represent 95% CI (confidence interval) i.e., the interval within which the true population parameter is expected to fall 95% of the time from repeated surveys with the same design.

4 Population size estimation

The unique object and event multipliers and SSPSE-imputed visibility were entered into the Anchored Multiplier model. However, the event multiplier method performed poorly in synthesis efforts and was

forced out of the models. Therefore, the final Anchor Multiplier Variance Adjusted PSE for each of the three survey sites were on Unique Object Multiplier PSE with 95% CI and SS-PSE imputed visibility with 95% CI. Population denominators are from the 2019 mid-year population estimates of men aged 18–64 years in the survey cities [31].

In Cape Town, there were an estimated 13,920 (95% CI: 11,700–16,400) MSM, which corresponds to 1.0% (95% CI: 0.9%–1.2%) of the adult male population aged 18–64 years (Table 4-1).

Table 4-1: Population size estimates of MSM in Cape Town, South Africa Men's Health Monitoring Study-II, 2019

	Population sizes Point, 95% CI			% of adult male population 18–64 years (Population=1,334,048)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAMHMS-I)	29,901	23,921	35,881	2.2	1.8	2.7
1. Unique object multiplier	4,940	4,000	6,260	0.4	0.3	0.5
2. Event attendance multiplier*	810	620	1,080	0.1	<0.1	0.1
3. SS-PSE (Imputed visibility)	6,860	5,200	7,350	0.5	0.4	0.6
Anchored Multiplier- variance adjusted	**13,920**	**11,700**	**16,440**	**1.0**	**0.9**	**1.2**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
All Estimates were rounded off to the nearest 10.
CI: Confidence Interval, SAMHMS: South Africa Men's Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation.

In Johannesburg, there were an estimated 26,780 (95% CI: 21,660–32,510) MSM, which corresponds to 1.6% (95% CI: 1.3%–1.9%) of the adult male population aged 18–64 years (Table 4-2).

Table 4-2: Population size estimates of MSM in Johannesburg, South Africa Men's Health Monitoring Study-II, 2019

	Population sizes Point, 95% CI			% of adult male population 18–64 years (Population=1,733,039)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAMHMS-I)	37549	30039	45059	2.2	1.7	2.6
1. Unique object multiplier	2100	1730	2640	0.1	0.1	0.2
2. Event attendance multiplier*	920	670	1280	0.1	<0.1	0.1
3. SS-PSE	5650	4280	6070	0.3	0.2	0.4
Anchored Multiplier- variance adjusted	**26780**	**21660**	**32510**	**1.6**	**1.3**	**1.9**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
All Estimates were rounded off to the nearest 10.
CI: Confidence Interval, SAMHMS: South Africa Men's Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation.

In Mahikeng, there are an estimated 1,300 (95% CI: 1,140–1,460) MSM, which corresponds to 0.5% (95% CI: 0.4–0.5) of the adult male population aged 18–64 years (Table 4-3).

Table 4-3: Population size estimates of MSM in Mahikeng, South Africa Men's Health Monitoring Study-II, 2019

	Population sizes Point, 95% CI			% of adult male population 18–64 years (Population=284,916)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAHMS1)	3,779	3,023	4,535	0.7	0.3	0.8
1. Unique object multiplier	900	850	980	0.2	0.2	0.3
2. Event attendance multiplier*	480	420	530	0.1	0.1	0.1
3. SS-PSE (Imputed visibility)	1,080	900	1340	0.8	0.6	0.8
Anchored Multiplier- variance adjusted	**1,300**	**1,140**	**1,460**	**0.5**	**0.4**	**0.5**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
All Estimates were rounded off to the nearest 10.
CI: Confidence Interval, SAMHMS: South Africa Men's Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation.

5 Discussion

5.1 HIV Prevalence

SAMHMS-II findings show that MSM in Cape Town and Johannesburg bear a disproportionately high burden of HIV compared to the general adult male population in their respective provinces. In Cape Town (Western Cape Province), the HIV prevalence among MSM was higher compared with provincial estimates among men aged 15 years and older in 2019: 26.8% (95% CI: 22.6%–31.4%) vs. 6.9% (95% CI: 6.6%–7.0%) [32]. Also, in Johannesburg (Gauteng Province), the HIV prevalence among MSM was higher compared with provincial estimates among men aged 15 years and older in 2019: 44.3% (95% CI: 39.2%–49.6%) vs. 11.7% (95% CI: 11.3%–12.1%) [32]. In Mahikeng (North West Province), the HIV prevalence among MSM was similar to provincial estimates among men aged 15 years and older in 2019: 16.7% (95% CI: 14.0%–19.8%) vs. 14.3% (95% CI: 13.7%–14.8%)[32].

In Cape Town, HIV prevalence in SAMHMS-II was similar to SAMHMS-I: 26.8% (95% CI: 22.6%–31.4%) vs. 22.5% (95% CI: 15.0%–30.3%). Also, in Mahikeng, HIV prevalence in SAMHMS-II was similar to SAMHMS-I: 16.7% (95% CI: 14.0%–19.8%) vs. 16.6% (95% CI: 12.2%–22.2%) in SAMHMS-I. In Johannesburg, HIV prevalence in SAMHMS-II was higher compared with SAMHMS-I: 44.3% (95% CI: 39.2%–49.6%) vs. 33.6% (95% CI: 27.0%–39.4%). Changes in HIV prevalence between the two survey rounds may be attributable to changes in the number of HIV infections and/or HIV-related mortality [33]. The survey did not collect any additional data to support any further interpretation of changes in HIV prevalence between the two survey rounds. However, given the reliance of RDS methodology on social networks, it is plausible that the differences in social networks between the two survey rounds may have resulted in unmeasured biases and the observed differences in HIV prevalence estimates.

In all three cities, HIV prevalence was lowest among younger participants aged 18–24 years. In Johannesburg and Mahikeng, HIV prevalence peaked among participants aged 35 years and above. The observed HIV prevalence estimates by age group, follow a similar pattern to the one observed among men in the general population [6].

Survey findings point to the importance of identifying MSM who may not be gay-identified, and who act as bridging populations. In this survey, 4.4%–11.1% of participants reported that they were MSM and also committed to a woman as married. Participants committed to a woman as married had the highest HIV prevalence compared to participants who were committed to a man as married, committed to both man and woman as married, or not in a committed relationship.

5.2 HIV testing

Findings from SAMHMS-II point to significant gains in the awareness of HIV status among people living with HIV. Although, 31.8%–37.1% of MSM living with HIV in the three cities were unaware of their HIV status, this was notably lower compared with findings from SAMHMS-I. In SAMHMS-I, more than half of MSM living with HIV in the three cities were unaware of their HIV-positive status: Cape Town 55.0% (95% CI: 36.0%–74.7%), Johannesburg 52.9% (95% CI: 41.1%–65.5%), and Mahikeng 85.6% (95% CI: 66.6%–98.0%) [34]. These gains may be attributed to the expanded access to HTS for MSM through the support of donor-operated NGOs. At the time of the survey, PEPFAR programme partners in all three cities were delivering HTS through mobile testing units that reached out to hot spots, drop-in centres staffed by nurses and counsellors, and government clinics.

At the time of the survey, there was generally low awareness of HIV self-screening among participants as a modality for knowing one's HIV status. In all three sites, the roll-out of HIV self-screening was in the early stages, although program roll-out had progressed further in Johannesburg compared to Cape Town and Mahikeng. HIV self-screening reduces the burden on human resources and physical infrastructure needed

with traditional counsellor or healthcare provider-driven testing interventions, and there is evidence of high acceptability and feasibility of HIV self-screening and network distribution of HIV self-screening test kits among MSM in South Africa [35,36]. HIV self-screening programs may improve the early detection of HIV among MSM and their networks. As HIV self-screening programs among MSM are brought to scale, there are opportunities to monitor and evaluate awareness, reach and utilisation of these approaches among MSM.

5.3 Initiation of antiretroviral therapy and viral load suppression

There are challenges with the attrition of MSM from testing HIV-positive to ART initiation, but once on ART, most MSM achieve treatment success. In all three cities, the proportion of participants aware of their HIV-positive status and receiving ART was lower (61.0% to 82.5%) than the national target of 90% of all people aware of their HIV positive status receiving ART. However, among participants receiving ART, 80.1%–92.7% were virally suppressed (i.e., <1000 copies/mL). These findings underscore the value of process and outcome evaluations to guide continuous quality improvement of programs to improve linkage to ART, such as peer-led outreach and mobilisation, targeted strategic communication and demand creation (e.g., U=U messaging), and MSM population-friendly mobile and drop-in centres[37,38].

5.4 HIV pre-exposure prophylaxis

HIV PrEP is essential to the toolkit for decreasing the number the new HIV infections among populations at high risk of HIV acquisition. In June 2016, the government of South Africa first rolled out oral HIV PrEP as a key HIV prevention intervention among FSW, and rollout among MSM started three years later in April 2018 in limited MSM sites. Findings from this survey show that one year after the initial roll out of HIV PrEP in South Africa (i.e., in 2019 when SAMHMS-II was conducted), MSM in all three survey cities had low awareness of HIV PrEP. Among HIV-negative MSM who had never used PrEP, the willingness to use PrEP ranged from 45.5% to 89.1%. This points to opportunities for increasing PrEP use among MSM.

5.5 Condoms and lubricants

Condom accessibility was high across all three sites, but our findings suggest that MSM commonly improvised for the purpose of lubrication during anal sex. While most clients had used commercially prepared water-based lubricants, 17.9%–62.1% of MSM reported using body creams as lubricants during anal sex. These findings highlight opportunities to increase accessibility of lubricants for MSM.

5.6 Use of alcohol and non-medical drugs

High alcohol consumption and non-medical drug use are known risk factors for sexual violence, HIV transmission, and poor mental and physical health [39,40]. In our study, most participants in the three cities were classified as hazardous alcohol drinkers, and a wide range of substances were reported for non-medical drug use. Over the years, the use of non-medical drugs among MSM has increased in the context of sexual encounters [39-41], although not well-documented in South Africa [42]. Importantly, findings from studies conducted among MSM, suggest that interventions that reduce the use alcohol and non-medical drugs among MSM, can reduce risky sexual behaviours [44-46]. There are tools in South Africa's National Drug Master Plan (2019–2024) that can be adapted for MSM-specific interventions and delivery by MSM peer educators [43]. These include, risk reduction counselling and health promotion, needle and syringe programs for injecting drug users, and opioid substitution therapy. Further, research that explores the social and cultural contexts for alcohol and non-medical drugs, may be considered to guide development of effective interventions.

5.7 Stigma, discrimination, and violence against men who have sex with men

Although MSM are not outlawed in South Africa, a sizeable proportion of MSM experience stigma and discrimination, mostly in the form of being made fun/called names and being treated rudely or unfairly. Importantly, experiences of stigma and discrimination among MSM have been associated with poor mental

health and increased HIV risk behaviours, such as anal intercourse without use of condoms[44,45]. Although, the survey did not explore access to psychosocial and mental health support services by MSM, there is value for routine programmes to monitor the reach and uptake of programmes to empower MSM against stigma, discrimination, and other human rights violations.

With regards to internalised stigma, SAMHMS-II findings suggest that MSM in Mahikeng (rural setting) are less confident in being identified as MSM. About 2 in 10 MSM from Mahikeng felt ashamed of being MSM and social involvement with other MSM made them feel uncomfortable. Psychosocial support as advocated by the South African National LGBTI Plan, may address the identified issues of internalised stigma [11].

5.8 Population size estimates

Estimating population sizes for MSM is important for planning and advocating for resources to improve accessibility of health and welfare programmes for MSM. Our empiric estimation methods which excluded consensus methods, yielded lower PSEs compared with the previous survey round (i.e., SAMHMS-I). It is plausible that the empiric methods may underestimate the population sizes of MSM in the three survey cities, yet on the other hand, it is equally plausible that consensus methods in the previous survey, may have overestimated the population sizes. UNAIDS recently provided guidance, recommending that the minimum PSE for MSM should be at least 1% of the adult male general population. In this regard, population sizes estimated from this survey in Cape Town and Johannesburg, were larger than the minimum threshold. However, the PSE in Mahikeng did not meet the 1% threshold and adjustments may be required to align with the recommendations.

5.9 Survey limitations

- The findings from this survey are limited to the MSM population in Cape Town, Johannesburg and Mahikeng and may not represent the MSM in other cities.
- Although RDS is a robust sampling method for reaching MSM populations, there are inherent limitations in the sampling approach. Despite the survey team routinely monitoring survey sample characteristics during the enrolment period, it is likely that some sub-populations might be underrepresented in the survey sample. Similar to SAMHMS-I, MSM from wealthier socio-economic backgrounds, many of whom likely use social media or other internet-based sites, may be underrepresented. Future rounds of this survey can consider planting seeds to initiate recruitment chains among MSM from wealthier socio-economic backgrounds and explore messaging that will encourage their participation in future surveys.
- SAMHMS-II did not include point-of-care or laboratory-based tests to estimate recency of HIV infection among HIV-positive participants. This limits the inferences about the proportion of new infections among MSM in these three cities.
- Given the high-burden of TB/HIV co-infection in South Africa, there were missed opportunities in SAMHMS-II to assess if MSM were knowledgeable of the symptoms of TB. This is an area which can be explored in future rounds of the survey.
- Population size estimates from the first survey round were based on consensus PSE which limits comparisons between the two survey rounds. A low number of objects and distribution patterns, as well as the MSM who attended the events (for event multiplier) relative to the survey catchment areas might have underestimated the PSEs. However, there were more unique objects distributed and there was higher attendance to the unique events in this survey round compared with the previous survey round.

6 Conclusions and next steps

1. HIV prevalence among MSM, remains disproportionately high compared to men of the same age range in the general population. This is accompanied by a sizeable proportion (about one-third in all

cities) of MSM who are unaware of their HIV status, and suboptimal linkages to ART. The use of social network strategies, strengthening of peer outreach approaches, and scale up of HIV self-screening approaches, may increase the reach and uptake of HTS by MSM.

2. The attrition from testing HIV-positive to initiating ART is a notable gap in the HIV care cascade among MSM. Strengthening program efforts to improve linkage to ART, may go a long way in maximising the HIV prevention benefits of ART, and in reducing AIDS-related morbidity and mortality.
3. The sub-population of MSM who may not be gay-identified are important to HIV prevention and treatment efforts. Programmes may consider targeting these men with the use of social media platforms which have been shown to be successful in reaching networks of older and non-gay identified MSM with adherence and PrEP messaging [46-48].
4. Although condom availability is high, knowledge and use of lubricants was limited, particularly in Cape Town where about 3 in 10 MSM had never used lubricants. In addition, planning tools such as the UNAIDS Condom Tool (https://hivpreventioncoalition.unaids.org/resource/condom-needs-and-resource-requirement-estimation-tool/), may assist program staff, to estimate the needs for lubricants and the associated costs for MSM in South Africa.
5. The willingness to use PrEP among HIV-negative MSM who had never used PrEP, points to opportunities for increasing PrEP use among MSM. This is supported by programmatic data which shows that the largest uptake of PrEP in South Africa is among the MSM. As new evidence emerges on PrEP delivery models, further guidance on implementing effective approaches such as event-driven PrEP, may also increase the reach and uptake of PrEP among MSM [49,50].
6. Hazardous alcohol and non-medical drug use, accompanied by reports of stigmatizing actions in urban areas, and internalized stigma in the rural site, points to the potential role of structural and social support interventions (e.g., “Mpowerment” intervention) [51]. In addition, referrals to peer support groups or psycho-social support teams could assist with dealing with stigmatization and discrimination [52,53] .

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Appendices

Appendix A: Comparison of study methods –SAMHMS-I and SAMHMS-II

	SAMHMS I	SAMHMS II	Comments
Formative Assessment			
Data collection	Key Informant Interviews Focus group discussions Ethnographic Mapping	Key Informant Interviews Focus group discussions Ethnographic Mapping	The same data collection methods will be applied
Age inclusion criteria	≥ 16years	≥ 18 years	To comply with the decision of the local IRB, participants 16 –17 years of age will be excluded from this survey. The stance of the local IRB on this issue has changed from the previous key populations conducted in South Africa –which were previously approved. Inclusions of participants in this age group will require parent assent and consent, which is not practical for RDS approaches. The study protocol has been revised to reflect these changes.
BBS			
Age inclusion criteria	≥ 16 years	≥ 18 years	See comment above
Unique participant identification	1. Coupon/survey code 2. Referral/coupon code 3. Fingerprint scan code 4. Unique testing code	1. Coupon/survey code 2. Referral/coupon code 3. Fingerprint scan code 4. Unique testing code	The identification of participants for different survey activities remain unchanged
Locations	1. Mafikeng (Northwest province) 2. Polokwane (Limpopo province) 3. Bloemfontein (Free State province) 4. Kimberly (Northern Cape province) 5. Port Elizabeth (Eastern Cape province) 6. Cape Town (Western Cape province) 7. Johannesburg (Gauteng province) 8. Durban (KwaZulu-Natal province) 9. Pretoria (Gauteng province)	1. Cape Town (Western Cape province) 2. Johannesburg (Gauteng province) 3. Mahikeng (Formerly Mafikeng, North West province)	Sites for SAMHMS-II selected through stakeholder consultation with the following considerations given: - 3 years since completion of SAMHMS-I - Active MSM population and population size sufficient to meet sample size - Investment in MSM programmes within the geographical location - Rural/urban mix
Laboratory testing	1. Lab testing on DBS 2. HIV ELISA 3. Viral Load testing 4. ARV Measurement 5. Western Blot 6. Recency of HIV infection (DBS)	1. Lab testing on DBS 2. HIV ELISA 3. Viral Load testing 4. ARV Measurement 5. Western Blot 6. TNA PCR	For SAMHMS II DBS specimens will be prepared from venous blood for all central laboratory tests.

Minimum sample size	Johannesburg - 546 Mahikeng - 511 Cape Town - 550	Johannesburg - 570 Mahikeng - 895 Cape Town - 840	Additional considerations to estimate virologic suppression among HIV infected participants
Population size estimation			
Methods	1. Unique object multiplier 2. Unique event multiplier 3. Service data multiplier 4. Successive sampling population size estimation 5. Consensus methods	1. Unique object multiplier 2. Unique event multiplier 3. Service data multiplier 4. Successive sampling population size estimation	Service multiplier not used (unable to deduplicate)

Appendix B: Characteristics of seeds selected to commence recruitment chains

	Cape Town n=6	Johannesburg n=10	Mahikeng n=13
Age years			
16–24	0	0	0
25–29	1	0	1
30–34	2	0	3
≥35	4	3	1
Citizenship			
South Africa	7	3	4
Non-South African	0	0	1
Race			
Black/African	5	3	5
Coloured	1	0	0
Indian	0	0	0
White	1	0	0
Contact with peer educator in 6 months preceding survey			
Yes	4	2	5
No	3	1	0
Non-medical drug use			
Yes	2	0	1
No	5	3	4
HIV status			
HIV-positive	6	3	2
HIV-negative	1	0	3
On antiretroviral therapy			
Yes	3	2	2
No	3	1	3