SOUTH AFRICAN HEALTH MONITORING SURVEY:

A BIOLOGICAL AND BEHAVIOURAL SURVEY AMONG FEMALE SEX WORKERS IN SOUTH AFRICA, 2018 (SAHMS2)

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Contents

List of acronyms and abbreviations

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
EIA	Enzyme immunoassay
ELISA	Enzyme-linked immunosorbent assay
FGD	Focus group discussion
FSW	Female sex workers
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
PSE	Population size estimation
PST	Plasma separation tubes
QA	Quality assurance
QC	Quality control
RDS	Respondent-driven sampling

RDS-A	Respondent-driven sampling analyst
SAHMS	South Africa 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	Sample size
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 resting
ZAR	South African rand

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1 Background

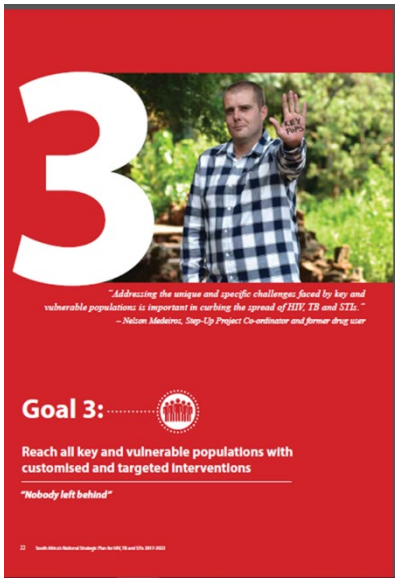
1.1 HIV in sub-Saharan Africa

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 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 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 receiving ART, and 73% of all PLHIV receiving ART will be virally suppressed [9].

1.3 Female sex workers: a KP for HIV

Female sex workers (FSW) are recognized as a key population (KP) at high risk for HIV infection in South Africa [11]. HIV prevalence among FSW in South Africa has been estimated to range from 40% to 88% [12,13]. Further, mathematical models suggest that FSW and their clients account for approximately 6% (interquartile range (IQR): 5%–8%) of heterosexual HIV transmission in South Africa [14]. In the context of a generalized HIV epidemic, individual and structural factors such as poverty, stigma, discrimination, and criminalization of sex work contribute to the increased vulnerability of FSW to HIV and also complicate efforts to control the HIV epidemic in this population [15-17]. Notably, the criminalization of sex work contributes to unsafe working environments, denies FSW legal redress from gender-based violence and economic exploitation, and restricts their access to health services [17,18]. Other risk factors that increase the risk of HIV acquisition among FSW include multiple sexual partners, challenges in negotiating consistent condom use, high prevalence of STIs, lack of access to appropriate lubricants, and relatively high rates of injecting drug use [17,19]. In addition to the high risk for HIV acquisition, there are high chances of onward transmission of HIV from FSW to their clients, especially in circumstances of inconsistent condom use, poor access to and utilisation of other biomedical HIV prevention methods such as pre-exposure prophylaxis (PrEP), or FSW with unsuppressed HIV viral load [20,21].

Although South Africa still criminalizes sex work, FSW are a visible, mobilized, and economically significant population across the country [22]. FSW live in major metropolitan areas that are centres of industrial and trade-based employment, provincial cities and towns, and rural areas [22]. FSW also work in areas traversed by South Africa's well-developed national highway network that links the Atlantic and Indian Ocean port cities to the South African interior as well as to the landlocked countries to the north [18,23]. In addition, FSW work in other diverse settings: in public venues (i.e., urban street corners, parks, bars, and taverns) as well as in more private spaces (i.e., private homes where they mainly interact with clients using social media platforms) [12].

1.4 The first bio-behavioural survey among female sex workers in South Africa (2014)

In 2014, the first bio-behavioural survey (BBS) among 2,180 FSW in South Africa (referred to as the South Africa Health Monitoring Study [SAHMS1]) was conducted in the three largest metropolitan areas: Johannesburg, Cape Town, and eThekwini (also known as Durban) [12]. The key findings from the BBS are summarized below.

- High HIV prevalence estimated among FSW: 71.8% in Johannesburg, 39.7% in Cape Town, and 53.5% in eThekwini.
- Most of the sampled participants had previously tested for HIV; most HIV-positive participants were already aware of their infection. The estimated proportion of unrecognized HIV infections among participants who had either never tested or had not tested within the past year was 15.6% in Johannesburg, 21.0% in Cape Town, and 12.7% in eThekwini. Of additional concern was the relatively high proportion of HIV infection observed among participants who self-reported having tested HIV-negative within the 12 months before the survey—8.8% in Johannesburg, 18.3% in Cape Town, and 8.7% in eThekwini—suggesting high incidence in the this population.
- Few HIV-positive participants were receiving ART at the time of the study interview: 26.9% in Johannesburg, 23.6% in Cape Town, and 35.3% in eThekwini.
- Self-reported condom use with FSW clients was high; more than three quarters of participants used condoms with their last client. However, condom use among non-paying partners was considerably lower.
- The programme reach of FSW peer educators was low. This is important because peer educators form the backbone of health and social welfare programmes targeting FSW and sexually exploited minors (i.e., participants under the age of 18 who identified as sex workers) [8].

Data from SAHMS1 contributed to the development of the South African National Sex Worker HIV Plan for 2016–2019 [8]. The National Sex Worker HIV plan outlines a core package of services to provide care and treatment to HIV-positive sex workers and sexually exploited minors and to combat new infections among this population. Further, the National Sex Worker Plan endorses the human rights of FSW and sexually exploited minors, provides PrEP to HIV-negative FSW and sexually exploited minors, and supports universal testing and treatment for this population to provide HIV care and ART to all HIV-positive sex workers and sexually exploited minors. In this plan, peer educators (i.e., current or former sex workers) are the backbone upon which the sex worker community accesses services.

1.5 The second bio-behavioural survey among female sex workers and sexually exploited minors in South Africa (2018)

1.5.1 Survey aims

The 2018 South African Health Monitoring Study (SAHMS2) was the second round of a BBS with population size estimation (PSE) among FSW and sexually exploited minors in South Africa. The overarching aims of the survey were

- To obtain a better understanding of the factors driving the HIV epidemic among this population
- To collect data for evaluating the South Africa National Sex Worker HIV Plan (2016–2019)
- To collect data for monitoring HIV indicators among this population that are required for country reports and international organizations such as UNAIDS

1.5.2 Survey objectives

The main objectives of the survey were to

- Measure the prevalence of HIV and viral load suppression among this population in Cape Town, eThekwini, and Johannesburg
- Identify risk behaviours for HIV among this population in Cape Town, eThekwini, and Johannesburg
- Assess current prevention/treatment program utilization among this population in Cape Town, eThekwini, and Johannesburg
- Estimate the population size of FSW and sexually exploited minors in Cape Town, eThekwini, and Johannesburg

1.5.3 Site selection

SAHMS2 was conducted in the three metropolitan cities included in SAHMS1: Cape Town (Western Cape Province), eThekwini (KwaZulu-Natal Province), and Johannesburg (Gauteng Province). These locations were selected for the second survey principally because one of the objectives of surveillance is to monitor the burden of disease over time. In addition, SAHMS1 provided population size estimates, which ensured that we could reach the required sample size in these sites using existing implementing partners to reach out to networks. A secondary consideration in selecting the locations was based on the potential to obtain a

better understanding of KP by conducting SAHMS2 in settings where similar surveys had been conducted among other KP for HIV in South Africa (e.g., MSM and transgender people).

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 [24]. 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 [24]. Most of the poor households are located within high density peripheral townships and established informal settlements [24].

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]. From SAHMS1, there were an estimated 6,500 (4,579–9,000) FSW and sexually exploited minors in Cape Town; two-thirds of the population (66.7%) were coloured, and the remaining one-third (33.3%) were Black Africans [12]. Most of the FSW reported that they met their clients in three primary settings: streets/roadside, entertainment hotspots such as bars and nightclubs, and brothels. The SAHMS1 survey also showed that 39.7% of the FSW in the city were estimated to be living with HIV, and HIV prevalence was highest among FSW aged 30-34 years (44.6% [95% CI: 28.8%–67.8%]) [12].

2. eThekwini Metropolitan City

eThekwini Metropolitan Municipality is in KwaZulu-Natal Province, in the east coast of South Africa. eThekwini is the third largest metropolitan municipality after Johannesburg and Cape Town, with a population of over 3.4 million people [25]. The metropolitan municipality includes eThekwini (where both SAHMS1 and SAHMS2 were conducted) and other smaller surrounding towns. The municipality is a major port city serving much of the sub-Saharan countries and has a large, mobile community of truckers coming from other South African provinces and neighbouring countries [25].

In 2017, the HIV prevalence in eThekwini was 16.7% (95% CI: 12.6%–22.0%) compared with the national HIV prevalence estimate of 14.0% (95% CI: 13.1%–15.0%) [6]. Among PLHIV aged 15–64 years in eThekwini/Durban; 96.7% (95% CI: 93.4%–98.4%) were aware that they were living with HIV; of these, 76.6% (95% CI: 65.4%–84.9%) were receiving ART; and, of these, 77.4% (95% CI: 66.3%–85.6%) were virally suppressed [6]. From SAHMS1, there were an estimated 9,323 (4000–10,000) FSW in eThekwini, with over one-third (40.8%) estimated as aged 16–24 years, and most (96.9%) were Black African [12]. Most of these FSW and sexually exploited minors reported that they met their clients in three primary settings: streets/roadside, entertainment hotspots such as bars and night clubs, and truck stops. SAHMS1 found that 53.5% of the FSW and sexually exploited minors in eThekwini were estimated to be living with HIV in 2014, and HIV prevalence was highest among FSW aged 30–34 years (86.3% [95% CI: 69.7%–97.5%]) [12].

3. Johannesburg Metropolitan City

Johannesburg is the largest city in South Africa, with approximately 5.8 million people [26]. The large population can be attributed to migration patterns associated with the city's role as the economic hub of South Africa and the African continent [26]. 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 [26].

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]. In SAHMS1, there were an estimated 9,323 (5,000–10,895) FSW in Johannesburg, with about one-third (36.5%) estimated as aged 16–24 years, and most (96.9%) were Black African [12]. Most of these FSW and sexually exploited minors met their clients in three primary settings: streets/roadside, entertainment hotspots such as bars and night clubs, and brothels. SAHMS1 found that 71.8% of the FSW and sexually exploited minors in Johannesburg were estimated to be living with HIV in 2014, and HIV prevalence was highest among FSW aged 30–34 years (93.0% [95% CI: 74.4%–97.7%]) [12].

2 Methodology

2.1 Survey design and sampling

The study design and methods for SAHMS2 were based on those used and validated in the 2014 SAHMS1 (see Appendix A for comparison of methods between the two survey rounds) [12]. SAHMS2 was a cross-sectional survey among FSW and sexually exploited minors using a respondent-driven sampling (RDS) approach, as done in SAHMS1 [27]. RDS is a probability-based sampling method that relies on peer-to-peer recruitment among populations that are socially networked. RDS may improve the chances of reaching less visible members of the population of focus and helps maintain the privacy of survey participants [12]. 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 [12].

Before recruiting FSW and sexually exploited minors into the SAHMS2, 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 purposively sampled FSW and sexually exploited minors and healthcare workers providing services for this population [28,29]. Similar to SAHMS1, the formative assessment findings from each of the three survey cities confirmed that FSW and sexually exploited minors knew/recognised each other as members of this population, they were socially networked and close enough to other FSW and sexually exploited minors to facilitate recruitment, and they were confident that the number of FSW and sexually exploited minors in their cities far exceeded the targeted sample sizes [12].

During the KII and FGD in each of the three cities, participants were asked to propose names of FSW and sexually exploited minors 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 FSW and sexually exploited minors. This process was to identify potential "seeds" that could start chains of recruitment among social networks of FSW and sexually exploited minors 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 as representative a sample as possible. The survey team aimed to select a diverse group of seeds in terms of some of the following characteristics: age, education level, type of sex work

(brothel or street-based), 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 either approached candidates directly if they had been part of the formative assessments or used FSW gatekeepers in the geographical area to facilitate discussions and provide further details of the envisaged role. FSW and sexually exploited minors 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 SAHMS2 was based on the following eligibility criteria:

- Female sex at birth
- Age ≥16 years
- Received money in exchange for sex in the previous 30 days
- 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 HIV 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 prevalence estimate. The sample size for each district 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 expected 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 2.0** was considered reasonable for this survey. Firstly, this was based on the observed design effects on awareness of HIV status, which ranged from 2.16 to 2.99 in SAHMS1. Secondly, two RDS surveys before SAHMS1 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 median of 2.25 and a mean of 1.87 [30,31]. Therefore, a design effect of 2.0 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% reduction in HIV prevalence from SAHMS1 to SAHMS2 for each of the three cities**. Although the HIV prevalence may have remained the same or increased due to increased survival of PLHIV receiving ART, assumptions of a lower HIV prevalence will yield conservatively higher sample sizes, ensuring that the study will remain adequately powered to estimate viral suppression within

the required precision. HIV prevalence among FSW and sexually exploited minors in each of the three cities was estimated as follows: Cape Town (35.7%), eThekwini (48.2%), and Johannesburg (64.6%).

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.

On the basis of the assumptions outlined above, the required minimum sample sizes for each survey city were
801 participants for Cape Town, 593 participants for eThekwini, and 443 participants for Johannesburg.

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 1-week training conducted centrally for all survey sites. The training included an overview of the epidemiology of HIV globally and in South Africa, sensitization to issues affecting FSW and sexually exploited minors in South Africa, principles and ethics of research, 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 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 Health Monitoring Study 2018

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 ensured 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 procedure, survey 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 participant identifiers (PIDs) 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) [32]. 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 130 South African rands (ZAR) (equivalent of approximately 10 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 2.30 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.

At the Cape Town site, which had the highest target sample size, participants were issued up to five coupons for peer recruitment. In eThekwini and Johannesburg, participants were issued up to three coupons for peer recruitment.

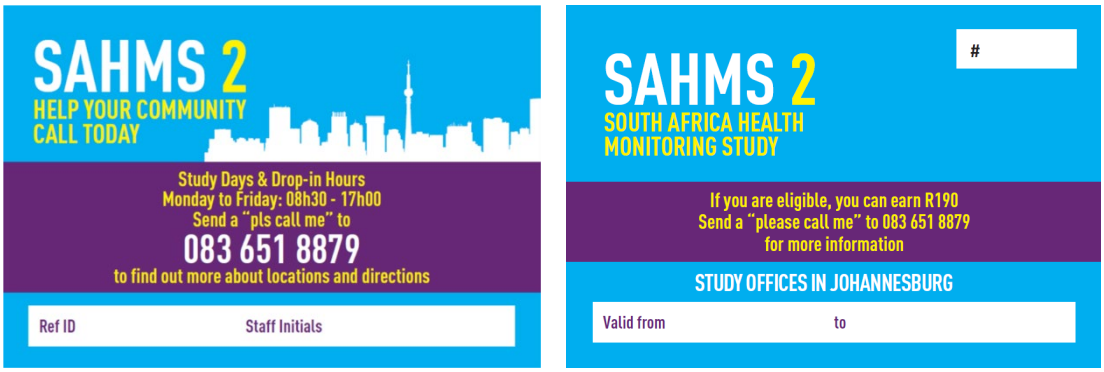


Figure 2-1: Example of survey coupon used for South Africa Health Monitoring Study 2018

2.4.3 Informed consent

South Africa has 11 official languages including English, which is widely spoken and understood throughout the country [33]. Survey information sheets and consent forms were made available in the common primary languages specific to survey sites (Cape Town: isiZulu, Xhosa, Afrikaans, Sesotho, and English; eThekwini: isiZulu and English; and Johannesburg: isiZulu, Xhosa, Sesotho, and English) [33]. 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, FSW and sexually exploited minors willing to participate in the survey were asked to sign or place a mark and date the consent form. To participate in the survey, participants had to consent to all the survey requirements listed below:

- Administration of the behavioural questionnaire
- Providing blood specimens for laboratory-based HIV testing, antiretroviral drug 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

The signed consent forms were stored in a locked cabinet located in a centralized lockable room with 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.

2.4.4 Survey questionnaire

Behavioural data were collected using a standardized questionnaire from SAHMS1, which was adapted for FSW and sexually exploited minors in South Africa. However, some questions for SAHMS2 were revised to align with national programme priorities such as uptake of HIV self-testing, uptake of HIV PrEP, and linkage to HIV care for all people with an HIV-positive diagnosis [10]. The questionnaire for SAHMS2 also explored additional risky sexual behaviours such as dry sex and douching practices, which involve the insertion of drying agents into the vagina to increase sexual pleasure [34,35]. Agents used for douching or dry sex have been shown to alter pH-levels of the vagina and may cause ulcerations and lesions that increase the risk of HIV transmission [35]. The practice of hiding menstrual bleeding while continuing with sex work also was explored in SAHMS2. This practice has been documented in other South African studies but remains understudied given the implications that such practices may have for efforts to prevent HIV transmission [36]. The questionnaire also was used to collect data for evaluating the South Africa National Sex Worker HIV Plan (2016–2019) and to monitor HIV indicators among FSW and sexually exploited minors 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 FSW and sexually exploited minors, HIV-related knowledge, attitude, practices, stigma, discrimination, perceptions of risk, access to HIV care, and HIV testing behaviour.

The questionnaire was tested and reviewed by study investigators and members of the survey team prior to data collection and during the training workshops. The questionnaire was programmed for electronic data capture using Questionnaire Development System (QDSTM) version 2.6.1 (http://www.novaresearch.com/QDS/) and was administered by interviewers using CAPI software on a laptop computer. 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 [37]. Each AUDIT-C question had five possible responses, with a score ranging from 0 points to 4 points. Consistent with categorisation among women, participants with a score of 3 or more were considered positive for hazardous drinking or active alcohol use disorders [37].

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. Counsellors first collected about 4 mL of blood from the arm into an anticoagulant-coated blood tube. This blood specimen was used for POC-HIV testing (where participants consented) and for laboratory tests (section 2.5). This was followed by pre-test counselling that 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 [38]. 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).

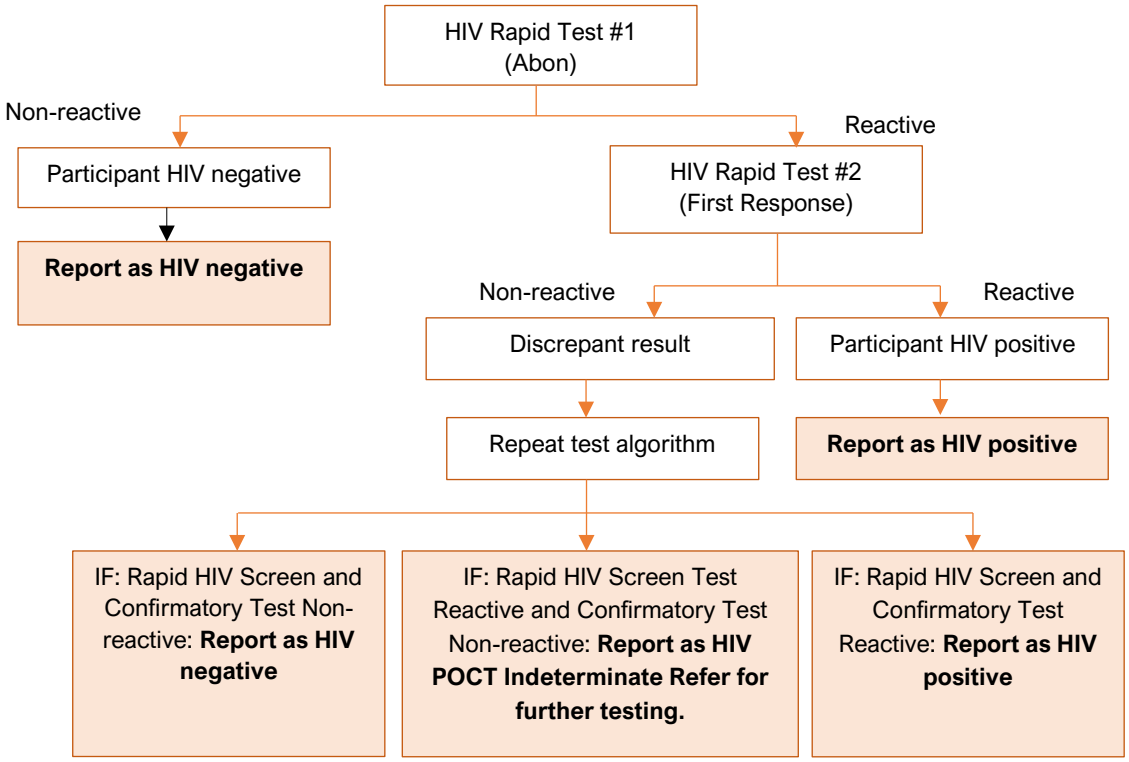


Figure 2-2: Algorithm for point-of-care HIV testing, South Africa Health Monitoring Study 2018

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 of 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. QC measures were also important for assessing counsellor compliance to standard testing procedures and requirements. 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.

2.5 Laboratory methods

2.5.1 Shipment and tracking of blood specimens

All whole blood specimens collected at the survey sites were shipped to the NICD for HIV serological testing, HIV viral load measurement and the qualitative detection of antiretroviral drugs. Blood specimens were collected for all participants and sent for laboratory testing, regardless of whether POC-HIV testing was conducted. For tracking purposes, all blood specimens were identified with the unique PIDs, which the survey recorded and used as the primary link to the coupon code. Upon receipt of blood specimens, the

laboratory staff also linked the PIDs to uniquely generated numbers allocated to each specimen by the Laboratory Information System.

Blood specimens were transported to the lab in temperature-regulated containers (about 4°C) and had to reach the laboratory within 24 hours of collection. Specimens were rejected at the laboratory if they were haemolysed and if the details on the blood tubes did not match the laboratory request forms. In such cases, requests were sent back to the survey sites to repeat blood collection (for clients who were willing to come back to the survey site).

2.5.2 HIV antibody testing

Whole blood specimens received at the NICD reference laboratory were centrifuged to obtain plasma. 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.

2.5.3 HIV viral load testing

HIV viral load testing was performed for 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.

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.

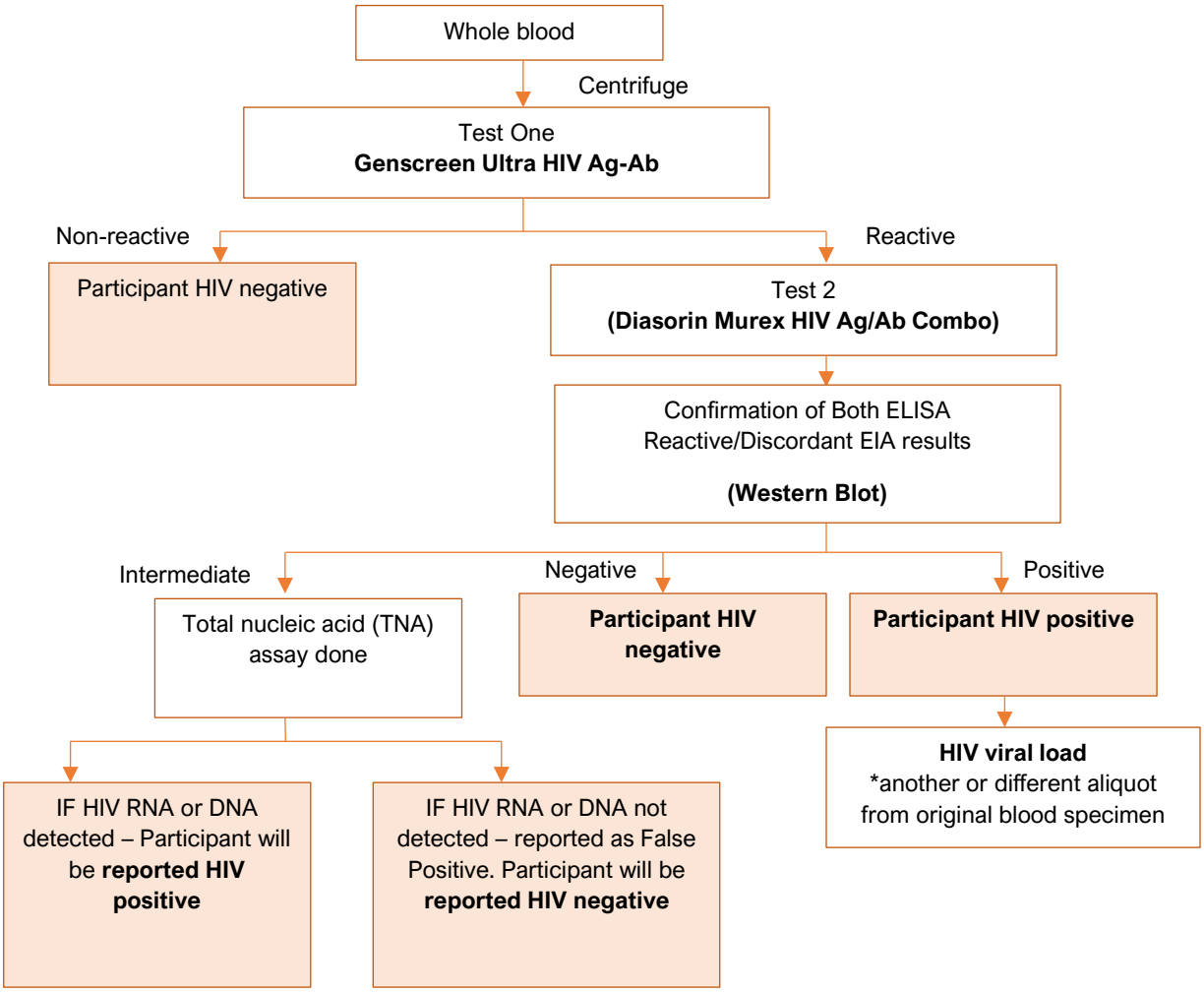


Figure 2-3: Algorithm for laboratory HIV testing, South Africa Health Monitoring Study 2018

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: 171006), CDC (Division of Global HIV & TB and Center for Global Health [CGH HSR #2018-121a]), 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 Inclusion of minors aged 16–17 years

We decided to include minors (aged 16–17 years) in the survey after careful consideration. Similar to SAHMS1, there was consensus among investigators and stakeholders that gathering behavioural and epidemiological data from this particularly vulnerable population was critical to understanding their HIV and social welfare. At the time of the survey, there was evidence from Ukraine and Cambodia on the effectiveness of targeted age-specific programmes in facilitating behaviour change and lowering HIV prevalence among people who inject drugs (PWID), sex workers, and sexually exploited minors [39]. Therefore, the exclusion of this age group from surveillance would have restricted the collection of valuable data to be used for programmatic purposes, potentially causing more harm to the population and the progression of the epidemic.

Prior to commencement of the survey, the investigators worked with the Human Research Ethics Committees of the University of the Witwatersrand and the CDC Associate Director for Science to balance the needs of the survey while acting in the best interests of the social welfare of sexually exploited minors. Additionally, the investigators consulted extensively with three stakeholder groups:

- Sex Workers Education and Advocacy Taskforce (SWEAT), a South African non-governmental organization (NGO) that provides healthcare, advocacy, and welfare services to sex workers in South Africa
- Wits Reproductive Health Institute (WRHI) and Perinatal HIV Research Unit (PHRU), both Johannesburg-based NGOs and academic research institutions, that provide clinical services to sex workers in Johannesburg and that have conducted extensive research into the health and welfare needs of the sex worker population in South Africa

Our referral protocol for sexually exploited minors included an initial referral to these three organizations that had the expertise to conduct appropriate needs assessments and provide referral to specific services. Our referral protocol included the following steps:

- Referral of sexually exploited minors by project staff to FSW stakeholder partner entities (e.g., SWEAT, WRHI, and PHRU)
- Counselling and onward referral of sexually exploited minors by our partners to local governmental welfare agencies (e.g., local social work offices and child protection units in the respective areas) as appropriate

2.6.3 Maintaining participant confidentiality

FSW are a highly stigmatised population in South Africa. Therefore, protecting participant confidentiality was a primary concern for the survey team. Inadvertent disclosure of information collected from the survey may have subjected participants to discrimination and potential harm. Further, involuntary disclosure of participants' HIV status by survey staff was also a potential risk for causing harm to survey participants. 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 referral for care. These lists were stored in locked cabinets in the Site Supervisor's Office at the end of each day and kept separate from the other survey forms.
- Names or other identifying information were not written on the survey forms or on any lab specimens.
- All paper-based survey 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.

2.6.4 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 [38]. 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 their willingness to receive their results to the counsellor. 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 by the survey staff. 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 FSW are essential for planning the provision of appropriate interventions, allocation of resources, target setting for programmes, and advocacy. In the past, PSE from the SAHMS1 were used by the South Africa National AIDS Council (SANAC) and the Department of Health for policy and program planning and as the basis for providing HIV care and treatment cascades for the three cities.

There is no gold standard for PSE methods. Similar to SAHMS1, 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 [32].

2.7.1 Multiplier methods

The multiplier methods require two data sources [43]: the “benchmark” (n), which is a count of the number of FSW or sexually exploited minors who accessed a service during a pre-specified timeframe (e.g., HIV testing), or attended an event, or the number of FSW or sexually exploited minors 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).

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

a) **Unique Object Multiplier:** Following standard methods for unique object distribution for PSE, 1 month before the data collection started, a fixed number of unique objects (i.e., bangles) were distributed by outreach teams to eligible FSW and sexually exploited minors 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). FSW and sexually exploited minors who received 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 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, FSW and sexually exploited minors were invited, with assistance from program partners, to a themed event. To improve the participation, we provided transportation or transportation reimbursement. During the event, the number of FSW and sexually exploited minors in attendance were counted using a logbook. During the survey, the enrolled participants answered the following question:

> Cape Town: "On the 1st of June 2018 did you attend an event hosted by ANOVA held at Crew Bar in Green Point, with them theme 'Our health matters, protect us'?"
>
> eThekwini: "On the 29th of May 2018 did you attend an event hosted by ANOVA with the theme 'Sebenza Gal'?"
>
> Johannesburg: "On the 20th of June 2018 did you attend an event hosted by the Aurum Institute at the Hillbrow Theatre with the theme ''Zajik' Izinto'?"

Service Data Multiplier: Service providers to FSW in each city were asked to provide unduplicated counts of FSW reached by their program for HIV testing in a specified period. The major FSW health service providers for HTS at the time of the survey were two NGOs: WRHI (Johannesburg) and TB/HIV Care (Cape Town and eThekwini). During the survey, the enrolled participants answered the following question:

> Johannesburg: "Between 1 January and 16 June 2018, did you ever visit Esselen Clinic (Wits RHI) for a clinical visit or other service?"
>
> Cape town: "Between 1 January and 1 June 2018 did you receive HIV screening/testing from a TB/HIV Care mobile van/testing site?"
>
> eThekwini: "Between 1 January and 1 June 2018 did you receive HIV screening/testing from a TB/HIV Care mobile van/testing site?"

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 (unlike network scale-up, multiplier and capture-recapture methods), which may in themselves be biased [40,41]. 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 [41]. 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.

To calculate more accurate PSE estimates, we imputed the visibility using a measurement error model with self-reported network size and wave of recruited participants as predictors (date/time of interview was missing for some cases) [45]. Then, we used the imputed visibility for PSE. The visibility imputation helps to smooth the network sizes and produce more accurate results (Table 2-2).

Table 2-2. Key considerations for calculating imputed visibility for each survey city, South Africa Health Monitoring Study 2018

City	Sample size	Max # of coupons	Number of seeds	Maximum recruitment waves	Self-reported network size Mean ± SD (range)	Imputed visibility Mean ± SD (range)	Study period
Cape Town	781	5	7	29	22.6 ± 33.5 (1–250)	10.4 ± 2.9 (3–21)	June – November 2018
eThekwini	600	3	3	15	26.6 ± 41.2 (1–250)	5.3 ± 1.7 (2–10)	June – September 2018
Johannesburg	546	3	5	14	15.45 ± 23.1 (1–250)	7.8 ± 1.6 (1–10)	June – September 2018

SD: standard deviation

2.7.3 Anchored multiplier

The Anchored Multiplier calculator synthesizes multiple estimates of the size of a population into a single estimate [42]. 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 always will display the "Anchored Multiplier" estimate. When there is additional variance between the estimated population sizes entered that needs to be considered, the calculator also will 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 SAHMS1 (Table 2-3) were used as the estimates for prior knowledge (e.g., an estimate from a previous study).

Table 2-3: Consensus population size estimates, South Africa Health Monitoring Study 2014

City	Point PSE	Lower bound of PSE	Upper bound of PSE
Cape Town	6,500	4,579	9,000
eThekwini	9,323	4,000	10,000
Johannesburg	7,697	5,000	10,895

PSE: population size estimation

2.7.4 Adult female population

After estimating the number of FSW, we calculated the proportion of FSW among adult women in each city. The total number of adult (15–64 years) women for the three cities for mid-2018 was estimated from the total population in 2016, after applying the annual growth rate of 1.6% (in 2016 and 2017) and 33.0% (19,043,117/57,725,605) as the proportion of adult women to the total population (Table 2-4).

Table 2-4: Adult female population (15–64 years) in 2018 in the three cities

City	Total Population for 2016*	Estimates of annual growth rates**	Estimated total population for 2017	Estimated total population for 2018	Proportion of females (15–64 y) out of the total population **	Estimated female population 15-64 y for 2018
Cape Town	4,005,015	1.60%	4,068,294	4,131,353	33.0%	1,362,893
eThekwini	3,702,231	1.60%	3,760,726	3,819,018	33.0%	1,259,857
Johannesburg	4,949,346	1.60%	5,027,546	5,105,473	33.0%	1,684,246

* Community Survey 2016 (StatsSa website)
** STATISTICAL RELEASE P0302, Mid-year population estimates 2018, Statistics South Africa.

2.8 Data Management

2.8.1 Registration and tracking of participants

The registration of eligible FSW and sexually exploited minors 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 (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 coordinator 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

QC procedures included reviewing 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 FSW and sexually exploited minors 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 women who exchange sex for money in <Study Area: Cape Town, eThekwini, or Johannesburg> 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, 2018–November 30, 2018, 1,927 FSW and sexually exploited minors were enrolled across the three survey sites. In Cape Town, eight seeds were planted to reach a sample size of 781 participants. In eThekwini, three seeds yielded a sample of 600 participants. In Johannesburg, five seeds were planted, and 546 participants were enrolled. Selected demographic characteristics of the seeds are described in Appendix B.

In Cape Town, participants received a maximum of five coupons, and 888 of the 2,296 (38.7%) issued coupons were returned to the site by peer recruits. In eThekwini and Johannesburg, participants received a maximum of three coupons for peer recruitment. In eThekwini, 672 of 1,698 (39.6%) issued coupons were returned to the site by peer recruits. In Johannesburg, 572 of 1,386 (41.3%) issued coupons were returned to the site by peer recruits.

RDS-A measures of homophily (Table 3-1) suggest that there were high mixing patterns of networks across all three cities, in terms of HIV status (range, 1.07–1.14), age (range, 0.98–1.30), and engagement in peer educator services (range, 1.04–1.12). In Cape Town, the elevated network homophily by zone of residence (1.78) suggests that participants tended to recruit peers from their suburban community. However, the network homophily by zone in eThekwini (1.08) and Johannesburg (1.28), suggested that participants recruited peers outside of the zones they mostly resided, socialised or worked.

Table 3-1: Homophily of key survey variables among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Variable	Cape Town	eThekwini	Johannesburg
HIV status	1.14	1.12	1.07
Zone of residence, socialising or work	1.78	1.25	1.08
Age group	0.98	1.30	1.24
Contact with peer educator in the 12 months preceding the survey	1.04	1.06	1.12

3.2 Sociodemographic characteristics

Sociodemographic characteristics of participants in each city are presented in Table 3-2. Participants in Cape Town (median age, 32 years [interquartile range (IQR): 27–37 years]) and Johannesburg (median age, 32 years [IQR, 27–38 years]) were of a similar median age, whereas participants in eThekwini were slightly younger (median age, 29 years [IQR, 26–36 years]). Most participants were South African citizens; Johannesburg had the highest proportion of non-South African citizens (12.2%). Most participants in Cape Town were Coloured or of mixed race (64.7%), and about one-third were Black (30.3%). In contrast, most participants in eThekwini (92.0%) and Johannesburg (97.9%) were Black Africans. Across all three cities, most participants were not married and had not advanced beyond a primary school education level.

Table 3-2: Sociodemographic characteristics among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Age (years)									
16–24	99	18.8	14.5–24.2	107	20.2	16.2–24.9	82	16.1	12.6–20.3

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
25–29	198	22.8	19.2–26.8	197	31.6	26.8–36.7	117	22.5	18.2–27.5
30–34	214	26.3	22.1–31.1	117	19.5	15.6–24.0	137	24.3	20.0–29.3
≥35	270	32.0	27.5–36.9	179	28.8	24.0–34.0	210	37.1	32.2–42.3
Median (interquartile range)		32	27–37		29	26–36		32	27–38
Citizenship									
South Africa	762	97.8	96.4–98.7	589	98.7	97.0–99.4	490	87.8	83.2–91.2
Non-South African	19	2.2	1.3–3.6	11	1.3	0.6–3.0	56	12.2	8.8–16.8
Race									
Black/African	247	30.3	26.0–35.0	548	92.0	88.8–94.3	533	97.9	96.0–98.9
Coloured	493	64.7	59.8–69.3	35	4.5	2.9–6.7	11	1.9	1.0–3.8
Indian	4	0.6	0.1–2.2	11	1.8	0.9–3.9	1	0.1	0.1–1.0
White	37	4.4	2.9–6.6	6	1.7	0.7–4.2	1	0	0–0.3
Marital status									
Not in a union	695	89.7	86.1–92.5	559	92.3	88.9–94.8	512	93.9	91.0–95.9
Married	12	1.1	0.5–2.1	8	1.1	0.5–2.6	6	1.0	0.2–1.7
Living with someone as married	74	9.2	6.5–12.8	33	6.5	4.3–9.9	28	5.4	3.5–8.3
Highest Education Completed									
Primary school and below	682	89.2	86.1–91.7	480	81.2	76.7–84.9	326	68.3	63.2–72.9
Secondary School and above	99	10.8	8.3–13.9	120	18.8	15.1–23.3	220	31.7	27.1–36.8

CI – confidence interval; n – number with characteristic described

3.3 Sexual history and sex work practices

Most participants in all three cities had their sexual debut at the age of 15–17 years, although most started sex work after the age of 18 years. About one-third of participants had been engaging in sex work for up to 3 years. Sex work was the main source of income for most participants, with most reporting the need for money to cover daily life expenses as the reason for engaging in sex work. In Cape Town (90.3%) and eThekwini (82.2%), most participants usually meet their clients on the streets. In Johannesburg, venue-based sex work was more common (73.3%). Very few participants met clients through dating sites or intermediaries. In the 6 months preceding the survey, most had never practiced sex work in another province outside of the one where they were recruited for the survey. Across all three cities, most participants reported that the least amount of money exchanged for sex in the past month was R21–50 (approximately USD1.60–3.84) and the most amount of money was R101–500 (approximately USD 7.76–38.46).

Table 3-3: Sexual history and sex work practices among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Age at sexual debut, years									
<15	128	16.6	13.1–20.7	91	13.8	10.6–17.8	73	13.5	10.3–17.5
15–17	393	48.0	42.8–53.1	322	53.5	48.2–58.8	287	50.4	45.1–55.8
≥18	260	35.5	30.5–40.9	187	32.7	27.9–37.8	186	36.0	30.9–41.5
At what age did you start sex work									
≤ 18 years	166	23.1	19.0–27.7	120	21.1	17.0–25.8	67	15.1	11.5–19.5
>18 years	615	76.9	72.3–81.0	480	78.9	74.2–83.0	479	84.9	80.5–88.5

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Duration of sex work, years									
<1	58	13.1	9.3–18.0	43	7.5	5.1–10.8	28	6.8	4.5–10.3
2–3	186	26.0	21.6–30.8	142	27.2	22.7–32.3	155	27.7	23.2–32.8
4–5	170	15.5	12.8–18.7	106	18.8	15.0–23.3	132	25.9	21.4–30.9
6–10	157	19.7	16.1–23.9	193	30.5	25.7–35.8	129	23.1	19.0–27.7
≥11	210	25.8	21.5–30.5	116	15.9	12.5–20.2	102	16.5	13.1–20.6
Sex work as main source of income									
Yes	734	94.4	92.1–96.0	568	97.1	95.1–98.3	473	90.6	87.4–93.1
No	47	5.6	4.0–7.9	32	2.9	1.7–4.9	73	9.4	6.9–12.6
Where usually meet client*									
Fixed venues	192	20.8	17.4–24.6	177	29.0	24.3–34.2	416	73.3	68.3–77.8
Streets	728	93.0	89.6–95.3	467	82.2	77.6–86.0	269	52.1	46.8–57.3
E-meeting dating sites/internet	19	2.7	1.1–6.2	26	5.3	3.4–8.3	13	1.8	1.0–3.5
Intermediary	16	2.2	1.3–3.8	6	0.7	0.2–2.0	19	2.5	1.4–4.4
Reasons for sex work*									
Need money for daily life	711	90.4	87.3–92.8	447	83.1	79.4–86.3	466	87.6	83.6–90.7
Didn't know any other work to do	14	2.1	1.0–4.1	115	31.5	26.5–37.0	244	38.9	34.0–44.1
Encouragement from friends and family	52	5.4	3.4–8.5	72	9.6	7.1–12.9	85	12.8	9.6–16.9
Mean number of paying sexual clients in the past 30 days									
Mean (± standard deviation)	25	±1		25	±1		21	±2	
Ever worked as a sex worker in another province									
Yes	71	7.7	5.8–10.3	98	15.1	11.7–19.1	90	16.1	12.2–20.9
No	710	92.3	89.7–94.2	502	84.9	80.9–88.3	456	83.9	79.0–87.9
Least amount of money exchanged for sex in the past 30 days									
<ZAR20	58	7.3	4.9–10.9	64	8.7	6.2–12.1	16	3.7	2.1–6.7
ZAR21–ZAR50	290	40.2	35.2–45.5	403	65.7	60.5–70.7	358	63.2	57.9–68.2
ZAR51–ZAR100	271	31.2	26.9–35.9	93	18.2	14.4–22.9	95	18.1	14.5–22.5
ZAR101–ZAR500	154	20.6	16.8–25.0	38	7.2	4.8–10.4	73	13.9	10.5–18.2
>ZAR500	7	0.6	0.3–1.5	2	0.2	0.0–0.8	4	1.0	0.3–2.8
Most amount of money exchanged for sex in the past month									
<ZAR20	2	0.3	0.1–1.5	-	-	-	-	-	-
ZAR21–ZAR50	8	1.3	0.6–3.2	12	3.4	1.8–6.2	6	2.1	1.0–4.7
ZAR51–ZAR100	41	7.6	4.8–12.0	27	5.6	3.5–8.8	37	6.4	4.4–9.3
ZAR101–ZAR500	508	66.5	61.5–71.2	315	56.7	51.4–62.0	419	77.4	72.5–81.6
>ZAR500	221	24.1	20.3–28.5	246	34.3	29.5–39.5	84	14.2	10.7–18.5

* more than one answer could be chosen for these questions

ZAR – South Africa Rand; CI – confidence interval; n – number with characteristic described.

3.4 HIV testing

At the time of the survey, most participants had tested at least once for HIV: Cape Town (98.9%), eThekwini/Durban (96.7%), and Johannesburg (99.2%; Table 3-4). Among participants who self-reported being HIV negative, the proportion that tested for HIV every 3 months varied by survey city: Cape Town (23.7%), eThekwini (33.3%), and Johannesburg (25.3%).

At the time of the survey in 2018, only participants in Cape Town (24.2%) and eThekwini (41.2%) had ever heard about HIV self-screening before, compared with Johannesburg where just over half (50.9%) of participants were aware of HIV self-screening. The use of HIV self-screening was low among participants who were aware of HIV self-screening and self-reported being HIV negative: Cape Town (14.7%), eThekwini (14.8%), and Johannesburg (31.5%). Despite the low use of HIV self-screening, most participants who self-reported being HIV negative and were aware of HIV self-screening were willing to conduct an HIV self-test if provided with the test kits.

Table 3-4: Access to and utilisation of HIV testing services among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever tested									
Yes	772	98.9	97.9–99.5	584	96.7	93.8–98.3	540	99.2	97.4–99.7
No	9	1.1	0.5–2.1	16	3.3	1.7–6.2	6	0.8	0.3–2.6
Ever tested at government facility									
Yes	756	97.8	96.5–98.6	584	97.9	95.5–99.0	509	88.9	84.7–92.1
Most recent HIV test result									
HIV positive	198	30.5	25.6–36.0	370	67.4	62.3–72.1	226	39.1	34.0–44.4
HIV negative	574	69.5	64.1–74.3	214	32.6	27.9–37.8	314	60.9	55.6–66.0
Among self-reported HIV negative									
Frequency of testing									
At least once every 6 weeks	15	1.4	0.7–2.7	1	0.2	0.02–1.1	12	3.5	1.8–6.9
At least once every 3 months	143	23.7	19.1–29.0	67	33.3	25.3–42.4	75	25.3	19.5–32.3
At least once every 6 months	160	26.3	21.9–31.3	38	19.3	12.8–27.9	39	12.5	8.7–17.7
At least once per year	142	23.5	19.0–28.8	41	13.5	9.0–19.7	57	19.2	14.5–25.1
Less than once per year	114	25.0	19.9–31.0	67	33.8	25.9–42.7	131	39.4	33.0–46.2
Ever heard of self-screening									
Yes	160	24.2	19.7–29.5	107	41.2	32.9–50.1	178	50.9	44.0–57.7
No	414	75.8	70.5–80.3	107	58.8	49.9–67.1	136	49.1	42.3–56.0
Ever conducted HIV self-screening									
No	134	85.3	77.2–90.8	94	85.2	72.2–92.7	120	68.5	58.7–76.9
Yes	26	14.7	9.2–22.8	13	14.8	7.3–27.8	58	31.5	23.2–41.3
Willingness to conduct HIV self-screening									
Likely	108	83.3	73.6–89.9	60	63.2	48.9–75.4	97	77.8	67.2–85.7
Neutral	7	3.9	1.7–8.8	0	-	-	8	7.4	3.3–15.7
Unlikely	19	12.8	7.0–22.3	34	36.8	24.6–51.1	15	14.8	8.4–24.7

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

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 (60.5%), eThekwini (58.0%), and Johannesburg (82.7%) (Table 3-5).

Table 3-5: Alcohol use (AUDIT-C score) among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
AUDIT-C score									
Hazardous drinking	439	60.5	55.5–65.3	329	58.0	52.7–63.2	453	82.7	78.0–86.5
No drinking hazard	342	39.5	34.7–44.5	271	42.0	36.8–47.3	93	17.3	13.5–22.0

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

3.6 Non-medical drug use

Most participants in Cape Town (61.8%) and eThekwini (52.2%) used at least one recreational drug in the preceding 12 months of the survey (Table 3-6). In Johannesburg, less than one-third (27.8%) of participants reported use of at least one recreational drug in the preceding 12 months of the survey. The types of drugs used by participants varied across the three cities. The drug most commonly consumed by participants in Cape Town was methamphetamine (tik) (60.2%) followed by cannabis (23.4%). In eThekwini, cocaine (54.2%) and cannabis (46.3%) were the most commonly used. Cannabis (48.2%) and cocaine (25.8%) were the most commonly used drugs by participants in Johannesburg. About 2 in 10 of the participants in Cape Town reported use of methaqualone (mandrax) and heroin, which was considerably higher compared to participants in eThekwini and Johannesburg. Nyaope was more commonly reported in eThekwini compared to the other two cities.

Table 3-6: Non-medical drug use among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever consumed drugs without having a medical reason in the past 12 months									
Yes	503	61.8	56.7–66.7	319	52.2	46.8–57.6	151	27.8	23.2–32.9
No	278	38.2	33.3–43.3	281	47.8	42.4–53.2	395	72.2	67.1–76.8
Types of drugs among users*									
Cannabis	107	23.4	17.9–30.0	141	46.3	39.2–53.6	75	48.2	38.0–58.6
Methaqualone (mandrax)	97	19.5	14.5–25.7	-	-	-	2	1.5	0.3–6.8
Heroin, “Brown Sugar"	117	19.7	15.1–25.3	23	8.1	4.9–13.1	13	8.6	4.6–15.8
Cocaine or Crack	14	2.4	1.3–4.6	173	54.2	46.9–61.4	39	25.8	18.0–35.5
Ecstasy	3	0.6	0.2–2.3	29	7.4	4.5–12.0	2	0.6	0.1–2.9
Prescription Medications	6	1.0	0.4–2.6	3	1.5	0.4–5.2	-	-	-
Methamphetamine (tik)	290	60.2	53.7–66.2	2	0.1	<0.1–0.5	8	2.7	1.0–6.8
Nyaope	36	7.3	4.7–11.2	72	22.0	16.6–28.7	18	11.7	6.7–19.7
Ever injected drugs									
Never	743	95.9	93.9–97.3	579	96.9	94.5–98.3	543	99.8	99.4–100.0
Yes, but not in past 12 months	9	1.0	0.5–1.9	3	0.5	0.1–2.6	-	-	-
Yes, in past 12 months	29	3.1	1.9–5.1	18	2.6	1.4–4.8	3	0.2	0.1–0.6

* more than one answer could be chosen for these questions

CI – confidence interval; n – number with characteristic described

3.7 Access to and utilisation of HIV prevention programmes

3.7.1 Condoms and lubricants

Most participants in all three cities reported easy access to male condoms, with most obtaining the condoms from government facilities (Table 3-7). In eThekwini, a large proportion of participants (51.3%) accessed male condoms through NGO mobile clinics and peer educators. In Johannesburg, about one-third of participants obtained male condoms through shebeens and bars.

At the time of the survey, most participants knew about female condoms: Cape Town (89.0%), eThekwini (97.8%), and Johannesburg (97.1%). However, only a small proportion of these had ever used female condoms: Cape Town (25.3%), eThekwini (21.8%), and Johannesburg (29.2%). Most participants in Cape Town and Johannesburg who ever used female condoms reported using female condoms sometimes. However, most participants in eThekwini who ever used female condoms did so rarely. Government facilities and NGO mobile clinics were common sources for obtaining female condoms, but this varied by city.

The use of lubricants was reported by most participants in all three cities, ranging from 53.9% in Johannesburg to 66.3% in eThekwini. Water-based lubricants were the most commonly reported type of lubricants used by participants in all three cities. Further, about 2 in 10 participants in Johannesburg, use petroleum jelly for lubrication during sexual intercourse.

Table 3-7: Access to and utilisation of condoms and lubricants among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ease of obtaining male condoms									
Very easy	585	67.3	62.1–72.1	502	92.2	89.5–94.2	537	98.5	96.9–99.3
Somewhat easy	141	25.4	20.9–30.5	94	6.9	5.1–9.4	4	0.5	0.2–1.6
Not easy	55	7.3	5.2–10.1	4	0.9	0.3–2.7	5	1.0	0.4–2.4
Usual source for male condoms*									
Government facility	451	60.6	55.7–65.4	335	63.0	57.6–68.0	422	72.5	67.4–77.0
NGO mobile clinic/peer educators	150	14.6	11.6–18.2	311	51.3	45.9–56.6	40	7.4	5.1–10.7
Sex partner	35	3.1	2.1–4.7	42	5.6	3.7–8.2	3	0.4	0.1–1.4
Shebeen or bar	66	8.9	6.4–12.1	67	13.0	9.5–17.6	189	30.1	25.5–35.1
Ever heard of female condoms									
Yes	727	89.0	84.0–92.5	592	97.8	95.5–99.0	535	97.1	94.3–98.5
No	54	11.0	7.5–16.0	8	2.2	1.0–4.5	11	2.9	1.5–5.7
Ever heard of female condoms and ever used female condoms									
Yes	195	25.3	20.9–30.2	147	21.8	17.8–26.5	215	29.2	24.8–34.2
No	532	74.7	69.8–79.1	445	78.2	73.5–82.2	320	70.8	65.9–75.2
Frequency of female condom use									
All the time	6	7.1	1.9–23.8	5	3.2	1.3–8.1	12	6.1	3.0–11.9
Sometimes	112	59.2	48.2–69.4	53	23.2	15.5–33.0	120	56.0	46.6–65.1
Rarely	77	33.6	25.0–43.5	89	73.6	63.6–81.7	83	37.9	29.1–47.5
Usual source for female condoms*									
Government facility	105	61.4	51.0–70.9	80	58.6	47.3–69.0	174	70.4	60.7–78.6
NGO mobile clinic/peer educators	41	14.0	9.5–20.2	69	48.2	37.3–59.4	6	2.1	0.8–5.5
Sex partner	1	0.3	<0.1–2.0	1	0.2	0.03–1.4	-	-	-
Shebeen or bar	10	4.4	2.0–9.4	4	1.1	0.3–3.5	15	8.3	4.4–15.3
Ever used lubricant									
Yes	493	57.8	52.5–63.0	446	66.3	60.8–71.4	312	53.9	48.6–59.2
No	288	42.2	37.0–47.5	154	33.7	28.6–39.2	234	46.1	40.8–51.4
Type of lubricant used among lubricant users*									
J-Lube	78	11.5	8.9–14.8	8	2.0	0.8–5.0	5	1.0	0.3–2.7

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Petroleum jelly	17	3.7	2.1–6.3	23	2.5	1.3–4.7	46	20.2	14.8–27.0
Baby oil	7	1.3	0.6–3.0	11	2.0	0.8–5.0	11	3.2	1.5–7.0
Lotion	5	0.7	0.2–1.8	1	0.2	0.03–1.6	2	1.0	0.2–4.7
Water-based	246	46.5	40.2–52.8	331	63.5	57.0–69.5	117	24.9	19.8–30.9

* more than one answer could be chosen for these questions

NGO: Non-governmental organisation; CI – confidence interval; n – number with characteristic described.

3.7.2 HIV pre-exposure prophylaxis

A larger proportion of self-reported HIV-negative participants in Johannesburg (51.2%) had ever heard about HIV PrEP than in Cape Town (31.3%) and eThekwini (32.6%; Table 3-8). Among the self-reported HIV-negative participants aware of PrEP, a small proportion had ever used PrEP, ranging from 7.7% in Cape Town to 30.7% in eThekwini.

Table 3-8: Awareness and utilisation of HIV pre-exposure prophylaxis (PrEP) among HIV-negative female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	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	202	31.3	26.5–36.6	92	32.6	24.9–41.3	165	51.2	44.4–58.0
No	372	68.7	63.4–73.5	122	67.4	58.6–75.1	149	48.8	42.0–55.6
Among those who responded they had heard of PrEP: Have you ever started using PrEP; a pill every day to prevent HIV infection?									
Yes	14	7.7	4.2–13.9	27	30.7	18.7–46.0	32	24.5	16.1–35.6
No	188	92.3	86.1–95.8	65	69.3	54.0–81.3	133	75.5	64.5–83.9

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

3.8 Sexual behaviours and practices

The proportion of participants who had ever practiced anal sex varied by location, ranging from 19.5% in eThekwini to 34.7% in Cape Town (Table 3-9). Practices of tightening the vagina were common among participants across all three cities, with 21.8%–32.7% reporting the practice all the time and 10.5%–26.6% reporting the practice some of the times they performed sex work in the month preceding the survey. Using ice was a common method to tighten the vagina across all three cities. In Cape Town, 66.7% of participants also reported the use of soap as a method for tightening the vagina, and 12.1%–16.7% of participants in Johannesburg and eThekwini reported the use of herbs or snuff for vagina tightening.

Most participants in all three cities reported that they never hid their menstrual bleeding from their clients in the 30 days preceding survey participation: Cape Town (86.3%), eThekwini (63.8%), and Johannesburg (64.5%). In Johannesburg 13.3% of participants hid menstrual bleeding all the time, the highest across all three cities. The use of cotton wool, sponges, and tampons was commonly reported but varied across sites. With regards to sponges, participants reported using kitchen, mattress, and female condom sponges.

Most participants in all three cities reported using a condom the last time they had sex (anal or vaginal) with each of their last three paying sex clients. The proportion of participants reporting this ranged from 68.9% in Johannesburg to 81.7% in eThekwini. In the 6 months preceding the survey, 20.2%–36.0% of participants

had at least one sexual encounter where they used condoms after sexual intercourse had started, and 25.1%–47.4% reported removing condoms before sexual intercourse was finished.

Table 3-9: Sexual behaviours among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever had anal sex									
Yes	281	34.7	30.0–39.7	123	19.5	15.6–24.0	179	28.1	24.0–33.0
No	500	65.3	60.3–70.0	477	80.5	76.0–84.4	367	72.0	67.1–76.2
Frequency of drying or tightening vagina before having sex in the past 30 days									
Never	435	56.8	51.6–61.9	228	44.0	38.5–49.6	280	60.4	55.2–65.3
All the time	274	32.7	27.9–37.8	139	29.4	24.6–34.8	139	21.8	17.9–26.1
Sometimes	72	10.5	7.6–14.3	188	26.6	22.2–31.5	127	17.9	14.5–21.9
Methods used to dry or tighten your vagina before having sex*									
Soap	237	66.7	59.1–73.6	16	2.7	1.5–4.8	31	12.7	8.2–19.2
Herb/snuff	5	1.7	0.6–4.2	56	16.7	12.1–22.6	33	12.1	7.8–18.2
Ice/water	266	73.7	65.8–80.3	242	71.3	64.3–77.6	149	54.3	46.7–61.8
Frequency of hiding bleeding/menstruation in the past 30 days									
Never	649	86.3	83.2–89.0	327	63.8	58.4–68.9	343	64.5	59.1–69.5
All the time	39	3.7	2.4–5.5	61	8.6	6.2–11.7	72	13.3	10.1–17.3
Sometimes	93	10.0	7.7–12.8	94	27.6	22.9–32.8	71	22.2	17.9–27.2
Method used to hide bleeding*									
Tampon	31	26.6	17.8–37.8	31	8.6	5.1–14.2	6	4.7	1.9–11.0
Kitchen sponge	37	26.4	18.0–37.1	142	65.6	56.9–73.4	78	33.9	26.0–42.7
Cotton wool	7	4.4	1.8–10.0	33	16.1	10.5–23.9	33	18.5	10.9–29.6
Other	43	29.2	20.5–39.7	33	13.5	8.9–20.0	75	39.0	30.3–48.5
Used condoms with last three paying clients									
No	175	23.7	19.6–28.4	108	18.3	14.5–22.7	181	31.1	26.5–36.2
Yes	606	76.3	70.6–80.4	492	81.7	77.2–85.5	365	68.9	63.9–73.5
Incorrect condom use: Reported use of condoms after starting intercourse in the past 6 months									
Yes	140	20.2	16.2–25.0	119	21.5	17.3–26.3	169	36.0	31.0–41.4
No	641	79.8	75.0–83.8	481	78.5	73.7–82.7	377	63.9	58.6–69.0
Incorrect condom use: Removal of condoms before finishing intercourse in the past 6 months									
Yes	182	25.1	20.8–29.9	154	31.2	26.3–36.5	269	47.4	42.2–52.8
No	596	73.9	69.0–78.3	446	68.8	63.5–73.7	277	52.5	47.2–57.8
Condom breakage during intercourse in the last 6 months									
Yes	387	46.5	41.4–51.6	442	69.6	64.3–74.4	268	54.8	49.5–54.8
No	394	53.5	48.4–58.6	158	30.4	25.6–35.7	278	45.2	40.0–50.5

* more than one answer could be chosen for these questions

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

3.9 Stigma and discrimination

A very small proportion of participants reported being denied healthcare in the past 12 months because someone believed them to be a sex worker: Cape Town (0.9%), eThekwini (2.3%), and Johannesburg (0.8%; Table 3-10). More than half of participants in all three cities reported verbal insults directed at them because the person believed they were a sex worker. Further, 22.0%–28.0% of participants reported being hit, kicked, or beaten because someone thought they were a sex worker. A considerable proportion of

participants in Cape Town and eThekwini reported that police refused to assist them and confiscated condoms and lubricants. Also, about one-third of participants in Cape Town were refused restaurant/bar service because someone believed they were sex workers.

Table 3-10: Stigma and discrimination among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Refused healthcare	8	0.9	0.4–2.3	12	2.3	1.1–4.7	8	0.8	0.3–1.8
Refused employment	34	2.7	1.8–4.1	31	3.6	2.2–5.8	5	0.6	0.2–1.7
Refused church/religious service	12	1.2	0.6–2.2	11	1.9	0.9–4.1	1	0.1	<0.1–0.5
Refused restaurant/bar service	35	3.0	2.1–4.4	38	4.8	3.2–7.1	14	2.8	1.2–6.6
Refused housing	25	2.2	1.4–3.5	48	8.1	5.6–11.4	12	1.6	0.8–3.1
Refused police assistance	181	19.8	16.6–23.5	249	32.7	28.1–37.7	39	4.4	2.9–6.6
Police confiscated condoms or lubricant	235	24.2	20.6–28.1	261	33.0	28.4–38.0	54	6.4	4.5–9.0
Had verbal insults directed	528	59.8	54.3–65.0	518	78.2	72.8–82.8	343	57.4	52.0–62.6
Been hit, kicked, or beaten	230	25.3	21.7–29.4	239	28.0	23.7–32.8	134	22.0	18.1–26.5
Forced to have sex through sexual assault or rape	120	11.1	8.9–13.7	212	33.6	28.8–38.9	86	14.0	10.8–17.9

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

3.10 Sexually transmitted infections

Most participants reported that they were aware of STI symptoms, with genital discharge and pain during urination mentioned by more than half of the participants in all three cities (Table 3-11). The proportion of participants who experienced symptoms of an STI in the previous 12 months (survey questions asked about symptoms of discharge or an ulcer on the vagina or anus) was smallest among participants in Cape Town (25.4%) followed by eThekwini (46.2%) and Johannesburg (51.2%). Across all three survey cities, most participants who experienced STI symptoms sought care, and almost all sought care from public sector clinics.

Table 3-11: Self-reported knowledge of symptoms for sexually transmitted infections and utilisation of medical care among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Aware of at least one STI symptom									
Yes	680	84.8	80.5–88.3	573	91.4	87.4–94.2	531	97.5	95.5–98.6
No	101	15.2	11.7–19.5	27	8.6	5.8–12.6	15	2.5	1.4–4.5
STI symptoms mentioned*									
Genital discharge	566	81.9	77.6–85.4	502	87.7	83.7–90.8	458	88.3	84.8–91.0
Pain on urination	504	69.1	63.8–73.9	343	54.0	48.3–59.5	400	73.0	67.8–77.7
Inflammation of genital area	320	42.6	37.2–48.2	219	26.6	22.5–31.2	111	30.7	25.6–36.2
Abdominal pain	194	26.1	21.5–31.4	239	37.1	32.0–42.6	271	44.4	39.1–49.7
Irritation of genital area	360	45.0	39.7–50.4	447	80.9	76.3–84.8	269	48.7	43.4–54.1
Genital ulcer	254	37.1	31.8–42.7	283	44.9	39.4–50.4	250	43.6	38.4–49.0
Blood in urine	18	1.9	1.0–3.5	72	12.1	9.0–16.1	12	1.8	0.8–4.0
Loss of weight	9	0.7	0.4–1.4	19	2.4	1.4–4.1	2	0.2	<0.1–0.9
Abnormal discharge or sore or ulcer in the past 12 months									
Yes	223	25.4	21.4–29.8	280	46.2	40.8–51.5	257	51.2	45.9–56.5

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
No	558	74.6	70.2–78.6	320	53.8	48.5–59.2	289	48.8	43.5–54.1
Sought medical care for abnormal discharge or sore or ulcer									
Yes	187	86.3	79.8–90.9	264	92.4	86.9–95.7	220	85.2	78.9–89.8
No	36	13.7	9.1–20.3	16	7.6	4.3–13.1	37	14.8	10.2–21.1
Sought care from public sector clinics									
Yes	176	96.3	92.2–98.3	252	94.5	89.2–97.3	199	90.1	84.2– 93.9
No	11	3.7	1.7–7.8	12	5.5	2.8–10.9	21	9.9	6.1–15.8

* more than one answer could be chosen for these questions

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

3.11 HIV knowledge

HIV knowledge was generally high among participants in all three cities (Table 3-12). In Johannesburg, 59.1% of participants thought that having sex with one faithful partner reduces the risk of HIV transmission, compared with 83.9% in Cape Town and 91.5% in eThekwini. About 2 in 10 participants in eThekwini and Johannesburg thought that HIV cannot be transmitted from the mother to her child through breastfeeding.

Table 3-12: HIV knowledge among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	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	677	83.9	79.9–87.2	561	91.5	87.8–94.2	333	59.1	53.7–64.2
Answered incorrectly	98	15.1	11.8–19.0	38	8.4	5.8–12.2	212	40.7	35.6–46.0
Did not know	6	1.0	0.4–2.5	1	<0.1	<0.1–0.2	1	0.2	<0.1–1.7
People can reduce their chance of getting HIV by using a condom every time they have sex									
Answered correctly	739	92.1	88.2–94.7	573	97.6	95.5–98.7	505	90.2	85.9–93.3
Answered incorrectly	41	7.9	5.2–11.7	27	2.4	1.3–4.5	41	9.8	6.7–14.1
Did not know	1	0.1	0.0–0.4	-	-	-	-	-	-
A healthy-looking person can be living with HIV									
Answered correctly	754	93.9	90.3–96.3	547	87.4	83.0–90.7	527	97.3	95.2–98.5
Answered incorrectly	27	6.1	3.7–9.7	53	12.6	9.3–17.0	19	2.8	1.6–4.8
Did not know	-	-	-	-	-	-	-	-	-
A person can get HIV from mosquito bites									
Answered correctly	596	74.2	69.5–78.4	462	70.3	64.9–75.1	430	75.8	71.0–80.1
Answered incorrectly	149	21.3	17.3–25.9	132	28.8	24.0–34.1	112	23.0	18.8–27.7
Did not know	36	4.5	3.0–6.6	6	0.9	0.3–2.6	4	1.2	0.4–3.9
A person can get HIV by sharing a meal with someone who is infected									
Answered correctly	740	93.1	88.8–95.8	567	93.2	89.8–95.5	527	96.4	93.7–98.0
Answered incorrectly	40	6.7	4.0–11.0	33	6.8	4.5–10.2	19	3.6	2.1–6.3
Did not know	1	0.2	<0.1–1.6	-	-	-	-	-	-
The virus that causes AIDS can be transmitted from a mother to her baby during pregnancy									
Answered correctly	727	89.6	84.7–93.0	475	86.2	82.3–89.3	436	82.8	78.5–86.4
Answered incorrectly	54	10.4	7.0–15.3	125	13.8	10.7–17.7	110	17.2	13.6–21.5
Did not know	-	-	-	-	-	-	-	-	-
The virus that causes AIDS can be transmitted from a mother to her baby during delivery									
Answered correctly	697	86.1	81.9–89.5	464	83.2	78.9–86.7	447	83.5	79.2–87.1

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Answered incorrectly	84	13.9	10.5–18.1	136	16.8	13.3–21.1	99	16.5	13.0–20.8
Did not know	-	-	-	-	-	-	-	-	-
The virus that causes HIV can be transmitted from a mother to her baby by breastfeeding									
Answered correctly	684	85.7	81.5–89.1	443	77.8	73.1–82.0	426	79.8	75.0–83.8
Answered incorrectly	97	14.3	10.9–18.5	157	22.2	18.0–26.9	120	20.2	16.2–25.0
Did not know	-	-	-	-	-	-	-	-	-

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

3.12 TB history and knowledge of TB symptoms

The proportion of participants who had ever been diagnosed with TB varied by city: 19.4% in Cape Town, 25.6% in eThekwini, and 14.3% in Johannesburg (Table 3-13). The knowledge of all four key TB symptoms (cough, weight loss, fever, and night sweats) was low among participants in all three cities, ranging from 6.5% in Cape Town to 15.9% in Johannesburg.

Table 3-13: TB history and knowledge of TB symptoms among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town N=781			eThekwini N=600			Johannesburg N=546		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Ever diagnosed with TB									
Yes	147	19.4	15.6–23.7	141	25.6	20.9–30.9	72	14.3	10.9–18.5
No	634	80.6	76.3–84.4	459	74.4	69.1–79.1	474	85.7	81.5–89.1
TB symptoms mentioned by clients									
Cough	709	88.0	84.0–91.1	565	92.3	88.1–95.2	534	97.7	95.6–98.8
Weight loss	411	48.9	43.8–54.1	338	49.3	44.0–54.7	352	59.7	54.3–64.9
Fever	106	12.2	9.2–15.9	240	38.6	33.5–44.0	158	36.3	31.3–41.7
Night sweats	648	79.6	74.9–83.6	549	87.6	82.9–91.2	411	71.5	66.3–76.2
Mentioned all four symptoms	63	6.5	4.6–9.0	103	12.2	9.4–15.5	83	15.9	12.5–20.0
Can TB be transmitted to another person through the air when a person with TB coughs or sneezes?									
Yes	764	96.4	92.9–98.2	599	99.9	99.1–100.0	537	97.9	95.6–99.0
No	9	2.1	0.7–6.0	1	0.1	0.02–0.9	9	2.1	1.0–4.4
Don't know	8	1.5	0.7–3.2	-	-	-	-	-	-
Can TB disease be cured by taking medication?									
Yes	763	97.3	95.3–98.4	597	99.5	98.0–99.9	536	96.8	92.6–98.7
No	9	0.8	0.4–1.8	2	0.3	0.1–2.2	10	3.2	1.3–7.4
Don't know	9	1.9	0.9–3.8	1	0.1	0.02–0.9	-	-	-
Is there any difference in the chance/likelihood of getting TB for people living with HIV and those not living with HIV?									
Yes	587	69.1	64.1–73.6	179	40.2	35.0–45.7	377	73.6	68.9–77.8
No	151	23.8	19.6–28.6	412	57.7	52.2–63.0	166	26.0	21.7–30.6
Don't know	43	7.1	5.1–9.9	9	2.1	1.0–4.6	3	0.5	0.1–1.6

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

3.13 HIV Prevalence

We found the highest HIV prevalence among participants in eThekwini (77.7%), followed by Johannesburg (58.3%) and Cape Town (42.5%; Table 3-7). There was variability in HIV prevalence across the three cities with regards to demographic characteristics, sex work history, alcohol and non-medical drug use, sexual behaviours and beliefs about HIV transmission (Table 3-14).

Table 3-14: HIV prevalence among female sex workers and sexually exploited minors, South Africa Health Monitoring Study 2018

Measure	Cape Town n=777			eThekwini n=551			Johannesburg n=537		
	HIV-positive participants	%	95% CI	HIV-positive participants	%	95% CI	HIV-positive participants	%	95% CI
Total	290/777	42.5	37.4–47.8	415/551	77.7	72.9–81.9	331/537	58.3	52.9–63.5
Demographic characteristics									
Age, years									
16–24	24	25.3	14.4–40.4	60	65.4	52.7–76.3	28	34.9	23.7–48.2
25–29	75	43.3	34.4–52.6	138	75.1	65.8–82.5	69	53.3	41.0–65.3
30–34	86	48.0	38.1–58.1	88	85.5	75.2–92.0	82	61.1	50.3–70.9
≥35	105	47.7	39.1–56.5	129	84.0	75.8–89.7	152	69.5	61.1–76.8
Race									
Black/African	154	67.7	59.9–74.6	397	80.9	76.0–85.0	323	58.3	52.8–63.6
Coloured	132	33.7	27.3–40.7	13	39.3	20.9–61.2	7	59.2	26.5–85.4
Indian	0	-	-	3	47.2	16.1–80.6	1	-	-
White	4	6.6	2.2–18.3	2	38.0	6.9–83.4	-	-	-
Marital status									
Not in a union	259	41.4	36.1–47.0	392	79.3	74.4–83.5	309	57.4	51.8–62.8
Married	6	50.5	20.4–80.2	4	54.8	17.1–87.7	5	89.7	48.2–98.8
Living with someone as married	25	52.2	35.3–68.7	19	58.5	36.1–77.9	17	71.3	49.4–86.4
Highest Education Completed									
Primary school and below	260	43.7	38.2–49.4	345	79.3	73.9–83.8	204	61.9	55.3–68.1
Secondary School and above	30	33.0	21.1–47.5	70	70.7	58.8–80.3	127	50.6	41.4–59.7
Sex work history									
Age at first sexual debut, years									
<15	47	41.6	29.6–54.8	65	74.9	60.2–85.6	50	70.2	56.2–81.2
15–17	141	41.1	34.5–48.1	227	78.8	72.0–84.2	175	59.1	51.9–66.0
≥18	102	44.8	35.4–54.7	123	77.2	68.6–84.0	106	52.7	43.0–62.2
Sex work as main source of income									
Yes	265	41.4	36.1–47.0	392	77.3	72.4–81.7	281	57.4	51.7–63.0
No	25	61.2	44.3–75.4	23	90.1	70.9–97.2	50	66.9	51.0–79.7
Duration of sex work, years									
<1	15	39.1	22.2–59.0	32	78.5	57.8–90.7	12	44.4	25.2–65.4
1–3	64	39.1	29.2–50.1	90	72.9	62.8–81.1	89	55.1	44.5–65.2
4–5	52	39.1	29.1–50.2	72	74.7	62.2–84.1	70	50.3	39.2–61.4
6–10	82	45.4	35.5–55.7	141	83.4	75.4–89.2	86	66.1	55.6–75.3
≥11	77	50.5	41.0–60.0	80	78.3	64.7–87.7	74	70.1	57.9–80.1
Ever worked as a sex worker in another province									
Yes	31	43.1	29.3–58.1	68	75.1	62.0–84.8	63	60.5	44.5–74.5
No	259	42.5	37.1–48.1	347	78.2	72.9–82.7	268	57.9	52.2–63.4
Alcohol and non-medical drug use									
AUDIT-C score									
Hazardous drinking	181	49.0	42.1–56.0	236	76.9	70.2–82.5	273	60.1	54.3–65.6
No drinking hazard	109	32.6	26.0–40.0	179	78.9	71.8–84.6	58	49.5	35.8–63.4
Ever consumed drugs without having a medical reason in the past 12 months									

Measure	Cape Town n=777			eThekwini n=551			Johannesburg n=537		
	HIV-positive participants	%	95% CI	HIV-positive participants	%	95% CI	HIV-positive participants	%	95% CI
Yes	154	35.8	29.4–42.6	202	70.9	63.6–77.2	91	65.0	55.3–73.7
No	136	53.7	45.1–62.0	213	85.2	78.8–89.9	240	55.7	49.3–61.9
Sexual behaviours									
Ever had anal sex									
Yes	93	44.2	35.5–53.3	75	68.1	55.3–78.6	105	54.4	45.1–63.4
No	197	41.6	35.4–48.1	340	79.9	74.7–84.3	226	59.8	53.2–66.1
Dried or tightened vagina before having sex in the past 30 days									
Never	163	41.8	35.3–48.6	198	84.6	77.6–89.7	167	57.8	50.3–65.0
All the time	99	44.3	35.0–54.0	92	71.6	61.3–80.2	88	60.9	50.4–70.4
Sometimes	28	40.9	26.0–57.7	129	73.6	63.4–81.7	76	57.0	45.6–67.7
Hid vaginal bleeding/menstruation in the past 30 days									
Never	238	42.9	37.2–48.8	229	81.7	75.8–86.4	192	55.8	49.2–62.1
All the time	15	42.3	24.1–63.0	42	68.9	50.9–82.5	49	58.5	43.6–72.0
Sometimes	12	42.0	23.0–63.8	67	67.5	52.0–80.0	43	57.6	42.8–71.2
Ever had abnormal discharge or sore or ulcer in the past 12 months									
Yes	109	42.5	42.0–60.1	204	78.2	70.8–84.1	149	58.5	51.0–65.8
No	181	39.6	33.5–46.0	211	77.3	70.6–82.8	182	58.1	50.4–65.5
Used condoms with last three paying clients									
Yes	219	41.0	35.3–47.1	343	78.1	72.6–82.7	223	58.0	51.4–64.4
No	71	47.2	36.7–58.1	72	75.9	64.6–84.5	108	58.9	49.6–67.6
Beliefs about HIV transmission									
Believes that having sex with only one faithful uninfected person reduces the risk of HIV transmission									
Yes	244	40.2	34.6–46.0	387	76.8	71.7–81.2	197	54.7	47.6–61.6
No	44	55.8	43.3–67.7	27	88.6	69.1–96.4	133	63.3	55.1–70.8
Does not know	2	38.7	-	-	-	-	1	100.0	-
Believes that people can reduce their chance of getting HIV by using a condom every time they have sex									
Yes	273	42.0	36.7–47.5	399	77.6	72.6–81.8	305	57.5	51.8–62.9
No	17	48.9	28.7–69.5	16	83.5	65.0–93.3	26	66.6	46.4–82.2
Does not know	-	-	-	-	-	-	-	-	-

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

3.14 Achievement of the 90–90–90 targets among participants living with HIV

The proportion of participants living with HIV who were aware of their HIV status ranged from 73.4% to 87.8%. Among participants aware of their HIV status, 41.4%–74.9% were receiving ART. Viral load suppression among participants aware of their HIV status and receiving ART ranged from 72.6% to 87.4% (Table 3-15, Figure 3-2).

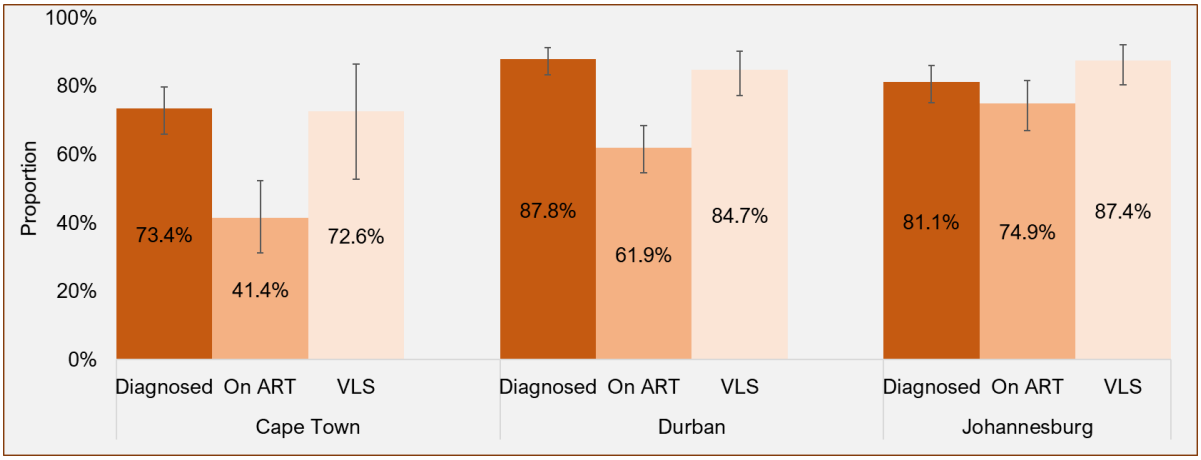
Table 3-15: 90–90–90 cascade[a] for female sex workers and sexually exploited minors living with HIV, South Africa Health Monitoring Study 2018

	N[b]	N[b]	Point estimate adjusted for respondent-driven sampling % (95% CI[c])
Cape Town			
Aware of HIV status[d]	208	290	73.4 (65.9–79.7)
Aware of HIV status and on ART[e]	80	196	41.4 (31.2–52.4)

	N[b]	N[b]	Point estimate adjusted for respondent-driven sampling % (95% CI[c])
On ART and virally suppressed[f]	62	80	72.6 (52.7–86.3)
eThekwini			
Aware of HIV status	359	415	87.8 (83.2–91.2)
Aware of HIV status and on ART	199	330	61.9 (54.7–68.6)
On ART and virally suppressed	162	197	84.7 (77.2–90.1)
Johannesburg			
Aware of HIV status	271	331	81.1 (75.2–85.9)
Aware of HIV status and on ART	206	266	74.9 (67.0–81.5)
On ART and virally suppressed	180	206	87.4 (80.4–92.1)

a) 90-90-90 cascade has three targets aimed at ensuring that 90% of all PLHIV know their HIV status; of these, 90% receive ART; and of these, 90% have viral suppression
b) Depending on the outcome reported; N = total number included in the denominator; n = number with measured outcome
c) 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.
d) Awareness of HIV status was defined as self-reporting HIV-positive status and/or detection of antiretroviral drugs in the participant's blood specimen.
e) Being on antiretroviral therapy (ART) was based on the detection of antiretroviral drugs in the participant's blood specimen.
f) Viral load suppression is defined as HIV RNA <1,000 copies/mL of plasma among people living with HIV.

Figure 3-1: 90-90-90 cascade for female sex workers and sexually exploited minors living with HIV, South Africa Health Monitoring Study 2018. 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

4.1 Population size estimation

The event multiplier method produced very low PSE results in all cities (particularly in Cape Town and eThekwini). Therefore, the PSE was calculated once including the event multiplier and once without it. Both results are presented and as they are slightly different—it was decided to report the Anchored Multiplier-VA (event multiplier not included) as the final PSE (Table 4-1). Population denominators are from the 2018 mid-year population estimates of South Africa [46].

In Cape Town, there are an estimated 6,680 (95% CI: 4,560–9,200) FSW and sexually exploited minors, which corresponds to 0.5% (95% CI: 0.3%–0.7%) of the adult female population aged 15–64 years (Table 4-14-1).

In eThekwini, there are an estimated 9,300 (95% CI: 8,620–10,000) FSW and sexually exploited minors, which corresponds to 0.7% (95% CI: 0.7%–0.8%) of the adult female population aged 15–64 years (Table 4-2).

In Johannesburg, there are an estimated 7,980 (95% CI: 5,530–11,010) FSW and sexually exploited minors, which corresponds to 0.5% (95% CI: 0.3–0.7) of the adult female population aged 15–64 years (Table 4-3).

Table 4-1: Population size estimates of FSW and sexually exploited minors in Cape Town, South Africa Health Monitoring Study 2018

	Population sizes Point, 95% CI			% of adult female population 15–64 years (Population=1,362,893)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAHMS1)	6,500	4,579	9,000	0.5	0.3	0.7
1. Unique object multiplier	2,938	2,707	3,226	0.2	0.2	0.2
2. Service multiplier	8,221	7,039	9,902	0.6	0.5	0.7
3. Event attendance multiplier*	665	639	691	0.1	<0.1	0.1
4. SS-PSE**	1,593	1,198	2,076	0.1	<0.1	0.2
Anchored Multiplier-VA	5,896	4,317	7,654	0.4	0.3	0.6
Anchored Multiplier-VA (Event multiplier not included)* **	**6,680**	**4,560**	**9,200**	**0.5**	**0.3**	**0.7**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
** There was a convergence problem in the Markov chain Monte Carlo (MCMC), and so the PSE from this method are not reliable and so not included in the final PSE calculation.
*** Estimates were rounded off to the nearest 10.
CI: Confidence Interval, FSW: Female Sex Workers, SAHMS: South Africa Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation; VA: variance adjusted.

Table 4-2: Population size estimates of FSW and sexually exploited minors in eThekwini/in Durban, South Africa Health Monitoring Study 2018

	Population sizes Point, 95% CI			% of adult female population 15–64 years (Population=1,259,857)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAHMS1)	9,323	4,000	10,000	0.7	0.3	0.8
1. Unique object multiplier	2,809	2,502	3,213	0.2	0.2	0.3
2. Service multiplier	8,967	7,908	10,305	0.7	0.6	0.8
3. Event attendance multiplier*	818	763	890	0.1	0.1	0.1
4. SS-PSE	9,488	8,156	9,991	0.8	0.6	0.8
Anchored Multiplier-VA	9,313	8,618	10,019	0.7	0.7	0.8
Anchored Multiplier-VA (Event multiplier not included) **	**9,300**	**8,620**	**10,000**	**0.7**	**0.7**	**0.8**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
** Estimates were rounded off to the nearest 10.
CI: Confidence Interval, FSW: Female Sex Workers, SAHMS: South Africa Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation; VA: variance adjusted.

Table 4-3: Population size estimates of FSW and sexually exploited minors in Johannesburg, South Africa Health Monitoring Study 2018

	Population sizes Point, 95% CI			% of adult female population 15–64 years (Population=1,684,246)		
	Point	Lower bound	Upper bound	Point	Lower bound	Upper bound
Prior (based on SAHMS1)	7,697	5,000	10,895	0.5	0.3	0.7
5. Unique object multiplier	6,424	5,368	8,040	0.4	0.3	0.5
6. Service multiplier	3,643	3,283	4,094	0.2	0.2	0.2
7. Event attendance multiplier*	1,378	1,240	1,556	0.1	0.1	0.1
8. SS-PSE (Imputed visibility)	10,594	9,776	10,895	0.6	0.6	0.7
Anchored Multiplier-VA	7,745	5,139	10,770	0.5	0.3	0.6

	Population sizes Point, 95% CI			% of adult female population 15–64 years (Population=1,684,246)		
Anchored Multiplier-VA (Event multiplier not included)**	**7,980**	**5,530**	**11,010**	**0.5**	**0.3**	**0.7**

* The "event attendance multiplier" method produced very low estimates, and so not included in the final PSE calculation.
** Estimates were rounded off to the nearest 10.
CI: Confidence Interval, FSW: Female Sex Workers, SAHMS: South Africa Health Monitoring Study, SS-PSE: Successive Sampling method to estimate the Population Size Estimation; VA: variance adjusted.

5 Discussion

5.1 HIV Prevalence

SAHMS2 findings show that FSW and sexually exploited minors in the three metropolitan cities continue to bear a disproportionately high burden of HIV compared to the general population. More than half of participants in eThekwini and Johannesburg were living with HIV. In Cape Town, just over 4 in every 10 participants were living with HIV. In contrast, the estimated HIV prevalence among the South African adult female population aged 15–64 years (in 2017) ranged from 5.8% to 39.4% [6].

There were notable changes in HIV prevalence between SAHMS1 and SAHMS2 (referred to as the two survey rounds). The estimated HIV prevalence among FSW and sexually exploited minors in Cape Town and eThekwini was higher in SAHMS2 than in SAHMS1. In Cape Town, the estimated HIV prevalence (42.5% [95% CI: 37.4%–47.8%]) was similar to the previous round (39.7% [95% CI: 30.1%–49.8%]). In eThekwini, the estimated HIV prevalence among FSW and sexually exploited minors increased from 53.5% (95% CI: 37.5%–65.6%) to 77.7% (95% CI: 72.9%–81.9%) between the two survey rounds. In Johannesburg, the estimated HIV prevalence was lower in SAHMS2 (58.3% [95% CI: 52.9%–63.5%]) compared with SAHMS1 (71.8% [95% CI: 56.5%–81.2%]). 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 [47]. 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.

5.2 HIV testing

South Africa has made significant strides in expanding access to HIV testing for FSW through the support of donor-operated NGOs. At the time of the survey, PEPFAR programme partners were delivering HTS through mobile testing units that reached out to hot spots, drop-in centres staffed by nurses and counsellors, and government clinics. Encouragingly, there was high awareness among participants about HTS locations. Findings from SAHMS2 show that access to HIV testing has increased, suggesting that the combination of government health facilities, mobile HTS approaches, and fixed HTS sites run by NGOs may have served an important role for FSW in the HIV care continuum.

Findings from SAHMS2 revealed low testing frequency among participants who self-report being HIV negative. The South Africa HIV testing guidelines recommend HIV testing every 3 months for high-risk groups such as FSW [38]. HIV testing every 3 months as recommended by the guidelines is essential for the early detection of HIV infection, which allows for opportunities to optimise the individual benefits of ART and the reduction of risk in transmitting HIV to HIV-negative clients and intimate partners. However, among

participants who self-reported being HIV negative at the time of study enrolment, only 23.7%–33.3% reported that they tested for HIV every 3 months.

HIV self-screening is a testing modality that shifts the locus of care from the provider to the client – building on a patient-centred care model. HIV self-screening reduces the burden on human resources and physical infrastructure needed with traditional counsellor or healthcare provider-driven testing interventions. In 2017, the World Health Organisation provided recommendations for HIV self-screening to be offered as an additional approach to complement existing HTS [48]. At the time of the survey, there was generally low awareness of HIV self-testing among participants as a modality for knowing one's HIV status. However, a large proportion of participants indicated that they would likely use an HIV self-test if it was available.

5.3 Achievement of the 90–90–90 targets among female sex workers and sexually exploited minors living with HIV

There are notable changes between the two survey rounds in the proportion of FSW and sexually exploited minors living with HIV who were aware of their status. In Cape Town, the proportion of HIV-positive participants aware of their HIV status increased from 22.9% in SAHMS1 to 73.4% (95% CI: 65.9%, 79.7%) in SAHMS2. In eThekwini, the proportion of HIV-positive participants aware of their HIV status increased from 39.0% in SAHMS1 to 87.8% (95% CI: 83.2%, 91.2%) in SAHMS2. In Johannesburg, the proportion of HIV-positive participants aware of their HIV status increased from 50.2% in SAHMS1 to 81.1% (95% CI: 75.2%, 85.9%) in SAHMS2. The proportion of participants aware of their HIV status was higher than the average HIV testing and status awareness among sex workers from 53 other countries that contributed to the UNAIDS 2020 estimates [49]. In these 53 countries, about 62.7% of sex workers living with HIV were aware of their HIV status during 2016–2017 [49].

The high attrition from HIV diagnosis to ART initiation is a major concern. Less than 75% of participants aware of their HIV-positive status were receiving ART across all three survey cities. Further, as few as 4 in 10 participants aware of their HIV status were receiving ART in Cape Town, despite the availability of ART for all people living with HIV in South Africa at the time of the survey. We did not compare ART uptake between the two survey rounds because there was a shift from ART initiation based on clinical staging (in SAHMS1) to *Test and Treat* approaches during SAHMS2 implementation. In addition, ART uptake in SAHMS1 was self-reported, which makes comparing results difficult.

The goal of the third target in the South Africa NSP is to ensure that 90% of all PLHIV receiving ART have virologic suppression, an indication of treatment success. In all three survey cities, less than 90% of participants living with HIV receiving ART had virologic suppression. Notably, only 72.6% (95% CLI: 52.7%, 86.3%) of participants who were receiving ART in Cape Town were virally suppressed, which is below the 90% target. Encouragingly, once participants in eThekwini and Johannesburg initiated ART, they had favourable treatment outcomes. Anecdotal reports from routine FSW programmes implemented by Wits Reproductive Health Institute and TB HIV Care at the time of the survey suggest several barriers to adherence and retention of FSW on ART. These barriers include limited access to ongoing healthcare support/interventions among FSW operating in highly controlled or violent environments (i.e., pimps or gangsterism) and challenges in obtaining accurate or updated contact details to facilitate follow-up support for FSW receiving ART. In a study conducted among FSW in eThekwini, fears of job losses to due to voluntary or involuntary disclosure to clients and brothel managers, theft of ART supplies on the job, substance use, and work-related migration were identified as key occupational barriers to ART initiation and retention [50].

Notably, SAHMS1 procedures did not include testing for antiretroviral drugs and viral load testing. Therefore, comparisons cannot be made in this regard.

5.4 HIV prevention interventions

HIV PrEP could decrease the number of 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. Findings from SAHMS2 show that 2 years after the initial roll out of HIV PrEP in South Africa, participants in all three survey cities had low awareness of HIV PrEP. Among participants who had heard about PrEP, fewer than 4 in 10 had ever used PrEP. Findings from a qualitative study conducted among participants in Johannesburg suggest the importance of collecting more information about what motivates FSW to use PrEP, and the development of tailored messaging to promote the demand and support for PrEP [51,52].

About 8 in every 10 participants in all three survey cities reported using a condom the last time they had sex (anal or vaginal) with a paying sex client. Furthermore, at least 7 in 10 participants in all three survey cities reported using a condom with their last three paying clients. Both estimates of condom use in SAHMS2 are higher than the 38.9% national average for condom use at last sex in the general population in 2017 [6]. While higher than the general population estimates, the reported condom use at last sex in SAHSM2 is lower than the targets set out in the South African National Sex Worker HIV Plan that aims to ensure that 95% of sex workers use condoms with their clients. Notably, rates of condom use with last paying sex client reported in SAHMS2 were comparable to prior findings from SAHMS1. A fairly high proportion of participants across the three cities reported using condoms after sex had been initiated and removing condoms before sex had been completed. This points to opportunities for enhancing health education on condom use.

5.5 Reach of peer educator-led programmes

In South Africa, FSW educator services include increasing access to HIV prevention and HIV treatment services and building social capital; supporting FSW human rights; empowering FSW economically; and providing psychosocial support for FSW. Findings from SAHMS2 point to the sub-optimal reach of peer educator programmes in all three cities. Anecdotal reports from routine FSW programmes implemented by Wits Reproductive Health Institute and TB HIV Care at the time of the survey highlight several barriers to expanding the reach of peer educator-led programmes: inaccessibility of FSW due to restrictions placed by pimps, high levels of gangsterism that characterise some of the sex work environments, programme fatigue by FSW, reluctance of FSW to confront the importance of self-care, or the anticipated stigma faced by some FSW who fail to disclose their practice of sex work and miss opportunities to engage with available health and welfare services.

5.6 Stigma, discrimination, and violence against female sex workers and sexually exploited minors

The criminalization of sex work in South Africa contributes to unsafe working environments, denies FSW of legal redress from gender-based violence and economic exploitation, and restricts their access to health services [17,18]. Such vulnerabilities and the perceived lack of control over one's life will likely result in FSW not prioritizing their health needs in favour of immediate concerns such as safety and survival [53].

There were notable changes in the proportion of participants who reported being physically assaulted (i.e., being hit, kicked, or beaten) because someone thought they were a sex worker. The proportion of participants who reported ever being physically assaulted in the 12 months preceding the survey decreased from 47.3% (95% CI: 37.8%, 57.0%)–%) to 25.3% (95%CI: 21.7%, 29.4%) and 50.9% (95% CI:

33.7%, 68.9%) to 22.0% (95% CI: 18.1%, 26.5%) in Cape Town and Johannesburg, respectively, between the two survey rounds. In eThekwini, the proportion of participants who reported ever being physically assaulted in the 12 months before the survey increased from 14.1% (95% CI: 8.0%, 23.4%)–%) to 28.0% (95% CI: 23.7%, 32.8%) between the two survey rounds.

5.7 Alcohol and drugs

High alcohol consumption and non-medical drug use are known risk factors for sexual violence, HIV transmission, and poor mental and physical health [54]. The National Sex Worker HIV Plan advocates for educating FSW on the risk of alcohol and substance use and providing harm reduction counselling and referral of FSW who require intervention.

Compared to SAHMS1, the proportion of participants categorised as hazardous alcohol drinkers in SAHMS2 remained relatively stable across all three cities. In Cape Town 58.4% (95% CI: 48.55, 67.8%) of participants were hazardous alcohol drinkers in SAHMS1 compared to 60.5% (55.5%, 65.3%) in SAHMS2. In eThekwini, 43.0% (95% CI: 28.1%, 63.7%) of participants were hazardous alcohol drinkers in SAHMS1 compared with 58.0% (95% CI: 52.7%, 63.2%) in SAHMS2. In Johannesburg, 81.5% (95% CI: 70.1%, 88.8%) of participants were hazardous alcohol drinkers in SAHMS1 in SAHMS1 compared with 82.7% (95% CI: 78.0%, 86.5%) in SAHMS2.

The use of non-medical drugs was similar between the two survey rounds among participants in Cape Town and Johannesburg. In eThekwini, non-medical drug use among participants increased from 13.1% (7.7%, 21.1%) in SAHMS1 to 52.2% (46.8%, 57.6%) in SAHMS2. In SAHMS2, cannabis, cocaine, and methamphetamine (tik) were commonly reported as the most frequently used drugs. The proportion of participants who reported injecting drug use was very low and remained stable between the two survey rounds. Fewer than 5 in 100 participants self-reported injecting drug use in both SAHMS1 and SAHMS2.

5.8 Population size estimation

PSE for FSW and sexually exploited minors is important for planning and advocating for resources to improve accessibility of health and welfare programmes for FSW. The estimated population size of FSW in the three survey cities has remained stable in comparison to the estimates from SAHMS1.

5.9 Limitations of the survey

- The findings from this survey are limited to FSW and sexually exploited minors in Cape Town, eThekwini, and Johannesburg and may not represent these populations in provincial and rural communities. For example, the low mobility observed among the survey participants from all three cities may be lower than anticipated among populations working along transportation corridors or in less densely populated areas. In this regard, different sampling methods (i.e., time-location sampling) might be more appropriate in those environments to explore the dynamics of the HIV epidemic and uptake of health and welfare services among mobile FSW populations.

- Although RDS is a robust sampling method for reaching FSW, 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. Limitations in generalising survey results to these underrepresented sub-populations are listed below:

  - Similar to SAHMS1, FSW 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 FSW from wealthier socio-economic backgrounds and explore messaging that will encourage their participation.
  - The survey team in Johannesburg found it difficult to access FSW populations in the northern suburbs of the city where peer educator-led programmes were not well established. Most participants lived, worked, or socialised in the western or central suburbs of Johannesburg, where two PEFAR-funded programme partners were operating (see Appendix C for distribution participants by the zone where they lived, worked, or socialised)
  - Similar to SAHMS1, the survey team in Cape Town had limited success in recruiting venue-based FSW into the sample. This was a persistent challenge despite innovative attempts such as establishing satellite survey sites in communities and accessing brothels with the consent of the owners. Additional challenges encountered by the survey team in this setting include time restrictions placed on survey activity by proprietors

- Although eligible to participate, very few participants aged 16–17 years (nine across all three cities) were recruited into the survey. This limits the survey's ability to provide specific information about this particularly vulnerable age group. The survey teams in all three cities made attempts to recruit seeds of this age group with limited success.

- Both SAHMS1 and SAHMS2 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 participants in these three cities.

- This report seeks to convey descriptive survey findings in a manner that is easily understood within the context of the programme priorities outlined in the National Sex Worker HIV plan.

6 Conclusions

6.1 Conclusions

1. HIV prevalence among FSW and sexually exploited minors remains disproportionately high compared to women of the same age range in the general population.
2. There is sub-optimal progress toward achieving UNAIDS 90-90-90 targets among FSW; none of the three survey cities achieving the 90-90-90 targets. Notably, an extremely low proportion of participants aware of their HIV status were receiving ART, despite the availability of ART for all people living with HIV in South Africa at the time the survey implementation.
3. The frequency of HIV testing among participants who self-reported being HIV negative was low in all three survey cities.
4. There was low awareness of PrEP among participants and low PrEP utilisation among those aware of PrEP.
5. Condom usage by participants was higher than national estimates of the general female population. However, this is lower than the target of 95% set out in the National Sex Worker HIV Plan. In addition, high incorrect condom usage and condom breakage was reported by participants in all three survey sites.

6. The reach of peer educator-led services was low across all three survey cities. Programs could employ rigorous education and empowerment of peer educators to ensure linkages to health services.
7. There are notable decreases in physical and sexual assault reports between the two survey rounds. However, a sizeable proportion of FSW remain highly vulnerable.
8. The use of non-medical drugs across all three survey cities has increased between the two survey rounds, although injecting drug use has remained relatively low.

6.2 Next steps

1. Implementation research and quality improvement programmes could promote uptake of ART and retention in care and optimise reach and breadth of peer educator-led services.
2. Conduct a third surveillance round to understand dynamics of the epidemic a few years after universal *Test and Treat*. Future survey rounds also could consider rapid tests for recent HIV infection to improve the understanding of the contribution of new infections on HIV prevalence among FSW. In addition, future survey rounds could include clients of sex workers to show the extent of transmission dynamics.
3. Future survey rounds could consider including qualitative rapid assessments and targeted ethnography to provide more detailed information for sexually exploited minors aged 16–17 years.
4. Civil society and government partnership are essential for promoting reforms that provide an enabling legal and human rights environment to address HIV among FSW.
5. Increased non-medical drug and hazardous alcohol usage among FSW highlight opportunities to strengthen psychosocial support, self-care education, and referrals for medical and mental health support.
6. The high rates of incorrect condom use and burst condoms points to a need for consistent education and renewed messaging on correct condom use.
7. The willingness of FSW to conduct HIV self-testing suggests opportunities for programmes to scale up access to HIV testing among this population and among their clients.
8. There are opportunities to optimise demand generation and utilisation of PrEP as a key HIV prevention intervention.

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Appendices

Appendix A: Comparison of study methods – SAHMS1 and SAHMS2

	SAHMS 2013/14	SAHMS 2017/18	Comments
Age inclusion criteria	≥16 years	≥16 years	The same age inclusion criteria
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 study activities remain unchanged
Locations	1. Johannesburg 2. eThekwini 3. Cape Town	1. Johannesburg 2. eThekwini 3. Cape Town	The same metropolitan cities
Laboratory testing	1. HIV ELISA 2. Syphilis Test	1. HIV ELISA 2. Viral Load Tests 3. ARV measurements	Syphilis dropped from the battery of tests –lack of validated syphilis POCT at the time of the survey Viral load and antiretroviral measurements added to assess progress towards 90-90-90 among FSW population
Minimum sample size	Johannesburg - 500 eThekwini - 500 Cape Town - 500	Johannesburg - 500 eThekwini - 575 Cape Town - 776	Additional considerations to estimate virologic suppression among HIV infected participants
Population size estimation	1. Unique object multiplier 2. Unique event multiplier 3. Service data multiplier 4. Wisdom of crowds 5. Modified Delphi input 6. Successive sampling population estimation	1. Unique object multiplier 2. Unique event multiplier 3. Service data multiplier 4. Wisdom of crowds 5. Modified Delphi input 6. Successive sampling population estimation	The same population size estimation methods will be applied

SAHMS: South Africa Health Monitoring Study; ELISA: enzyme-linked immunosorbent assay; POCT: point-of-care testing FSW: female sex workers.

Appendix B: Characteristics of seeds selected to commence recruitment chains

	Cape Town n=7	eThekwini n=3	Johannesburg n=5
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
Duration of sex work, years			
<1	0	0	0
1–3	1	0	1
4–5	1	0	1
6–10	1	0	1
≥11	4	3	2
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

Appendix C: Participant distribution by zone

Zone	Area	Cape Town (N=781) n (%)
1	**Table Bay District**	271 (31.2)
	A - CBD, Seapoint, Greenpoint, Waterfront.	
	B - Bantry Bay, Camps Bay, Llandudno, Hout Bay, Mouille Point.	
	C- Brooklyn, Milnerton, Rondebosche, Woodstock	
	D- Epping, Maitland, Observatory, Salt River, Langa	
2	**Blaauwberg**	133 (16.8)
	A- Gardens, Mamre, Atlantis	
3	**Northern and Tygerberg District**	90 (13.6)
	A - Durbanville, Cape Flats	
	B - Parow, Delft	
4	**Khayelitsha/Mitchells plain District**	287 (38.4)
	A - Mfuleni, Mitchells Plain	
	B - Nyanga, Philipi, Strandfontein, Gugulethu	
	C. Kayelitsha	

Zone	Areas	eThekwini (N=600) n (%)
1	eThekwini **Central**	123 (20.8)
	A - CBD	
	B - Umbilo	
	C - Windermere and Morningside, Umgeni	
	D - Berea	
	E - Bellaire	
	F - Habour	
	G- Clairewood	
2	eThekwini **North**	421 (69.9)
	A - Blue Lagoon	
	B - Virginia	
	C- Verulam	
	D - Phoenix, Ntzuma, Inanda, KwaMhashu	
	E-KwaMhashu, Newland East,	
	F-Tongaat, Umhlanga	
3	eThekwini **South**	43 (7.2)
	A - Isipingo	
	B - Chatsworth	
	C - Shallcross	
	D - Umlazi, Folweni, Makhuta,	
4	eThekwini **West**	13 (2.1)
	A - Pinetown	
	B-Claremont, Wybank,	
	C-New Germany,	

Zone	Area	Johannesburg (N=546) n(%)
1	**Johannesburg Inner-City and South**	510 (95.3)
	Hillbrow, Joubert Park, Berea, Yeoville, Braamfontein, Auckland Park	
	CBD, Marshaltown, Newtown	
	Rosettenville, Boysens	
	Soweto	
	Kensington, Jeppestown	
2	**Johannesburg East***	5 (0.4)
	Wynberg	
	Alexandra	
	Ivory Park	
	Bruma	
3	**Johanesburg North**	15 (1.9)
	Sandton- Illovo, Rivoinia; Rosebank, Saxonworld, Parkwood, Killany	
	Midrand- Halfway; Randjespark	
	Orange Grove, Alexandra, Lyndhurst	
	Randburg	
4	**Johanneburg West**	16 (2.4)
	Fleurhof	
	Roodepoort	
	Dieplsloot	

*In Round 1 Zone 2 included, Tembisa, Benoni, Brakpan, Springs, Boksburg, Heidelberg, Thokoza, Wadeville and Germiston – these were dropped in current survey as they fall outside Johannesburg Metro.